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

[redacted]

Form Number **1112**

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 7/14/2003
Effective Fall 2004

A. CURRENT LISTING

Home Department: Atmospheric, Oceanic, & Space Sciences | Div #: 241 | Course Number: 556

Cross Listed Course Information:

Course Title: Space System Design for Space Sciences

TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Deign for Spac Sci; Transcript Max = 20 Spaces: Desg Space Sc

Course Description:
Team leadership in high level project design of a space system, including launch facilities, booster systems spacecraft subsystems and their integration, communications, ground control, data processing, project management, safety, environmental impact, economic and potitical factors. One hour is spent on topics such as concurrent engineering, manufacturing, marketing and finance, etc.

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: Graduate Standing ○ 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 4 Max 14 | 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

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 ☐ 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 4 Max 4 | 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 ☐ After Years ☐ Even Years ☐ Odd Years
Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Thomas Zurbuchen 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. AOSS Perry Samson
Cross-listed Dept(s). .....

Form Number

1112

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

[redacted]

Form Number **1213**

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

[X] Course Title: Space Systems Management

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Space Syst Manag
	Transcript Max = 20 Spaces	Space Sys Mang

[X] Course Description
The first part of the course will offer a comprehensive introduction to modern management methods used in large projects. The second part will concentrate on successful management examples of complex space projects. This course will usually be taught by adjunct faculty with extensive experience in successful management of large space projects.

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: Graduate Standing ○ 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, & Space Sciences | Div #: AOSS | Course Number: 581

Cross Listed Course Information: Aerospace | AERO 581

Course Title: Space Policy and Management

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Space Pol & Manage
	Transcript Max = 20 Spaces	Space Pol & Manage

Course Description for Official Publication (Max = 50 words)
The first part of the course will provide detailed information on how space policy is developed in the United States and the international space community, and how these policies result in specific missions. The second part will provide detailed information on modern management techniques and processes. Project managers from NASA centers and industry will lecture on the detailed management techniques and processes.

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: Graduate Standing ○ 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 13

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: Lennard A. Fisk | 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). AERO

Form Number

1213

SUPPORTING STATEMENT

The class "Space Policy and Management" covers an important part of any space system development. The class covers important management techniques and currently used space systems development. In addition, the class discusses the historical and current space policy. There is no such class in the college of engineering.

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

Detail the Special requirements

AOSS 581

SPACE POLICY AND MANAGEMENT

Objectives: This course is intended to provide detailed information on how space policy is developed in the United States and the international space community, how these policies result in specific space missions, and how space missions are managed. The course will provide the context in which space missions are executed, as well as detailed information on management techniques and processes. Project Managers from NASA centers and industry will lecture on the detailed management techniques and processes.

The course outline, roughly by week during the semester, is:

1. The history of space policy in the United States.
2. The structure of the US Government , and US programs in space.
3. The current processes for approving and selecting US space missions.
4. The current state of international space programs.
5. The current state of commercial space activities.
6. The prospects for and constraints on the future of space.
7. How to develop proposals; forming teams; estimation techniques.
8. The fundamentals of project management.
9. Work breakdown structures.
10. PERT/CPM and GANTT project planning, reporting and tracking; variance and earned value tracking.
11. Risk management and quality assurance practices.
12. Case studies.
13. Case studies.
14. Case studies.

Grading Policy: Students will be assigned a research project on as aspect of space policy for 50% of their grade, and will participate in a case stud for the remaining 50%.

