

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Oct 22, 2019 – 1:30-3:00pm
Lurie Engineering Center, GM Conference Hall

Attending: Dale Karr; Won Sik Yang; Susan Montgomery; Fred Terry; Ed Durfee; Kevin Pipe; Xeuding Wang; Yavuz Bozer; Christian Lastoskie; Emmanuelle Marquis; Mary Jane Northrop; Leung Tsang; supporting staff: Matthew Faunce; Joshua Wirgau; guests: Aaron Ridley; Richard Rood

Call to Order: 1:37

Adjourned: 2:47

AGENDA

1. 10.8.2019 Meeting Minutes: APPROVED pending minor edits
2. Modification of MSE Undergraduate BSE [*Emmanuelle Marquis presented*]: APPROVED (removal of list of classes from sample schedule)
3. Curriculum Committee Member Guide [*informational item*]: To be discussed and finalized during the November 5 meeting.

CARF SUMMARIES

| PAGE | SUBJECT | COURSE # | ACTION | SUMMARY | EFFECTIVE TERM | MIN. GRADE REQ. FOR ENF. PREPREQ | APPROVED | NOTES & REVISIONS | TABLED |
|------|---------|----------|--------|---------|----------------|----------------------------------|----------|---|--------|
| 11 | EAS | 505 | NEW | | FT 2019 | | X | Richard Rood presented; conditionally approved pending the following items: determine grading/credit for outreach component (is it to be a part of the grade? Richard Rood to discuss with co-instructor); update course description (remove “after the conference”); change course credit type to include undergrad students; change effective term to FA 2020; obtain signatures. | |

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|----|---------|-----|-----|------------------------|---------|----|---|---|
| 24 | NERS | 547 | MOD | | WT 2020 | | X | |
| 27 | NERS | 311 | MOD | Enforced Prerequisites | WT 2020 | C | X | |
| 30 | SPACE | 584 | MOD | | WT 2020 | | X | |
| 33 | CLIMATE | 586 | MOD | | WT 2020 | | X | Conditionally approved pending the following items: remove “climate data” from course description and replace with “space data”; change “are both” to “is both” in course description; remove apostrophe in “literature’s” in course description. |
| 36 | CEE | 431 | MOD | | WT 2020 | | X | CARF deletion requested for CEE 431. |
| 50 | CHE | 488 | MOD | Enforced Prerequisites | FT 2020 | C- | X | |
| 53 | EECS | 507 | NEW | | WT 2020 | | X | |
| 61 | BIOMEDE | 442 | NEW | Enforced Prerequisites | FT 2020 | | X | Conditionally approved pending the following items: remove “current listing” (i.e. Biomed 499); change enforced prereqs to: ENG [101 or 151] or EECS [180 or 183 or 280]; edit min. grade req. to “C-”; trim course description. |

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|-----|---------|-----|-----|--|---------|--|---|--|--|
| 69 | IOE | 525 | NEW | | WT 2020 | | X | | |
| 83 | IOE | 545 | MOD | | WT 2020 | | X | Conditionally approved pending the following items: edit current course listing; include old course description. | |
| 87 | IOE | 837 | MOD | | WT 2020 | | X | | |
| 90 | EECS | 510 | DEL | | WT 2020 | | X | | |
| 93 | EECS | 534 | DEL | | WT 2020 | | X | | |
| 96 | EECS | 535 | DEL | | WT 2020 | | X | | |
| 99 | EECS | 536 | DEL | | WT 2020 | | X | | |
| 102 | EECS | 559 | DEL | | WT 2020 | | X | | |
| 105 | CLIMATE | 462 | DEL | | WT 2020 | | X | Update supporting statement. | |

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting

UPCOMING MEETING: Tuesday, November 5, 2019, 1:30-3:00pm
Location: GM Conference Room, Lurie Engineering Center
MEETING AFTER NEXT: Tuesday, November 19, 2019 1:30-3:00pm
Location: GM Conference Room, Lurie Engineering Center

AGENDA

1. Approval of 10.8.2019 Meeting Minutes (pg 4)
2. Modification of MSE Undergraduate BSE [*Emmanuelle Marquis and Amit Misra to present*] (pg 6)
3. Curriculum Committee Member Guide [*informational item*] (pg 9)

CARF SUMMARIES

| PAGE | SUBJECT | COURSE # | ACTION | SUMMARY | EFFECTIVE TERM | MIN. GRADE REQ. FOR ENF. PREPREQ | APPROVED | NOTES & REVISIONS | TABLED |
|------|---------|----------|--------|------------------------|----------------|----------------------------------|----------|--------------------------|--------|
| 11 | EAS | 505 | NEW | | FT 2019 | | | Richard Rood to present. | |
| 24 | NERS | 547 | MOD | | WT 2020 | | | | |
| 27 | NERS | 311 | MOD | Enforced Prerequisites | WT 2020 | C | | | |
| 30 | SPACE | 584 | MOD | | WT 2020 | | | | |
| 33 | CLIMATE | 586 | MOD | | WT 2020 | | | | |
| 36 | CEE | 431 | MOD | | WT 2020 | | | | |

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|-----|---------|-----|-----|------------------------|---------|----|--|--|--|
| 50 | CHE | 488 | MOD | Enforced Prerequisites | FT 2020 | C- | | | |
| 53 | EECS | 507 | NEW | | WT 2020 | | | | |
| 61 | BIOMEDE | 442 | NEW | Enforced Prerequisites | FT 2020 | | | | |
| 69 | IOE | 525 | NEW | | WT 2020 | | | | |
| 83 | IOE | 545 | MOD | | WT 2020 | | | | |
| 87 | IOE | 837 | MOD | | WT 2020 | | | | |
| 90 | EECS | 510 | DEL | | WT 2020 | | | | |
| 93 | EECS | 534 | DEL | | WT 2020 | | | | |
| 96 | EECS | 535 | DEL | | WT 2020 | | | | |
| 99 | EECS | 536 | DEL | | WT 2020 | | | | |
| 102 | EECS | 559 | DEL | | WT 2020 | | | | |

| | | | | | | | | | |
|-----|---------|-----|-----|--|---------|--|--|--|--|
| 105 | CLIMATE | 462 | DEL | | WT 2020 | | | | |
|-----|---------|-----|-----|--|---------|--|--|--|--|

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Oct 8, 2019 – 1:30-3:00pm
Lurie Engineering Center, GM Conference Hall

Attending: Dale Karr, Fred Terry, Won Sik Yang, Gretchen Keppel-Aleks, Emmanuelle Marquis, Leung Tsang, Mary Jane Northrop, Christian Lastoskie, Luis Bernal, Susan Montgomery, Ed Durfee, Yavuz Bozer, Jwo Pan; supporting staff: Betsy Dodge, Joshua Wirgau; guests: Sarah Zimmerman, Dana Muir, Eric Rutherford (?)

Call to Order: 1:02

Adjourned: 2:42

AGENDA

1. 9.24.19 meeting minutes: APPROVED
2. Augmented and Virtual Reality Certificate Proposal (email vote): APPROVED
3. Proposal of Master of Engineering in Electrical and Computer Engineering: postponed to November 5 meeting at Leung Tsang's request.
4. Modification of MSE Undergraduate BSE Curriculum [*Emmanuelle Marquis presented*]: APPROVED; proposal should increase program flexibility; expected effective term of FA 2020.
5. CoE PCDC Requirement Request (Ross Business Law and Business Communication) [*Dana Muir and Sarah Zimmerman presented*]: APPROVED; presenters feel the request is an administrative change only; in the CoE Bulletin, "LHC" (Law History and Communication) is to be replaced with "BL&BCOM" (Business Law and Business Communication)
6. Matters Arising (Re: Onboarding Documentation for New CC Members): Suggested ideas include: finding a substitute if a CC member is unable to attend a meeting; members should be aware of agenda items and be able to answer questions prior to each meeting; Fred Terry shared a Google document with members for edits and comments; members discussed ABET removal from CARF system; Dale will forward emails from Joanna Millunchick and Steven Yalisove; Betsy Dodge will look into adding a new signature line for CC members to CARF form; members should be aware of their respective departments' ABET requirements.