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

[redacted]

Form Number **1221**

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 11/21/2003
Effective Fall 2004

A. CURRENT LISTING	B. REQUESTED LISTING
X Home Department: Aerospace; Div #; Course Number	Home Department: Atmospheric, Oceanic, & Space Sciences; Div #: AOSS; Course Number: 582
Cross Listed Course Information: Atmospheric, Oceanic, & Space Sciences AOSS 582	Cross Listed Course Information: Aerospace AERO 582
☐ Course Title	Course Title: Spacecraft Technology
TITLE ABBREVIATION — Time Sched Max = 19 Spaces; Transcript Max = 20 Spaces	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Spacecraft Tech; Transcript Max = 20 Spaces: Spacecraft Tech
X Course Description: A systematic and comprehensive review of spacecraft and space mission technology, including trajectory and orbital mechanics, propulsion systems, power and thermal systems, structures, control, and communications.	Course Description for Official Publication (Max = 50 words): Systematic and comprehensive review of spacecraft and space mission design and key technologies for space missions. Discussions on project management and the economic and political factors that affect space missions. Specific space mission designs are developed in teams. Students of AERO 483/583 choose their projects based on these designs.
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	PROGRAM OUTCOMES: ☒ a ☐ b ☐ c ☒ d ☐ e ☐ f ☒ g ☐ h ☒ i ☒ j ☒ k
Degree Requirements: ◉ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ◉ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other
☐ Prerequisites: ○ Enforced ○ Advised	Prerequisites: Graduate Standing ○ Enforced ⊙ Advised
☐ Credit Restrictions	Credit Restrictions
X 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	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	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: Thomas H. Zurbuchen; 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. AERO
Cross-listed Dept(s). AOSS Perry Samson

Form Number

1221

SUPPORTING STATEMENT

This class introduces students to spacecraft technologies and the process of their integration into a space system. It begins with a through introduction on the space system design process in which top-level objectives are formulated and broken down into sub-system requirements. This process is illustrated using recent space missions with a variety of purposes. Key spacecraft technologies are then discussed in this context. The technologies discussed here include propulsion, orbit design, space environment, and many others. The emphasis for each of these discussions is the understanding of key properties and top-level systems aspects from each technology. Several of these technologies are analyzed in detail, using modern design tools, analytical and numerical methods.

In a second part, a specific space mission design is developed in teams, to apply the design process taught in this class. The class is given top-level objectives defining a space mission. Based on these objectives, alternative architectures are to be developed and formulated in a Phase A study. This practical design study is concluded in a public presentation to the next students of AERO 483/583 who will choose their projects based on these presentations. The students participating in 582 will become technology specialist as part of 483/583.

The 582-583 sequence is to be inter-departmental and interdisciplinary. Due to the fact that AERO 583 is co-taught with AERO-483, its home department appropriately is Aerospace Engineering. Subsequently, to reflect the key idea of this sequence of design classes, AOSS 582 is moved to the AOSS department.

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

Detail the Special requirements

Computer room with software for orbit design, space environment modeling, CAD and other packages relevant for technology study.

Course Objectives:

1. Introduce space system design process.
2. Familiarize students on how to apply this process for existing space missions.
3. Introduce students to key spacecraft technologies, including propulsion, orbit design, space environment, space launcher, and others.
4. Familiarize students with technology tradeoffs using analytic, numerical and designated tool-kits.
5. Experience the integration of these technologies by performing a design study of a space mission at the Phase A level.

Course Outcomes:

1. Have basic understanding of space systems and how they relate to their subsystems and technologies.
2. Understand the basic principles of key technologies that are relevant for these systems.
3. Know how to apply these design processes for space systems and perform relevant trade studies of key-subsystems.
4. Perform top-level space design by working in a group of technology specialists.

Assessment Tools

1. Written homework for individuals and small groups.
2. Mid-term exam
3. Final Exam

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

[redacted]

Form Number 1222

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 11/21/2003
Effective Fall 2004

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Div # / Course Number	Home Department: Atmospheric, Oceanic, & Space Sciences / Div #: AOSS / Course Number: 584
Cross Listed Course Information	Cross Listed Course Information
Course Title	Course Title: Space Instrumentation
TITLE ABBREVIATION — Time Sched Max = 19 Spaces; Transcript Max = 20 Spaces	Time Sched Max = 19 Spaces: Space Instrumenta; Transcript Max = 20 Spaces: Space Instrumenta
Course Description	Course Description for Official Publication (Max = 50 words): A survey of the physical principles and engineering of instrumentation used throughout the many related fields of space science. Upon completion of the course, students will have a firm grasp of the principles and techniques used to sense and measure photons, neutral gases, charged particles, and cosmic dust.
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	**PROGRAM OUTCOMES:** ☒ a ☐ b ☒ c ☒ d ☒ e ☒ f ☒ g ☒ h ☒ i ☒ j ☒ k
Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other
Prerequisites: ○ Enforced ○ Advised	Prerequisites: Graduate Standing ○ Enforced ○ Advised
Credit Restrictions	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	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: ___	Credit Hours Min / Max: 3 / 3 ; Contact Hrs/Wk: 3 ; Number of Wks: 13
C. Repeatability (Indl 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: J.H. Walte; 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

1222

SUPPORTING STATEMENT

The course is being offered to provide graduate students and senior level undergraduates with hands on experience in the design, development, and operations of space instrumentation. Course is necessary to meet the needs of the new SGUS in Space Engineering Program.

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

Detail the Special requirements

1) the use of an in class computer lab resource – Rm# 2139
2) the use of a vacuum lab facility – Rm# 2114, 3) the use of an optical lab facility – Rm# 2120
4) the use of several pieces of SPRL lab equipment such as an RGA
5) engineering support from SPRL personnel

AOSS 584 Space Instrumentation

Space science instrumentation is a discipline aimed at creating state-of-the-art sensors capable of measuring the environments of the Earth, the planets and their satellites, the Sun, and interplanetary space. AOSS 584 is a recently developed course that surveys the physical principles and engineering of instrumentation used throughout the many related fields of space science. Upon completion of the course students will have a firm grasp of the principles and techniques used to sense and measure photons, neutral gases, charged particles, and cosmic dust. After a review of methods, instrumentation, and vacuum technology, the laboratory section of the course will concentrate on the testing and characterization of prototype instruments for future Mars missions. The laboratory is equipped with a small (clean) high-vacuum facility, clean bench, modern electronic instrumentation, photon and particle sources, and optical benches (photon and charged particle). For further information, please contact Dr. J. Hunter Waite (hunterw@umich.edu).

1. Course Outline (including weekly schedule sample from 2003 winter term)

AOSS 584 Space Science Instrumentation Winter 200?

Date	No.		Lecture/lab Descriptions	Comment
	1	LAB	Laboratory safety introduction	John Eder/Lisa Stowe
	2a	LEC	HW: Introduction: Instructors & office hours, purpose and philosophy of course (science *and* engineering); lab basics; prototype development; course structure; reading lists; grading; homework.	Student bios
	2b	LEC	HW: Mars as a scientific backdrop	
	3	LEC	HW: The space environment: gravitation, vibration, vacuum, thermal, radiation, plasma, debris; Instrument concepts & design	
	4	LEC	HW: Introduction to particle optics	
	5	LAB	TZ: Lab 1a, Particle optics	
	6	LAB	TZ: Lab 1b, Particle optics	
	7	LEC	NR: Introduction to photon optics	
	8	LEC	NR: Photon optics systems	Lab report #1
	9	LAB	NR: Lab 2b, Photon Optics	
	10	LAB	NR: Lab 2b, Photon Optics	
	11	LEC	HW: Introduction to vacuum systems	
	12	Lab	BB: Lab 3a, Measurement of partial pressure	
	13	LAB	BB: Lab 3b, Measurement of partial pressure	
	14	LEC	HW: Mass Spectrometers and Ion Sources	
Winter break				