CARF SUMMARIES

| PAGE | SUBJECT | COURSE # | ACTION | SUMMARY | EFFECTIVE TERM | MIN. GRADE REQ. FOR ENF. PREPREQ | APPROVED | NOTES & REVISIONS | TABLED |
|------|---------|----------|--------|---------|----------------|----------------------------------|----------|--|--------|
| 24 | CLIMATE | 324 | MOD | | WT 2020 | | X | Conditionally approved pending removal of "Rackham Grad Student" and "non-Rackham Grad Student" from course credit type; need CARF | |

| | | | | | | | | | |
|----|---------|-----|-----|--|---------|---|---|--|--|
| | | | | | | | | deletion request for CLIMATE 462 | |
| 27 | CLIMATE | 480 | MOD | | WT 2020 | | X | | |
| 30 | EECS | 430 | MOD | | WT 2020 | C | X | Conditionally approved pending: enforced prerequisite language changed to "EECS 330 ('C' or better)"; addition of missing signatures | |
| 33 | NAVARCH | 331 | MOD | | WT 2020 | | X | | |
| 37 | NAVARCH | 332 | MOD | | WT 2020 | | X | | |

10/13/2019

To: College Curriculum Committee
Re: Changes to the MSE Undergraduate Curriculum

The MSE Department proposes to add a required math course to the Science and Technical elective requirements, in addition to the College math core requirements. Students may select the course from a set list below. The list is designed to focus on complementary mathematics foundations relevant to modern MSE applications: computational MSE, experimental / computational design, and data science.

This modification to the MSE undergraduate curriculum was discussed during the May 2019 departmental retreat and approved unanimously by the MSE faculty.

List of courses

- STATS 412 (3) Intro to probability – suggested year: sophomore
- EECS 301 (4) Probabilistic methods in engineering – suggested year: sophomore
- Math 404 (3) Intermediate differential eqs – suggested year: junior/senior
- Math 417 (3) Matrix algebra I – suggested year: sophomore/junior
- Math 471 (3) Intro to numerical methods – suggested year: sophomore/junior
- PHYSICS 351 (3) Methods of Theoretical Physics I – suggested year: junior
- Math 450 (4) Advanced math for engineers – suggested year: junior/senior
- ENG 570 (4): Methods and Practice of Scientific Computing – suggested year: junior/senior

Impact on MSE UG curriculum

- Increase technical preparedness for more advanced MSE courses
- Increase relevance and alignment of the MSE curriculum with modern trends in MSE
- Course will count towards the required Science and Technical elective credits and not impact the core requirements.

Attached are the current and proposed sample schedules.

Sincerely,



Amit Misra
Chair, MSE Department

Current sample schedule (includes 10/8/2019 changes)

| Materials Science and Engineering Sample Schedule | Credit Hours | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| subjects Required by all programs | | | | | | | | | |
| Mathematics 115, 116, 215, and 216 | 16 | 4 | 4 | 4 | 4 | | | | |
| Engineering 100, Introduction to Engineering | 4 | 4 | | | | | | | |
| Engineering 101, Introduction to Computers | 4 | | 4 | | | | | | |
| Chemistry 125/126 and 130 or Chemistry 210 and 211 ¹ | 5 | 5 | | | | | | | |
| Physics 140 with Lab 141; Physics 240 with Lab 241 | 10 | | 5 | 5 | | | | | |
| Intellectual Breadth | 16 | 4 | 4 | | 4 | | 4 | | |
| Science and Technical Subjects (14 hours) | | | | | | | | | |
| ME 211, Introduction to Solid Mechanics | 4 | | | | 4 | | | | |
| Science and Technical Electives | 9 | | | | | | | 3 | 6 |
| Program Subjects (47 hours) | | | | | | | | | |
| MSE 250, Principles of Engineering Materials or MSE 220, Introduction to Materials and Manufacturing | 4 | | | 4 | | | | | |
| MSE 242, Physics of Materials | 4 | | | | 4 | | | | |
| MSE 330, Thermodynamics of Materials | 4 | | | | | 4 | | | |
| MSE 335, Kinetics and Transport in Materials Engineering | 4 | | | | | | 4 | | |
| MSE 350, Structure of Materials | 4 | | | | | 4 | | | |
| MSE 360, Materials Lab I | 3 | | | | | 3 | | | |
| MSE 365, Materials Lab II | 3 | | | | | | 3 | | |
| MSE 420, Mechanical Behavior of Materials | 3 | | | | | | | 3 | |
| MSE 480, Materials and Engineering Design | 3 | | | | | | | | 3 |
| MSE 489, Materials Processing Design | 3 | | | | | | | 3 | |
| Electives | | | | | | | | | |
| Elect 3 MSE Electives ³ | 9 | | | | | 3 | 3 | 3 | |
| 4th MSE Elective ⁴ | 3 | | | | | | | | 3 |
| Unrestrictive Electives | 13 | | | 3 | | | 3 | 4 | 3 |
| Total | 128 | 17 | 17 | 16 | 16 | 14 | 17 | 16 | 15 |

- 1 - If you have a satisfactory score or grade in Chemistry AP, A-Level, IB Exams or credit from another institution you will have met the Chemistry Core Requirement for the College of Engineering.
- 2 - If you have a satisfactory score or grade in Physics AP, A-Level, IB Exams or credit from another institution you will have met the Physics Core Requirement for the College of Engineering
- 3 - Elect 3 from the following list:
 - MSE 400, EMO Materials for Modern Device Technology (3 hours)
 - MSE 410, Design and Applications of Biomaterials (3 hours)
 - MSE 412, Polymeric Materials (3 hours)
 - MSE 440, Ceramic Materials (3 hours)
 - MSE 454, Computational Approaches in Materials (3 hours)
 - MSE 465, Structure & Chemical Characterization of Materials (3 hours)
 - MSE 470, Physical Metallurgy (3 hours)
 - MSE 514, Composite Materials (3 hours)
- 4 - 400 or 500 level MSE course

Proposed sample schedule

| Materials Science and Engineering Sample Schedule | Credit Hours | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| subjects Required by all programs | | | | | | | | | |
| Mathematics 115, 116, 215, and 216 | 16 | 4 | 4 | 4 | 4 | | | | |
| Engineering 100, Introduction to Engineering | 4 | 4 | | | | | | | |
| Engineering 101, Introduction to Computers | 4 | | 4 | | | | | | |
| Chemistry 125/126 and 130 or Chemistry 210 and 211 ¹ | 5 | 5 | | | | | | | |
| Physics 140 with Lab 141; Physics 240 with Lab 241 | 10 | | 5 | 5 | | | | | |
| Intellectual Breadth | 16 | 4 | 4 | | 4 | | 4 | | |
| Science and Technical Subjects (14 hours) | | | | | | | | | |
| ME 211, Introduction to Solid Mechanics | 4 | | | | 4 | | | | |
| Science and Technical Electives (must include math course ³) | 9 | | | | | | 3 | 3 | 3 |
| Program Subjects (47 hours) | | | | | | | | | |
| MSE 250, Principles of Engineering Materials or MSE 220, Introduction to Materials and Manufacturing | 4 | | | 4 | | | | | |
| MSE 242, Physics of Materials | 4 | | | | 4 | | | | |
| MSE 330, Thermodynamics of Materials | 4 | | | | | 4 | | | |
| MSE 335, Kinetics and Transport in Materials Engineering | 4 | | | | | | 4 | | |
| MSE 350, Structure of Materials | 4 | | | | | 4 | | | |
| MSE 360, Materials Lab I | 3 | | | | | 3 | | | |
| MSE 365, Materials Lab II | 3 | | | | | | 3 | | |
| MSE 420, Mechanical Behavior of Materials | 3 | | | | | | | 3 | |
| MSE 480, Materials and Engineering Design | 3 | | | | | | | | 3 |
| MSE 489, Materials Processing Design | 3 | | | | | | | 3 | |
| Electives | | | | | | | | | |
| 3 MSE Electives ⁴ | 9 | | | | | 3 | | 3 | 3 |
| 4th MSE Elective ⁵ | 3 | | | | | | | | 3 |
| Unrestrictive Electives | 13 | | | 3 | | | 3 | 4 | 3 |
| Total | 128 | 17 | 17 | 16 | 16 | 14 | 17 | 16 | 15 |

1 - If you have a satisfactory score or grade in Chemistry AP, A-Level, IB Exams or credit from another institution you will have met the Chemistry Core Requirement for the College of Engineering.