AOSS 584			Space Science Instrumentation	Winter 200?
Date	**No.**		**Lecture/lab Descriptions**	**Comment**
Mar	15	LEC	HW: Measurement and Error, Mars background, Vacuum systems	Lab report #2
Mar	16	LAB	HW: Matlab simulation of vacuum system	
Mar	17	LAB	BB: Prototype lab, session one, Conductance calibration	Lab report #3
Mar	18	LAB	BB, HW: Prototype lab, session two, Zeolite pumping speed	
Mar	19	LEC	HW: Photon and particle detectors	
Mar	20	LAB	BB, HW: Prototype lab, session three, Molecular flow regime	
Mar	21	LAB	BB, HW: Prototype lab, session four, Staged pumping technique	
Mar	22	LAB	BB, HW: Prototype lab, session five, Known mixture characterization	
Apr	23	LAB	BB, HW: Prototype lab, session six, Temperature dependence	
Apr	24	LAB	BB, HW: Prototype lab, session seven, Unknown mixture	
Apr	25	LAB	BB: Prototype lab, session eight, Volcano sample analysis	
Apr	26	LAB	BB: Prototype lab, session nine, Volcano sample analysis	
Apr	27	LEC	BB, HW: Instrument concepts, design, and engineering; Prototype Reviews	Lab report #4

2. Required/recommended text books and/or coursepacks
Reading list (primary text in bold):

Moore, J. H., C.C. Davis, and M. A. Coplan, "Building Scientific Apparatus, third edition," Advanced Book Program, Perseus Books, Cambridge, MA., ISBN 0-8133-4066-3, 2003.

Cruise, A. M., et al., "Principles of Space Instrument Design," Cambridge Aerospace Series, Vol. 9, Cambridge U. Press, 1998; ISBN 0-521-45164-7.

Lipson, S. G., H. Lipson, and D. S. Tannhauser, "Optical Physics," 3rd Ed., Cambridge U. Press, 1995; ISBN 0 521 43631 1 (pb).

Wertz, J. R., and W. J. Larson, "Space mission analysis and design," 3rd Ed., Microcosm & Kluwer, 1999; ISBN 1-881883-10-8 (pb). (Chapters 1 through 4, 8, 9, 12, 19)

Wollnik, H., "Optics of charged particles," Academic Press, 1987; ISBN 0-12-762130-X.

3. Grading and exam policies

6 lab reports	88.5%
Oral presentation for the final	12.5%

4. Prerequisite courses (if any)

None required, but a thorough knowledge of college level physics and mathematics is highly recommended.

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

[redacted]

Form Number **1223**

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 11/21/2003
Effective Fall 2004

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Div # / Course Number	Home Department: Atmosperic, Oceanic, & Space Sciences / Div #: AOSS / Course Number: 585
Cross Listed Course Information	Cross Listed Course Information
Course Title	Course Title: Introduction to Remote Sensing and Inversion Theory
TITLE ABBREVIATION — Time Sched Max = 19 Spaces	Remote Sensing
TITLE ABBREVIATION — Transcript Max = 20 Spaces	Remote Sensing
Course Description: An introduction to the techniques of remote sensing in the optical spectral region. Atmospheric sounding and spectroscopic study of the atmosphere. Methods of inversion of measurements to yield model parameters. Optimal estimation, non-linear inversion, and sequential estimation.	Course Description for Official Publication (Max = 50 words): Introduction to active (radar and lidar) and passive (thermal emission) visible, infrared and microwave remote sensing. Fundamentals of electromagnetic emission, absorption and scattering. Sensor performance characteristics. Mathematical methods for inversion of integral transforms and ill-conditioned systems of equations commonly encountered in remote sensing applications.
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	PROGRAM OUTCOMES: ☒ a ☐ b ☒ c ☒ d ☒ e ☒ f ☒ g ☒ h ☒ i ☒ j ☒ k
Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ◉ Tech Elective ○ Other
Prerequisites: ○ Enforced ○ Advised	Prerequisites: Graduate Standing ○ Enforced ⊙ Advised
Credit Restrictions	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	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: ___	Credit Hours Min / Max: 3 / 3 ; Contact Hrs/Wk: 3 ; Number of Wks: 13
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: Christopher S. Ruf; 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

1223

SUPPORTING STATEMENT

The content of this course is being modified to include a more complete introduction to the phenomenology of remote sensing – to better set the context of the section on inversion methods. Some advanced topics in inversion methods previously covered in the course will be deleted to accommodate these additions. The changes are being made in order to better fit into the new SGUS and MEng in Space Engineering programs. The course will also serve senior undergraduates and first year PhD students.

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

Detail the Special requirements

1. Supporting Documentation:

1.1 Course Outline (including weekly schedule of subject matter covered)

Lecture number(s)	
1	Introduction to remote sensing and the inverse problem
2-4	Review of electromagnetic theory and instrumentation (propagation, radiative transfer, diffraction limited imaging, signal generation and detection.)
5	Active surface remote sensing fundamentals (radar and lidar)
6-7	Active surface remote sensing applications and examples (land imagery, ocean surface characterization, interferometric SAR)
8	Passive surface remote sensing fundamentals (Thermal emission, dielectric boundaries, emissivity)
9-10	Passive surface remote sensing applications and examples (IR and microwave land, ocean, cryosphere applications)
11	Atmospheric remote sensing fundamentals (atmospheric characteristics)
12-13	Passive atmospheric remote sensing applications and examples (limb and nadir sounding)
14-16	Active atmospheric remote sensing applications and examples (atmospheric lidar, meteorological radar)
17-18	Review of linear algebra and random processes (Vector spaces, linear operators, bases, determinants, eigenvalues and eigenvectors. Descriptions of noise processes and propagation of noise through a linear system. Noise correlation and covariance.)
19-21	Regression Analysis (Minimization of quadratic functionals, least squares solutions, constrained least squares solutions. Iterative non-linear minimization)
22-24	Other Inversion Methods (Optimal estimation. Statistical inversion. Maximum probability estimation.)
25-27	Information Content (Statistical interdependence of measurements, benefits of over sampling, and error magnification due to processing.)

1.2 Required/recommended textbooks and/or coursepacks

Elachi, C., *Introduction to the Physics and Techniques of Remote Sensing*, John Wiley & Sons, NY, 413 pp, 1987.

F.T. Ulaby, R.K. Moore and A.K. Fung, *Microwave Remote Sensing Active and Passive, Volume III From Theory to Applications*, Ch. 17, Artech House, Inc., Norwood, MA, 1986.

C.D. Rodgers, *Inverse Methods for Atmospheric Sounding*, World Scientific Publ., Singapore, 2000.

S. Twomey, *Introduction to the Mathematics of Inversion in Remote Sensing and Indirect Measurements*, Dover Publ., Mineola, NY, 1996.

1.3 Grading and exam policies:

Homework

- Homework will be assigned approximately every week

Midterm and Final Exams

- Lecture notes, homework solutions and copies of assigned readings are permitted during the exams.
- No additional books or reference materials are permitted.

Grading Policy

60% Homework

15% Midterm Exam (covering material from lectures, assigned readings, and homework)

25% Final Exam (comprehensive but focused on 2nd half of term)

1.4 Prerequisite courses (if any)

There are no specific prerequisites, but students are expected to be familiar with electricity and magnetism (at the level of Maxwell's equations), vector calculus, and linear algebra and to have a reasonable facility with scientific computer programming.

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

[redacted]

Form Number **1316**

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 2/4/2004
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

Prerequisites ( ) Enforced ( ) Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/addl 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 (Indl 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, & Space Sciences | Div #: AOSS | Course Number: 596

Cross Listed Course Information

Course Title: Gaskinetic Theory

TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Gaskinetic Theory; Transcript Max = 20 Spaces: Gaskinetic Theory

Course Description for Official Publication (Max = 50 words)
Maxwell-Boltzmann distribution, kinetic determination of equation of state, specific heats of gases. Dynamics of two-particle collisions. Elementary transport theory, molecular effusion, hydrodynamic transport coefficients, mean free path method. Advanced transport theory, the Boltzmann equation, collision terms, Chapman-Enskog transport theory. Aerodynamics of free-molecular flow. Shock waves.