2 - If you have a satisfactory score or grade in Physics AP, A-Level, IB Exams or credit from another institution you will have met the Physics Core Requirement for the College of Engineering

3 - Select 1 from the following list:

STATS 412 (3) Intro to probability

EECS 301 (4) Probabilistic methods in engineering

MATH 404 (3) Intermediate differential eqs

MATH 417 (3) Matrix algebra I

MATH 471 (3) Intro to numerical methods

PHYSICS 351 (3) Methods of Theoretical Physics I

MATH 450 (4) Advanced math for engineers

ENG 570 (4): Methods and Practice of Scientific Computing

4 - Elect 3 from the following list:

MSE 400, EMO Materials for Modern Device Technology (3 hours)

MSE 410, Design and Applications of Biomaterials (3 hours)

MSE 412, Polymeric Materials (3 hours)

MSE 440, Ceramic Materials (3 hours)

MSE 454, Computational Approaches in Materials (3 hours)

MSE 465, Structure & Chemical Characterization of Materials (3 hours)

MSE 470, Physical Metallurgy (3 hours)

MSE 514, Composite Materials (3 hours)

5 - 400 or 500 level MSE course

College of Engineering Curriculum Committee member guide

Useful first steps

- Figure out who the relevant staff member is in your department - Every department has a staff member that prepares materials for the College Curriculum Committee. Introduce yourself to that person, and ask them to run all materials that are going to the committee past you, so you are familiar with them and can speak to them at committee meetings. If you are not sure who that is, check with Betsy Dodge or Joshua Wirgau, administrative support for the committee, reachable at engineering-ro@umich.edu, the registrar's office email.
- Familiarize yourself with the rules and policies. a) The official duties and powers of the CoE Curriculum Committee are found in the [CoE Faculty Rules](#) in sections VI and VII.B. Changes in these rules must go through the CoE Rules Committee according to the procedures in these rules. b) Procedures that have been adopted by the Committee can be found at this [site](#). They include policies for course-related requests and for non-course-related requests. You'll want to read these and become acquainted with policies, as you are the go-to person in your department

CC Member Expectations

Members should try to review the business on the meeting agenda prior to the meeting. In particular,

- You should be familiar with any requests related to their academic unit. You should be ready to approve or reject minor changes in course approval forms (CARF's) that may arise during the Committee discussion. If the Committee raises issues that cannot be resolved in a meeting, at the direction of the Committee Chair, you should take the concerns back to your unit and attempt to resolve the issues for resubmission to the Committee.
- If your academic unit is submitting CARF's (Course approval requests forms), program changes or other business and you cannot attend the meeting, you and/or your unit should arrange for a representative to attend.
- When your academic unit submits CARF's or other business to CoE CC, you should be notified in advance. It is advisable for units to consult with you prior to submission.

- You should also be prepared to address issues as to how a proposed change by another academic unit might affect your degree programs and its students.
- You should have a good familiarity with the requirements of the degree programs (both graduate and undergraduate) in your academic unit. Members should also have a good familiarity with the academic rules of the CoE and Rackham, however, it is inevitable that this knowledge grows with time on the Committee.
- There is an issue as to whether or not the representatives should be aware of ABET (accreditation body) implications of proposed changes. Since the CoE is the body charged with approving course and program changes, either some consideration should be retained even with the ABET groups in the CoE. It would seem reasonable that CC members should have some familiarity with their program's ABET process.
- For any item reviewed at a Curriculum Committee Meeting that is to be addressed at a Faculty Meeting, that item's key constituent(s) must be informed of all final decisions related to that item immediately following the meeting's vote, such as who will be presenting it at the Faculty Meeting, what slides will be used, when the slides are due, etc.

CC Guiding Principles

- In most cases, the CC does not question the academic merit of the proposed course and curriculum changes. This is principally the responsibility and domain of the academic units; however, questions may be asked by Committee members in this area to ensure that these issues have been carefully considered and appropriately documented by the academic unit.
- Similarly, questions may be asked as to how the proposed course and curriculum changes will affect accreditation (both ABET and HLC).
- In most cases, the examination of changes in the CC will be centered on clarity of the proposed changes (course descriptions, prerequisites, etc.), whether or not there are unintended consequences from the proposed changes, and the effects of the proposed changes on students (time to graduation, plans for current students when a new program is introduced, etc.).



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-05-23

Effective Term: Fall 2019

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

CURRENT LISTING

REQUESTED LISTING

| <input checked="" type="checkbox"/> | Dept (Home): Subject: Catalog: | Dept (Home): Environment and Sustainability Subject: EAS Catalog: 505 | | | | | | |
|-------------------------------------|--|--|---|----------------|--|--|--|--|
| <input type="checkbox"/> | Course is Cross-Listed with Other Departments | <input checked="" type="checkbox"/> | Course is Cross-Listed with Other Departments | | | | | |
| <input checked="" type="checkbox"/> | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>Climate and Space Sciences and Engineering - CLIMATE - 531</td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | Climate and Space Sciences and Engineering - CLIMATE - 531 | |
| Department | Subject | Catalog Number | | | | | | |
| | | Climate and Space Sciences and Engineering - CLIMATE - 531 | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) | Course Title (full title) UN Framework Convention on Climate Change | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) | Abbreviated Title (20 char) UN Conv on Clim Chan | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) The United Nations Framework Convention on Climate Change (UNFCCC) is the primary vehicle for international negotiations addressing anthropogenic climate change. Once a year, the parties to the framework attend a meeting known as the Conference of the Parties (COP). The University of Michigan attained observer status in 2009. Students and faculty have attended, every year since 2009, as observer delegates. This course, provided in the Fall term, prepares student delegates and others interested in the UNFCCC. Outreach to the University community is required after the conference. | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: Graduate Min: 1 Undergraduate Max: Graduate Max: 1 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | |

| | | | | |
|---|---|---|--|---|
| Subject: | Catalog: | | | |
| <input checked="" type="checkbox"/> | <table style="width: 100%; border: none;"> <tr> <td style="width: 35%; vertical-align: top;"> Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only </td> <td style="width: 30%; vertical-align: top;"> Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> <td style="width: 35%; vertical-align: top;"> Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> </tr> </table> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |
| Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | | |

| | CURRENT LISTING | REQUESTED LISTING | | | |
|---|---|---|--|---|--|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) | | | |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: | | | |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | |
| <input checked="" type="checkbox"/> | <table style="width: 100%; border: none;"> <tr> <td style="width: 35%; vertical-align: top;"> Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study </td> <td style="width: 30%; vertical-align: top;"> Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td style="width: 35%; vertical-align: top;"> Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer </td> </tr> </table> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | |
| Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | | | |
| Cognizant Faculty Member Name: Richard Rood | | Cognizant Faculty Member Title: | | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|--------|--------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: | | Date: |
| Dept Chair(s): | | Date: |
| Home Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course DescriptionCourse Description

The United Nations Framework Convention on Climate Change (UNFCCC) is the primary vehicle for international negotiations addressing anthropogenic climate change. Once a year, the parties to the framework attend a meeting known as the Conference of the Parties (COP). The University of Michigan attained observer status in 2009. Students and faculty have attended, every year since 2009, as observer delegates. This course, provided in the Fall term, prepares student delegates and others interested in the UNFCCC. Outreach to the University community is required after the conference.

Class LengthClass Length

Full term

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

1

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

Cross-listed dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:Special resources of facilities required for this course:Supporting statement:

Course prepares students to attend the annual Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC)

**Seminar on the United Nations Framework Convention on Climate Change (UNFCCC)
EAS 501.158**

September 5 – October 17, 2018 | Wednesday, 5-6pm | 2024 Dana
1 credit (Satisfactory/Unsatisfactory grading)

INSTRUCTORS

| | | | |
|--------------|------------------|--------------|---------------------|
| Avik Basu | abasu@umich.edu | 734.262.5800 | 4556 Dana |
| Richard Rood | rbrood@umich.edu | 734.647.3530 | 2525 Space Research |

BACKGROUND

The United Nations Framework Convention on Climate Change (UNFCCC) is the primary vehicle for international negotiations addressing anthropogenic climate change. Once a year, the 194 parties to the framework attend a meeting known as the Conference of Parties (COP). Since 2009, when COP 15 was held in Copenhagen, University of Michigan students and faculty have attended as observer delegates. In December of this year, ten delegates from UM will be observing the negotiations at COP 24 in Katowice, Poland. This seminar will prepare those delegates and others interested in the UNFCCC.

OBJECTIVES

The COP can be viewed as an international discussion about climate change which has been in progress for over 25 years. Therefore, attending the COP for the first time can be like walking into the middle of a conversation. The purpose of this seminar is to provide an orientation to the central issues involved in the climate talks. We will explore the pillars of international climate change negotiations including climate science, mitigation, adaptation, loss and damage, finance, accountability, and the principle of common but differentiated responsibilities. The seminar also provides a forum for delegates to discuss how to make the most of this unique experience, including how to make a significant contribution at the COP and how to share their experience with a wider audience.

EVALUATION

Students will receive either a satisfactory or unsatisfactory grade depending on active participation during seminars and timely completion of readings and assignments, all of which are available on Canvas: <http://umich.instructure.com>.

SCHEDULE

| | |
|----------|--|
| Sep 5 | Introduction and logistics |
| Sep 12 | Climate change science and the COP |
| Sep 19 | Background, structure, and history of the UNFCCC |
| Sep 26 | Mitigation, adaptation, and implementation |
| Oct 3 | Climate Equity (Developing vs. developed countries) |
| Oct 10 | Mock UN negotiation |
| Oct 17 | Beyond the UNFCCC |
| Dec 3-14 | COP 24 in Katowice, Poland |

SYLLABUS**September 5 - Introduction and logistics**

[No readings]

September 12 - Climate change science and the COPIntroductory Material

Rood, R. (2018). Introductory Material (Climate Change)

<https://sites.google.com/a/umich.edu/introductorymaterial/>History of climate change science

Mason, J. (2013) The History of Climate Science

<https://skepticalscience.com/history-climate-science.html>Science and the UNFCCC

IISD (2015). The Science and Economics of Climate

<http://enb.iisd.org/paris-knowledge-bridge/video-3-the-science-and-economics-of-climate-governance/>The science

UNCC (2015). Introduction to Climate Change Science.