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: Graduate Standing ( ) Enforced (•) Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☒ Rackham Grad ☐ Rckhm Grad w/addl 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: Tamas Gombosi Title: Professor/Chair

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

1316

SUPPORTING STATEMENT

This is an old course in AOSS that originated from the Aero 532 (gaskinetic Theory) course. It was cross-listed for some 20 years between AOSS and Aero. However, a few years ago the Aero department made some fundamental changes to the course to reflect their changing needs. Aero 532 is no longer cross-listed in AOSS, and we would like to put Gaskinetic Theory back to our revised graduate curriculum.

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

Detail the Special requirements

Textbook:
Gombosi: Gaskinetic Theory, Cambridge University Press, Cambridge, UK, 1994.

Outline:

1. Introduction
1.1. Brief history of gaskinetic theory
1.2. The road to gaskinetic theory in science and engineering
1.2.1. Hydrostatics
1.2.2. Hydrodynamics (fluid mechanics)
1.2.3. Gaskinetic theory
1.3. Basic assumptions of gaskinetic theory
1.3.1. Molecular hypothesis
1.3.2. Classical conservation laws
1.3.3. Statistical nature of the theory
1.4. Solid angles and curvilinear coordinates
1.4.1. Spherical coordinates and solid angles
1.4.2. Cylindrical coordinates1.6.

2. Equilibrium Kinetic Theory
2.1. Distribution functions
2.2. Phase-space distributions and macroscopic averages
2.2.1. Phase-space
2.2.2. Phase-space distribution
2.2.3. Macroscopic averages
2.3. The Maxwell-Boltzmann distribution
2.3.1. Maxwell's assumptions
2.3.2. The distribution of molecular velocities under equilibrium conditions
2.4. Determination of the Lagrange multiplier
2.4.1. Gas pressure on a wall
2.4.2. Equation of state
2.5. Elementary properties of the Maxwell-Boltzmann distribution
2.5.1. Distribution of molecular speeds
2.5.2. Mixture of gases
2.5.3. Moments of the Maxwell-Boltzmann distribution
2.6. Specific heats of gases
2.6.1. Equipartition of translational energy
2.6.2. Specific heats of monatomic gases
2.6.3. Specific heats of diatomic gases
2.7. Problems

3. Binary Collisions
3.1. Kinematics of two particle collisions
3.1.1. Center of mass and relative position coordinates
3.1.2. Particle motion in a central field of force

6. Generalized Transport Equations
6.1. Moments of the Boltzmann equation
6.1.1. Velocity moments of the phase space distribution function
6.1.2. Maxwell's equation of change
6.2 The Euler equations
6.3. The 20 moment equations
6.3.1. The Chapman-Enskog distribution function
6.3.2. Transport equations for the Chapman-Enskog coefficients
6.3.3. Grad's closing relation and the 20 moment approximation
6.4 The 13 moment approximation and the Navier-Stokes equations
6.4.1. The 13 moment equations
6.4.2. Collision terms for a single species gas
6.4.3. The Navier-Stokes equation
6.5. Collision terms for multispecies gases
6.5.1. Collision term for the momentum equation
6.5.2. Collision term for the pressure tensor
6.5.3. Collision term for the heat flow vector
6.6 Simplified sets of transport equations
6.6.1. The 10 moment approximation
6.6.2 The 8 moment approximation
6.6.3. The 5 moment approximation