Vale, P.M. (2016) The changing climate of climate change economics

[OPTIONAL]

Rood, R. (2014). Climate Change: General Introduction

Wear, S. (2015). The Carbon Dioxide Greenhouse Effect

Wear, S. (2015). Simple Models of Climate Change

Johnson, G. (2013). Climate Change Science 2013: Haiku

IPCC (2014). Climate Change 2014: Synthesis Report

Various Authors (2011). Four degrees and beyond: the potential for a global temperature increase of four degrees and its implications. *Philosophical Transactions A of The Royal Society*.The numbers

McKibben, B. (2012). Global Warming's Terrifying New Math. Rolling Stone.

Roston, E. & Migliozi, B. (2015). What's really warming the world? Bloomberg Business.

Ge, M., Friedrich, J., and Damassa, T. (2015). 6 Graphs Explain the World's Top 10 Emitters.

World Resources Institute (2013). Infographic: The Global Carbon Budget

World Resources Institute (2014). Infographic: Choose Your Future: 4 Possible Emissions Pathways

World Resources Institute (2014). Interactive: Carbon Emissions Past, Present and Future

World Resources Institute (2014). U.S. Greenhouse Gas Emissions by Sector, 2011

World Resources Institute (2015). Infographic: What Do Your Country's Emissions Look Like?

Darby, M. (2015). Greening the world energy mix in 9 graphs. RTCC.

Data resources [OPTIONAL]

World Resources Institute (2015). Climate Data Explorer

World Bank (2015). Climate Change Data

September 19 - Background, structure, and history of the UNFCCC

Introduction

UNFCCC (2014). Adapting to a changing climate.

The agreements

The Convention (UNFCCC)

The Kyoto Protocol

The Paris Agreement

UNFCCC structure

COP: Conference of the Parties

CMA Conference of the Parties serving as the meeting of the Parties to the Paris Agreement

CMP: Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol

SBSTA: Subsidiary Body for Scientific and Technological Advice

SBI: Subsidiary Body for Implementation

APA: Ad Hoc Working Group on the Paris Agreement

IPCC: Intergovernmental Panel on Climate Change

Secretariat

History

Timeline of the UNFCCC

IISD (2018) Summary of the Bangkok Climate Change Conference in September 2018. Earth Negotiations Bulletin.

IISD (2018) The History of Climate Governance.

[OPTIONAL]

Rich (2018). Losing Earth: The Decade We Almost Stopped Climate Change

Falkner (2016). The Paris Agreement and the new logic of international climate politics

September 26 - Mitigation, adaptation, and implementation

Background: The three pillars

IISD (2015). The Pillars of Climate Governance

Pillar 1: Mitigation

UNFCCC (2018). Mitigation: The Big Picture

UNCC (2015). Introduction to Climate Change Mitigation

Pillar 2: Adaptation

UNFCCC (2018). Adaptation and resilience: The Big Picture

UNCC (2015). Introduction to Climate Change Adaptation

Pillar 3: Means of Implementation

UNFCCC (2018). Climate Finance: The Big Picture

UNFCCC (2018). Technology: The Big Picture.

UNFCCC (2018). Capacity Building: The Big Picture.

Nationally Determined Contributions (NDCs)

UNFCCC (2018). Nationally Determined Contributions

WRI (2015). Decoding INDCs: A Guide for Understanding Country Commitments

NDC Data [OPTIONAL]

UNFCCC NDC Registry

U.S. NDC

WRI (2015). CAIT Paris Contributions Map

October 3 - Climate Equity

Cameron, E. (2012). What Is Equity in the Context of Climate Negotiations? World Resources Institute.

Chan, N. (2016) Climate Contributions and the Paris Agreement: Fairness and Equity in a Bottom-Up Architecture

Pauw, P. et al. (2014). Different Perspectives on Differentiated Responsibilities. German Development Institute. Excerpt pp. 1-16.

Raman, M. (2016). The Climate Change Battle in Paris. Third World Network.

[OPTIONAL]

Rajamani, L. (2015). Differentiation in a 2015 Climate Agreement. Center for Climate and Energy Solutions.

Cameron, E. and Bevens, W. (2013). Climate Justice: Equity and Justice Informing a New Climate Agreement. World Resources Institute.

CAIT Equity Explorer. World Resources Institute.

Climate Equity Reference Calculator. EcoEquity and the Stockholm Environment Institute.

More on Mitigation, Adaptation, and Implementation

Briner, G. et al. (2014). Taking Stock of the UNFCCC Process and its Inter-linkages. Climate Change Expert Group. Paper No. 2014 (4). Excerpt pp. 15-19.

Porter, E. (2015). Getting to \$100 Billion in Climate Change Aid. NY Times.

Popovich, N. & Fountain, H. (2017). What is the Green Climate Fund and How Much Does the U.S. Actually Pay?

[OPTIONAL]

UNCC (2015). Introduction to Climate Change Finance

C2ES (2015). Market Mechanisms: Understanding the Options

October 10 - Mock UN negotiation

Pauw, P. et al. (2014). Different Perspectives on Differentiated Responsibilities. German Development Institute. Excerpt pp. 21-29.

Thwaites, J & Ameriasinghe, N.M. (2016). 5 Climate Finance Issues to Watch at Marrakech. WRI.

October 17 - Beyond the UNFCCC

The role of non-state Actors

UNFCCC (2015). Non-State Actor Zone for Climate Action (NAZCA).

[OPTIONAL]

Bodansky, D. (2011). Multilateral Climate Efforts Beyond the UNFCCC. Center for Climate and Energy Solutions.

Will technology save us?

Carbon Brief (2016) 10 ways 'negative emissions' could slow climate change

GAO (2011). Climate Engineering: Technical Status, Future Directions, and Potential Responses

Hamilton, C. (2015). The Risks of Climate Engineering. New York Times.

Monbiot, G. (2015). Meet the ecomodernists: ignorant of history and paradoxically old-fashioned. The Guardian.

The bigger picture

Rood, R. (2016). We Have No Choice, but to Carry On. WunderBlog.

Nixon, R. (2014). Naomi Klein's 'This Changes Everything'. New York Times.

Walsh, B. (2011). Fighting Climate Change by Not Focusing on Climate Change. Time.

Plautz, J. (2014). The Climate-Change Solution No One Will Talk About. The Atlantic.

Howard, E. (2015). 10 green leaders on the best ways you can fight climate change. The Guardian.

Knight, M. (2010). Idealism or Political Pragmatism: What should youth bring to the UN climate change negotiations?

ASSIGNMENTS

1. UNFCCC Countries data collection (Due: September 18)
2. Nationally Determined Contributions (Due: September 25)
3. UNFCCC Coalitions (Due: October 2)
4. UN Mock Event (Due October 9)
5. Making a difference as an observer organization (Due October 16)