7. Free Molecular Aerodynamics
7.1 Transfer of mass, momentum, and translational energy
7.1.1. Reflection coefficients
7.1.2. Transfer of mass
7.1.3. Transfer of perpendicular momentum
7.1.4. Transfer of tangential momentum
7.1.5. Transfer of translational energy
7.1.6. Limiting cases
7.2. Free molecular heat transfer
7.2.1. Recovery temperature, Stanton number and thermal recovery factor
7.2.2. Free molecular heat transfer to specific bodies
7.2.3. Heat transfer between two plates
7.3. Free molecular aerodynamic forces
7.3.1. Pressure and shearing stress
7.3.2. Lift and drag forces
7.3.3. Free molecular aerodynamic coefficients for specific bodies

8. Shock Waves
8.1 Hydrodynamic description
8.1.1. Normal shock waves in perfect gases
8.1.2. The structure of shock waves in viscous gases
8.2. Kinetic description of shocks: the Mott-Smith model

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

[redacted]

Form Number **1217**

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 11/19/2003
Effective Winter 2004

A. CURRENT LISTING

Home Department: Biomedical Engineering | Div #: 242 | Course Number: 417

Cross Listed Course Information: EECS | 252 | 417

Course Title: Electrical Biophysics

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

Course Description:
Electrical biophysics of nerve and muscle; electrical conduction in excitable tissue, quantitative models for nerve and muscle, including Hodgkin Huxely equations; biopotential mapping, cardiax electrophysiology, and functional electrical stimulation; group projects. Lecture and recitation.

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: EECS 206 and 215 or graduate standing ○ 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 4 Max 4
Contact Hrs/Wk 4
Number of Wks 14

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: Biomedical Engineering | Div #: 242 | Course Number: 417

Cross Listed Course Information: EECS | 252 | 417

Course Title: Electrical Biophysics

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

Course Description for Official Publication (Max = 50 words)
Electrical biophysics of nerve and muscle; electrical conduction in excitable tissue, quantitative models for nerve and muscle, including Hodgkin Huxely equations; biopotential mapping, cardiax electrophysiology, and functional electrical stimulation; group projects. Lecture and recitation.

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: EECS 206 and 215 or graduate standing ○ 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 4 Max 4
Contact Hrs/Wk 4
Number of Wks 14

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

W W

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

Cognizant Faculty Member: Charles Cain **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. Matthew O'Donnell, Chair Biomedical Engineering
Cross-listed Dept(s). EECS, David C. Munson Jr.

Form Number

1217

SUPPORTING STATEMENT

The terms are being changed from Fall to Winter for staffing reasons.

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

[redacted]

Form Number **1220**

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 11/19/2003
Effective Winter 2004

A. CURRENT LISTING

Home Department: Biomedical Engineering — Div #: 242 — Course Number: 458

Cross Listed Course Information: EECS — 280 — 458

Course Title: Biomedical Instrumentation and Design

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

Course Description:
Measurement and analysis of biopotentials and biomedical transducer characteristics; electrical safety; applications of FETs; integrated circuits, operational amplifiers for signal processing and computer interfacing; signal analysis and display on the laboratory minicomputer. Lecture and laboratory.

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: EECS 215 or EECS 314, or consent of the 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

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: Biomedical Engineering — Div #: 242 — Course Number: 458

Cross Listed Course Information: EECS — 280 — 458

Course Title: Biomedical Instrumentation and Design

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

Course Description for Official Publication (Max = 50 words)
Measurement and analysis of biopotentials and biomedical transducer characteristics; electrical safety; applications of FETs; integrated circuits, operational amplifiers for signal processing and computer interfacing; signal analysis and display on the laboratory minicomputer. Lecture and laboratory.

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

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

Prerequisites: EECS 215 or EECS 314, or consent of the 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

Printing Information (Optional): ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule
from W to both terms

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

Cognizant Faculty Member: Daryl Kipke — Title: Assoc. 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. Matthew O'Donnell, Chair Biomedical Engineering
Cross-listed Dept(s). EECS, David C. Munson Jr.

Form Number
1220

SUPPORTING STATEMENT

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

Detail the Special requirements