Instructor Report

2015-10-21 - 2015-10-28 Report ID: MSR04732

Instructor: Rood, Richard B

NRE 501 158 - AOSS 605 006

| | Responses from your Students** | | | | | | | Other Users of This Item* | | | | | |
|--|--------------------------------|--------|--------|--------|---------|----|----------------|---------------------------|--------------|--------------|----------------|--------------|--------------|
| | 5 SA | 4 A | 3 N | 2 D | 1 SD | NA | Your Median | University Wide | | | School/College | | |
| | | | | | | | | 75% Above | 50% Above | 25% Above | 75% Above | 50% Above | 25% Above |
| 1 Overall, this was an excellent course. | 3 | 4 | 0 | 2 | 0 | 0 | 4.13 | 3.92 | 4.31 | 4.73 | 4.17 | 4.61 | 4.79 |
| 2 Overall, the instructor was an excellent teacher. | 3 | 0 | 1 | 0 | 0 | 5 | 4.83 | 4.18 | 4.65 | 4.88 | 4.26 | 4.68 | 4.88 |
| 3 I learned a great deal from this course. | 4 | 4 | 0 | 1 | 0 | 0 | 4.38 | 4.00 | 4.39 | 4.75 | 4.30 | 4.63 | 4.83 |
| 4 I had a strong desire to take this course. | 6 | 2 | 1 | 0 | 0 | 0 | 4.75 | 3.59 | 4.14 | 4.61 | 4.28 | 4.58 | 4.75 |
| 121 I gained a good understanding of concepts/principles in this field. | 4 | 4 | 0 | 1 | 0 | 0 | 4.38 | 3.95 | 4.25 | 4.60 | | | |
| 204 The instructor was enthusiastic. | 3 | 0 | 1 | 0 | 0 | 5 | 4.83 | 4.50 | 4.83 | 4.93 | | | |
| 207 The instructor appeared to have a thorough knowledge of the subject. | 3 | 1 | 1 | 0 | 0 | 4 | 4.67 | 4.62 | 4.83 | 4.93 | | | |
| 230 The instructor seemed well prepared for each class. | 2 | 1 | 1 | 0 | 0 | 5 | 4.50 | 4.38 | 4.71 | 4.88 | | | |
| 231 The objectives of the course were clearly explained. | 3 | 1 | 3 | 2 | 0 | 0 | 3.33 | 4.10 | 4.38 | 4.70 | | | |
| 224 The instructor suggested specific ways students could improve. | 2 | 1 | 1 | 0 | 0 | 5 | 4.50 | 4.17 | 4.60 | 4.81 | | | |
| 226 The instructor kept students informed of their progress. | 2 | 1 | 1 | 0 | 0 | 5 | 4.50 | 4.00 | 4.50 | 4.75 | | | |
| 891 The workload for this course was (SA=LIGHT...SD=HEAVY). | 2 | 2 | 3 | 2 | 0 | 0 | 3.33 | 2.50 | 3.00 | 3.44 | | | |
| 892 Students felt comfortable asking questions. | 7 | 2 | 0 | 0 | 0 | 0 | 4.86 | 4.21 | 4.58 | 4.81 | | | |
| 893 Graded assignments reflected the material covered. | 5 | 2 | 0 | 0 | 0 | 2 | 4.80 | 4.13 | 4.48 | 4.72 | | | |
| 894 The grades in this course were fairly determined. | 4 | 2 | 0 | 0 | 0 | 3 | 4.75 | 4.00 | 4.33 | 4.69 | | | |
| 895 Students' difficulty with the material was recognized. | 3 | 4 | 1 | 0 | 0 | 1 | 4.25 | 3.88 | 4.17 | 4.50 | | | |
| 896 My expected grade in this course is (SA=A, A=B, N=C, D=D, SD=E). | 6 | 0 | 0 | 0 | 0 | 3 | 5.00 | 4.36 | 4.69 | 4.88 | | | |
| 897 The course requirements were clearly defined. | 3 | 3 | 3 | 0 | 0 | 0 | 4.00 | 4.17 | 4.50 | 4.75 | | | |
| 898 The instructor presented material clearly in lectures/discussions. | 2 | 1 | 1 | 0 | 0 | 5 | 4.50 | 4.25 | 4.67 | 4.86 | | | |

* The quartiles are calculated from Fall 2015 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on graduate level students in College of Engineering.

** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.



Instructor Report

2016-10-21 - 2016-10-28 Report ID: MSR04732

Instructor: Rood, Richard B

NRE 501 158

| | Responses from your Students** | | | | | | | Other Users of This Item* | | | School/College | | |
|---|--------------------------------|---|---|---|----|------|-----------------|---------------------------|-----------|-----------|----------------|-----------|-----------|
| | 5 | 4 | 3 | 2 | 1 | Your | University Wide | | | 75% | 50% | 25% | |
| | SA | A | N | D | SD | NA | Median | 75% Above | 50% Above | 25% Above | 75% Above | 50% Above | 25% Above |
| 4 I had a strong desire to take this course. | 7 | 1 | 0 | 0 | 0 | 0 | 4.93 | 3.75 | 4.19 | 4.64 | 4.25 | 4.50 | 4.79 |
| 891 As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). | 0 | 3 | 3 | 2 | 0 | 0 | 3.17 | 2.83 | 3.13 | 3.42 | | | |
| 1631 This course advanced my understanding of the subject matter. | 3 | 4 | 1 | 0 | 0 | 0 | 4.25 | 4.10 | 4.41 | 4.75 | | | |
| 1632 My interest in the subject has increased because of this course. | 4 | 3 | 1 | 0 | 0 | 0 | 4.50 | 3.75 | 4.19 | 4.63 | | | |
| 1633 I knew what was expected of me in this course. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever). | 1 | 6 | 1 | 0 | 0 | 0 | 4.00 | 4.00 | 4.33 | 4.67 | | | |
| 230 The instructor seemed well prepared for class meetings. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | 2 | 2 | 0 | 0 | 0 | 3 | 4.50 | 4.50 | 4.80 | 4.92 | | | |
| 199 The instructor explained material clearly. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | 3 | 0 | 0 | 0 | 0 | 4 | 5.00 | 4.25 | 4.67 | 4.86 | | | |
| 217 The instructor treated students with respect. | 3 | 1 | 0 | 0 | 0 | 3 | 4.83 | 4.69 | 4.86 | 4.95 | | | |
| 1 Overall, this was an excellent course. | 2 | 5 | 0 | 1 | 0 | 0 | 4.10 | 3.88 | 4.31 | 4.71 | 4.20 | 4.64 | 4.81 |
| 2 Overall, the instructor was an excellent teacher. | 3 | 0 | 0 | 0 | 0 | 4 | 5.00 | 4.33 | 4.73 | 4.90 | 4.67 | 4.81 | 4.91 |
| 3 I learned a great deal from this course. | 3 | 4 | 0 | 1 | 0 | 0 | 4.25 | 4.00 | 4.36 | 4.71 | 4.33 | 4.66 | 4.75 |
| 121 I gained a good understanding of concepts/principles in this field. | 4 | 4 | 0 | 0 | 0 | 0 | 4.50 | 3.96 | 4.25 | 4.63 | | | |
| 204 The instructor was enthusiastic. | 3 | 1 | 0 | 0 | 0 | 3 | 4.83 | 4.58 | 4.83 | 4.94 | | | |
| 207 The instructor appeared to have a thorough knowledge of the subject. | 4 | 0 | 0 | 0 | 0 | 3 | 5.00 | 4.67 | 4.86 | 4.94 | | | |
| 231 The objectives of the course were clearly explained. | 2 | 5 | 0 | 1 | 0 | 0 | 4.10 | 4.08 | 4.38 | 4.69 | | | |
| 224 The instructor suggested specific ways students could improve. | 3 | 0 | 0 | 0 | 0 | 4 | 5.00 | 4.25 | 4.65 | 4.83 | | | |
| 226 The instructor kept students informed of their progress. | 3 | 0 | 0 | 0 | 0 | 4 | 5.00 | 4.00 | 4.50 | 4.80 | | | |
| 892 Students felt comfortable asking questions. | 5 | 3 | 0 | 0 | 0 | 0 | 4.70 | 4.28 | 4.63 | 4.83 | | | |
| 893 Graded assignments reflected the material covered. | 4 | 4 | 0 | 0 | 0 | 0 | 4.50 | 4.17 | 4.50 | 4.75 | | | |
| 894 The grades in this course were fairly determined. | 5 | 3 | 0 | 0 | 0 | 0 | 4.70 | 4.08 | 4.42 | 4.71 | | | |
| 895 Students' difficulty with the material was recognized. | 2 | 5 | 0 | 0 | 0 | 1 | 4.20 | 3.95 | 4.25 | 4.58 | | | |
| 896 My expected grade in this course is (SA=A, A=B, N=C, D=D, SD=E). | 4 | 1 | 0 | 0 | 0 | 3 | 4.88 | 4.42 | 4.75 | 4.89 | | | |
| 897 The course requirements were clearly defined. | 4 | 3 | 0 | 1 | 0 | 0 | 4.50 | 4.17 | 4.50 | 4.75 | | | |
| 898 The instructor presented material clearly in lectures/discussions. | 3 | 0 | 0 | 0 | 0 | 4 | 5.00 | 4.39 | 4.72 | 4.88 | | | |

* The quartiles are calculated from Fall 2016 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on students in School of Natural Resources & Environment.

** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.



Instructor Report

2017-10-19 - 2017-10-26 Report ID: MSR04732

Instructor: Rood, Richard B
NRE 501 158

| | Responses from your Students** | | | | | | | Other Users of This Item* | | | School/College | | |
|---|--------------------------------|---|---|---|----|------|-----------------|---------------------------|-----------|-----------|----------------|-----------|-----------|
| | 5 | 4 | 3 | 2 | 1 | Your | University Wide | | | 75% | 50% | 25% | |
| | SA | A | N | D | SD | NA | Median | 75% Above | 50% Above | 25% Above | 75% Above | 50% Above | 25% Above |
| 4 I had a strong desire to take this course. | 6 | 4 | 1 | 0 | 0 | 0 | 4.58 | 3.70 | 4.17 | 4.63 | 4.15 | 4.62 | 4.83 |
| 891 As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). | 2 | 5 | 3 | 0 | 0 | 1 | 3.90 | 2.80 | 3.10 | 3.40 | | | |
| 1631 This course advanced my understanding of the subject matter. | 4 | 5 | 2 | 0 | 0 | 0 | 4.20 | 4.10 | 4.42 | 4.73 | | | |
| 1632 My interest in the subject has increased because of this course. | 2 | 8 | 1 | 0 | 0 | 0 | 4.06 | 3.75 | 4.17 | 4.63 | | | |
| 1633 I knew what was expected of me in this course. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever). | 4 | 6 | 1 | 0 | 0 | 0 | 4.25 | 4.00 | 4.36 | 4.68 | | | |
| 230 The instructor seemed well prepared for class meetings. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | 4 | 4 | 1 | 0 | 0 | 2 | 4.38 | 4.53 | 4.81 | 4.93 | | | |
| 199 The instructor explained material clearly. (SA=Almost Always, A=Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | 3 | 6 | 0 | 0 | 0 | 2 | 4.25 | 4.25 | 4.67 | 4.88 | | | |
| 217 The instructor treated students with respect. | 4 | 5 | 0 | 0 | 0 | 2 | 4.40 | 4.70 | 4.87 | 4.95 | | | |
| 1 Overall, this was an excellent course. | 4 | 6 | 1 | 0 | 0 | 0 | 4.25 | 3.88 | 4.30 | 4.70 | 4.18 | 4.60 | 4.85 |
| 2 Overall, the instructor was an excellent teacher. | 4 | 4 | 1 | 0 | 0 | 2 | 4.38 | 4.33 | 4.75 | 4.90 | 4.67 | 4.83 | 4.91 |
| 3 I learned a great deal from this course. | 2 | 6 | 2 | 1 | 0 | 0 | 3.92 | 4.00 | 4.38 | 4.70 | 4.35 | 4.60 | 4.84 |
| 121 I gained a good understanding of concepts/principles in this field. | 3 | 6 | 1 | 1 | 0 | 0 | 4.08 | 4.00 | 4.25 | 4.63 | | | |
| 204 The instructor was enthusiastic. | 3 | 4 | 2 | 0 | 0 | 2 | 4.13 | 4.56 | 4.83 | 4.95 | | | |
| 207 The instructor appeared to have a thorough knowledge of the subject. | 6 | 3 | 0 | 0 | 0 | 2 | 4.75 | 4.67 | 4.86 | 4.94 | | | |
| 231 The objectives of the course were clearly explained. | 5 | 6 | 0 | 0 | 0 | 0 | 4.42 | 4.00 | 4.33 | 4.67 | | | |
| 224 The instructor suggested specific ways students could improve. | 2 | 3 | 1 | 1 | 0 | 4 | 4.00 | 4.25 | 4.67 | 4.83 | | | |
| 226 The instructor kept students informed of their progress. | 2 | 3 | 1 | 0 | 0 | 5 | 4.17 | 4.00 | 4.50 | 4.79 | | | |
| 892 Students felt comfortable asking questions. | 6 | 5 | 0 | 0 | 0 | 0 | 4.58 | 4.27 | 4.63 | 4.83 | | | |
| 893 Graded assignments reflected the material covered. | 4 | 6 | 0 | 0 | 0 | 1 | 4.33 | 4.13 | 4.50 | 4.75 | | | |
| 894 The grades in this course were fairly determined. | 5 | 5 | 0 | 0 | 0 | 1 | 4.50 | 4.06 | 4.44 | 4.75 | | | |
| 895 Students' difficulty with the material was recognized. | 5 | 4 | 1 | 0 | 0 | 1 | 4.50 | 3.96 | 4.25 | 4.60 | | | |
| 896 My expected grade in this course is (SA=A, A=B, N=C, D=D, SD=E). | 6 | 1 | 0 | 0 | 0 | 4 | 4.92 | 4.50 | 4.75 | 4.90 | | | |
| 897 The course requirements were clearly defined. | 5 | 5 | 1 | 0 | 0 | 0 | 4.40 | 4.17 | 4.50 | 4.75 | | | |
| 898 The instructor presented material clearly in lectures/discussions. | 3 | 6 | 0 | 0 | 0 | 2 | 4.25 | 4.38 | 4.75 | 4.88 | | | |

* The quartiles are calculated from Fall 2017 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on students in School of Natural Resources & Environment.

** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.

Concerns raised for EAS 505 (with responses from Richard Rood):

Is a 1 credit hour graduate-level course to prepare students for a conference necessary?

Yes. First, the Conference of the Parties is not simply, “a conference.” It is a 2-week meeting of UN negotiations and side events with, frequently, more than 50,000 attendees. We sent students in the first years without training, and their time at the meeting was not well used. Hence, training greatly benefits the student’s experience, including their professional networks. One of the unique experiences of the meeting is that they see, first hand, the messy international processes of developing policy. They also see leading-edge international efforts at business and technology in the side events.

We learned in the first years that numerous of our partners (and competitors) provide a course to prepare their observer delegations. In our first year, Stanford (esp. Steve Schneider) invited us to participate in their preparations. Though that was useful, it was not possible to develop the same level of preparation.

The course does not serve, only, the students who go to the Conference of the Parties, but other students interested in the UN process and development of climate change mitigation and adaptation policy and practice. As such, it becomes the core cohort for the student group, Climate Blue.

The course has been taught for a number of years in partnership with SEAS/SNRE, and SEAS has moved to make the course permanent. CLaSP and SEAS were lead institutions in obtaining the University’s observer status, at it is appropriate for the College of Engineering’s roles in the University’s climate community to do the same.

The enrollment this year has topped the limit, and it is in the best interest of the College and Department to have proper accountability.

Students will receive either a satisfactory or unsatisfactory grade depending on active participation during seminars and timely completion of readings and assignments, but the form is marked A-E for grading.

I will let the administrators who know the rules take proper care of the form. The course and the delegation are open to a small number of undergraduates. I understand the undergraduates have to be given a letter grade. Please verify.

Does it meet 1 hour per week? Why not an independent study with S/U grading? No new course would be needed for that, and multiple students can sign up under the instructor’s section number. Are there other courses in CoE where students earn graduate credit to prepare for a conference?

It meets one hour per week, for seven weeks, then it is followed by a set of planning meetings 23 to prepare for the conference, then attendance at the conference. Then after the conference, the students are required to “give back” from the experience. Faculty are usually present at the conference as well, and in my experience, hold regular planning meetings at the conference to determine most effective engagement and experience.

We use the term “give back,” as alumni donors in SEAS and CLaSP have traditionally provide students with all or part of their expenses. In fact, the University and the College of Engineering have at times provide substantial contributions to the student’s travel.

Given the fact that these students are the University’s delegation, not the Professor’s, Department’s, or the College’s delegation, the course does not get the persistent presence as a catalogue offering if it is the instructor’s section number. It appears as that instructor’s special interest.

It is also true that, for example, an interested student in the medical school, is far more likely to get permission from their advisor to attend the course and the conference, if it is seen as an institutional course rather than an individual’s course.

Are there other courses to support training for a conference? Do not know. In my experience there is no other conference like the conference of the parties. It required application to the United Nations to obtain observer status, and each year requires interaction with the UN to obtain slots for participants and credentials. It is a conference where every nation of the world sends delegates, and where organizations interested in climate change make a presence. It is persistent and unique culture, and to show up at the meeting like it is a conference is a mistake.

Is it only open to students who can attend the conference? If so, it seems to be something that is not available to all students. If not, it seems that the contact hours (1 hour per week for 7 weeks) are insufficient for 1 unit of credit.

It is open to all students, and the majority of students do not attend the conference. See above.

How is outreach required? It doesn’t seem to be discussed in the “evaluation” section.

The outreach is planned, each year, by the students. It is executed through Climate Blue. It has evolved to involve students lecturing in a variety of classes on their experiences, to participation as a unit in a variety of ongoing activities (e.g. the MUSE conference), and sponsoring a springtime conference. The Michigan delegation has also been part of developing a statewide and region-wide consortium of universities.

Part of the outreach can be examined through the Climate Blue Facebook Page.

<https://www.facebook.com/ClimateBlue/>

Professor Rood’s monthly column in Michigan Today is here

<https://michigantoday.umich.edu/2019/07/18/climate-blue-an-introduction/>



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

1710 LSA Building
500 S. State Street
Ann Arbor, MI 48109-1382
Phone: 734.763.2113
Fax: 734.936.3148
ro.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2018-12-12
Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input type="checkbox"/> | Dept (Home): Nuclear Engin & Radiolog Sci Subject: NERS Catalog: 547 | Dept (Home): Nuclear Engin & Radiolog Sci Subject: NERS Catalog: 547 | | | | | | | | | | | | | | | |
|-------------------------------------|---|--|---------|----------------|--|--|--|---|------------|---------|----------------|--|--|--|--|--|--|
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Computational Fluid Dynamics for Nuclear Applications | Course Title (full title) Computational Fluid Dynamics for Industrial Applications | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Comp. Fluid Dynamics | Abbreviated Title (20 char) Comp. Fluid Dynamics | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Theoretical background on turbulence and modeling for single-phase and two-phase flow, and practical experience on using CFD codes. Evaluate simulations of 3-D flows, applicability/limitations of turbulence models, mesh generation and mesh convergence, numerical methods for solution of Navier-Stokes equation, theoretical exercises, computational project and presentation. | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 3 Graduate Min: 3 Undergraduate Max: 3 Graduate Max: 3 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | | | |

Subject: Nuclear Engin & Radiolog Sci Catalog: 547

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

CURRENT LISTING

REQUESTED LISTING

| | | | |
|--|---|--|--|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) NERS 344, MECHENG 320, CEE 325 or equivalent. | Advisory Prerequisite (254 char) NERS 344, MECHENG 320, CEE 325 or equivalent | |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) | Enforced Prerequisite (254 char) | |
| | Minimum grade requirement: | Minimum grade requirement: | |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions | |
| <input checked="" type="checkbox"/> | Course Components | Graded Component | Terms Typically Offered |
| | <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input type="checkbox"/> Fall |
| | <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input checked="" type="checkbox"/> Winter |
| | <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring |
| | <input type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer |
| | <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer |
| | <input type="checkbox"/> Independent Study | <input type="checkbox"/> | |
| Cognizant Faculty Member Name: Annalisa Manera | | Cognizant Faculty Member Title: | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person:

Email:

Phone:

Curriculum Committee:

Date:

Dept Chair(s):



4-16-19

Home Department:

Date:

[Signature]

Luis Bernal lpb@umich.edu

(734) 764-3396

Cross-Listed Department: Aerospace Engineering

Date: 1/22/2019

JIM SUN

Cross-Listed Department: *[Signature]*

Date: 4-22-19

Cross-Listed Department:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Course covers: theoretical background on turbulence and modeling for single-phase and two-phase flow, and practical experience on using CFD codes. Course includes: evaluate simulations of 3-D flows, applicability/limitations of turbulence models, mesh generation and mesh convergence, numerical methods for solution of Navier-Stokes equation, theoretical exercises, computational project and presentation.

Course Description

Theoretical background on turbulence and modeling for single-phase and two-phase flow, and practical experience on using CFD codes. Evaluate simulations of 3-D flows, applicability/limitations of turbulence models, mesh generation and mesh convergence, numerical methods for solution of Navier-Stokes equation, theoretical exercises, computational project and presentation.

Class Length

Full term

Class Length

Full term

Contact hours (lecture):

3

Contact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:

Tech Elective

ABET departmental program outcomes for undergraduate courses:Special resources of facilities required for this course:Supporting statement:

The change in title and the addition of cross-listed courses in other departments represents the broad applicability of the course across multiple disciplines.



Course Approval Request Form

Office of the Registrar, University of Michigan

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

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2019-04-09
 Effective Term: Fall 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input type="checkbox"/> | Dept (Home): Nuclear Engin & Radiolog Sci Subject: NERS Catalog: 311 | Dept (Home): Nuclear Engin & Radiolog Sci Subject: NERS Catalog: 311 | | | | | | | | | | | | |
|-------------------------------------|---|--|---------|----------------|--|--|--|---|------------|---------|----------------|--|--|--|
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Course Title (full title) Elements of Nuclear Engineering and Radiological Sciences I | Course Title (full title) Elements of Nuclear Engineering and Radiological Sciences I | | | | | | | | | | | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Nucl Engr/Rad Sci I | Abbreviated Title (20 char) Nucl Engr/Rad Sci I | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Photons, electrons, neutrons, and protons. Particle and wave properties of radiation. Introduction to quantum mechanics. Properties and structure of atoms. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 3 Graduate Min: Undergraduate Max: 3 Graduate Max: | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

Subject: Nuclear Engin & Radiolog Sci Catalog: 311


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

| | CURRENT LISTING | REQUESTED LISTING |
|--|---|---|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) Concurrent: NERS 320 |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Physics 240 Minimum grade requirement: C | Enforced Prerequisite (254 char) Physics 240 Minimum grade requirement: C |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Alex Bielajew | | Cognizant Faculty Member Title: |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: _____ Email: _____ Phone: _____

Curriculum Committee: _____ Date: _____

Dept Chair(s):  Date: 4-16-19

Home Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Photons, electrons, neutrons, and protons. Particle and wave properties of radiation. Introduction to quantum mechanics. Properties and structure of atoms.

Course Description

Photons, electrons, neutrons, and protons. Particle and wave properties of radiation. Introduction to quantum mechanics. Properties and structure of atoms.

Class Length

Full term

Class Length

Full term

Contact hours (lecture):

3

Contact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

ABET departmental program outcomes for undergraduate courses:

a,b

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

NERS 320 covers the content from MATH 454 needed for success in the course.



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

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Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-06-19

Effective Term: Winter 2020

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

CURRENT LISTING

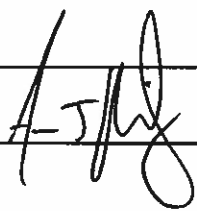
REQUESTED LISTING

| | | | | | | |
|---------------------------------------|---|-----------------|---|---|---------------|----------------|
| <input type="checkbox"/> | Dept (Home): Space Science & Engineering Subject: SPACE Catalog: 584 | | | Dept (Home): Space Science & Engineering Subject: SPACE Catalog: 584 | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| <input checked="" type="checkbox"/> | Course Title (full title) Space Instrumentation | | | Course Title (full title) Space Mission Design and Implementation on a High-Altitude Balloon | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Space Mission Design | | | Abbreviated Title (20 char) Space Mission Design | | |
| <input type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) This class teaches students how to design, build, test and deploy a completely autonomous, sophisticated system that is designed to accomplish a specific task. The primary system is a small-satellite, deployed on a high-altitude balloon. This system involves communication, position tracking, microcontrollers, instruments, and a power system. | | | | | |
| <input type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| | Undergraduate Min: 4 | Graduate Min: 4 | | Undergraduate Min: | Graduate Min: | |
| <input type="checkbox"/> | Undergraduate Max: 4 | Graduate Max: 4 | | Undergraduate Max: | Graduate Max: | |
| | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student | | | | | |
| <input type="checkbox"/> | Repeatability | | | | | |
| | <input type="checkbox"/> Course is Repeatable for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | | |

| | | | |
|--------------------------------------|---|--|---|
| Subject: Space Science & Engineering | | Catalog: 584 | |
| <input type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

| | CURRENT LISTING | REQUESTED LISTING | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|-------------------------|--------------------------------|---|-------------------------------------|-------------------------------|----------------------------------|--------------------------|--|-------------------------------------|--------------------------|---------------------------------|---|--------------------------|---------------------------------|-------------------------------------|--------------------------|--|--|--------------------------|--|--|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) Senior or graduate standing | Advisory Prerequisite (254 char) Senior or graduate standing | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: C- | Enforced Prerequisite (254 char) Minimum grade requirement: C- | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | <table style="width:100%; border:none;"> <tr> <td style="width:30%;">Course Components</td> <td style="width:30%;">Graded Component</td> <td style="width:40%;">Terms Typically Offered</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lecture</td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/> Fall</td> </tr> <tr> <td><input type="checkbox"/> Seminar</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/> Winter</td> </tr> <tr> <td><input type="checkbox"/> Recitation</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lab</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Summer</td> </tr> <tr> <td><input type="checkbox"/> Discussion</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring/Summer</td> </tr> <tr> <td><input type="checkbox"/> Independent Study</td> <td><input type="checkbox"/></td> <td></td> </tr> </table> | Course Components | Graded Component | Terms Typically Offered | <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input type="checkbox"/> Fall | <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input checked="" type="checkbox"/> Winter | <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | <input checked="" type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | |
| Course Components | Graded Component | Terms Typically Offered | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input type="checkbox"/> Fall | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input checked="" type="checkbox"/> Winter | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | |
| Cognizant Faculty Member Name: Susan Lepri | | Cognizant Faculty Member Title: | | | | | | | | | | | | | | | | | | | | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|---|----------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: |  | Date: |
| Dept Chair(s): | | Date: 7-2-2019 |
| Home Department: | | |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

This class teaches students how to design, build, test and deploy a completely autonomous, sophisticated system that is designed to accomplish a specific task. The primary system is a small-satellite, deployed on a high-altitude balloon. This system involves communication, position tracking, microcontrollers, instruments, and a power system.

Class Length

Full term

Contact hours (lecture):

4

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

This class teaches students how to design, build, test and deploy a completely autonomous, sophisticated system that is designed to accomplish a specific task. The primary system is a small-satellite, deployed on a high-altitude balloon. This system involves communication, position tracking, microcontrollers, instruments, and a power system.

Class Length

Full term

Contact hours (lecture):

4

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

Home dept

Describe how this course fits with the degree requirements:

Tech Elective

ABET departmental program outcomes for undergraduate courses:Special resources of facilities required for this course:Supporting statement:

The name of the course is changing to better reflect the content of the course.



Course Approval Request Form

Office of the Registrar, University of Michigan

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Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-06-19

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input type="checkbox"/> | Dept (Home): Climate & Meteorology Subject: CLIMATE Catalog: 586 | Dept (Home): Climate & Meteorology Subject: CLIMATE Catalog: 586 | | | | | | | | | | | | |
|-------------------------------------|---|---|---------|----------------|---------------|-----|--|---|------------|---------|----------------|---------------|-----|--|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td>CLaSP - SPACE</td> <td>586</td> <td></td> </tr> </tbody> </table> | Department | Subject | Catalog Number | CLaSP - SPACE | 586 | | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td>CLaSP - SPACE</td> <td>586</td> <td></td> </tr> </tbody> </table> | Department | Subject | Catalog Number | CLaSP - SPACE | 586 | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| CLaSP - SPACE | 586 | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| CLaSP - SPACE | 586 | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Climate Data Analysis | Course Title (full title) Advanced Data Analysis Techniques | | | | | | | | | | | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Adv Data Analysis | Abbreviated Title (20 char) Adv Data Analysis | | | | | | | | | | | | |
| <input type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Objective methods are introduced for analyzing climate data with inherent spatial and/or temporal correlation scales. These include time series analysis, pattern recognition techniques, regression, and linear modeling. The emphasis are both the usage of such methods and critical evaluation of literature's that employ them. | | | | | | | | | | | | | |
| <input type="checkbox"/> | Full Term Credit Hours Undergraduate Min: Graduate Min: 3 Undergraduate Max: Graduate Max: 3 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input type="checkbox"/> | Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | | | | | | | | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

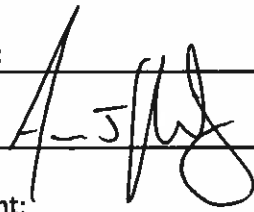
Subject: Climate & Meteorology Catalog: 586

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

| | CURRENT LISTING | REQUESTED LISTING | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|-------------------------|--------------------------------|---|-------------------------------------|-------------------------------|----------------------------------|--------------------------|--|-------------------------------------|--------------------------|---------------------------------|------------------------------|--------------------------|---------------------------------|-------------------------------------|--------------------------|--|--|--------------------------|--|--|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) Graduate Standing | Advisory Prerequisite (254 char) Graduate Standing | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: C- | Enforced Prerequisite (254 char) Minimum grade requirement: C- | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="0" style="width: 100%;"> <tr> <td style="width: 33%;">Course Components</td> <td style="width: 33%;">Graded Component</td> <td style="width: 34%;">Terms Typically Offered</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lecture</td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/> Fall</td> </tr> <tr> <td><input type="checkbox"/> Seminar</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/> Winter</td> </tr> <tr> <td><input type="checkbox"/> Recitation</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring</td> </tr> <tr> <td><input type="checkbox"/> Lab</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Summer</td> </tr> <tr> <td><input type="checkbox"/> Discussion</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring/Summer</td> </tr> <tr> <td><input type="checkbox"/> Independent Study</td> <td><input type="checkbox"/></td> <td></td> </tr> </table> | Course Components | Graded Component | Terms Typically Offered | <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input type="checkbox"/> Fall | <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input checked="" type="checkbox"/> Winter | <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | <input type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | |
| Course Components | Graded Component | Terms Typically Offered | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input type="checkbox"/> Fall | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input checked="" type="checkbox"/> Winter | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | |

Cognizant Faculty Member Name: Xianglei Huang Cognizant Faculty Member Title:

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|---|----------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: |  | |
| Dept Chair(s): | | Date: |
| Home Department: | | Date: 7-2-2019 |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

Objective methods are introduced for analyzing climate data with inherent spatial and/or temporal correlation scales. These include time series analysis, pattern recognition techniques, regression, and linear modeling. The emphasis are both the usage of such methods and critical evaluation of literature's that employ them.

Class Length

Full term

Contact hours (lecture):

3

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

Objective methods are introduced for analyzing climate data with inherent spatial and/or temporal correlation scales. These include time series analysis, pattern recognition techniques, regression, and linear modeling. The emphasis are both the usage of such methods and critical evaluation of literature's that employ them.

Class Length

Full term

Contact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

ABET departmental program outcomes for undergraduate courses:Special resources of facilities required for this course:Supporting statement:

The name of the course is changing to better reflect the content of the course.



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2018-04-06

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|-------------------------------------|--|---------|----------------|--|---------|----------------|
| <input checked="" type="checkbox"/> | Dept (Home): Civil & Environmental Engin | | | Dept (Home): Civil & Environmental Engin | | |
| | Subject: CEE | | | Subject: CEE | | |
| | Catalog: 431 | | | Catalog: 331 | | |
| | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Construction Contracting | | | Course Title (full title) Construction Management | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) Constr Contracting | | | Abbreviated Title (20 char) Constr Mgmt | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Introduction to a construction management process for engineers in which the project life-cycle is broken into organizing, evaluating, planning, monitoring and controlling. Students will learn about the project delivery, financial and procurement systems; legal issues; cost estimation; scheduling; bonding and insurance; and project resource planning and control. | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| | Undergraduate Min: 4 | | Graduate Min: | Undergraduate Min: | | Graduate Min: |
| | Undergraduate Max: 4 | | Graduate Max: | Undergraduate Max: | | Graduate Max: |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student | | | | | |
| <input type="checkbox"/> | Repeatability | | | | | |
| | <input type="checkbox"/> Course is Repeatabile for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

Subject: Civil & Environmental Engin Catalog: 431

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

| | CURRENT LISTING | REQUESTED LISTING |
|-------------------------------------|---|--|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) Senior standing. | Advisory Prerequisite (254 char) Junior standing. |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |

Cognizant Faculty Member Name: Carol C. Menassa Cognizant Faculty Member Title: Associate Professor

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Matt Blank Email: blankm@umich.edu Phone: 734.764.4106

| | |
|--|-------|
| Curriculum Committee: | Date: |
| Dept Chair(s): Jerome P. Lynch, Professor & Chair | |
| Home Department: Civil and Environmental Engineering | Date: |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Construction contracting for engineers, contractors, architects, owners. (1) Organization and administration; industry structure; construction contracts, bonds, insurance, dispute resolution. (2) Planning, estimating, and control; quantity takeoff and pricing; labor and equipment estimates; estimating excavation and concrete; proposal preparation; scheduling; accounting and cost control. Students use contract documents to prepare detailed estimate.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)Contact hours (lab)

1

Course Description

Introduction to a construction management process for engineers in which the project life-cycle is broken into organizing, evaluating, planning, monitoring and controlling. Students will learn about the project delivery, financial and procurement systems; legal issues; cost estimation; scheduling; bonding and insurance; and project resource planning and control.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)Contact hours (lab)

2

Additional Info:Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Program elective for the BSE in Civil Engineering.

ABET departmental program outcomes for undergraduate courses:

a,b,c,d,e,f,g,h,i,j,k

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

This class has been offered as CEE431: Construction Contracting. It is a program elective for the BSE in Civil Engineering. We are proposing to change the class number to CEE 331 to be in line with the other program electives and their lecture-laboratory content. The class name is being changed to Construction Management to better reflect the content of the class and emphasize that it is an introduction to Construction Management topics. The class will also serve as a prerequisite for CEE435: Building Information Modeling, a technical elective class for the BSE in Civil Engineering. The class content and laboratory requirements will not be affected by this change.

**CEE331: Construction Management
Fall 20--**

SYLLABUS

Instructor: **Professor Carol Menassa**

GS: **TBD**

**Lectures: MW 10:30 AM – Noon Rm. 2147 GGBL
Laboratory: F 10:30 AM – 11:30 AM Rm. 2147 GGBL or 1105 GGBL (Construction Lab)**

I. CONTACT INFORMATION

Course Website

Canvas Link: <https://umich.instructure.com/courses/163158>

You will be able to access the course resources on Canvas. Please take some time to familiarize yourself with the system if you have not used it before.

Instructor: Prof. Carol C. Menassa

Department of Civil & Environmental Engineering

Room 2140 GGBL

Phone: 734-764-7525

E-mail: menassa@umich.edu

Office Hours: Walk-in any time I am in the office or set an appointment – **Best way to reach me to set up an appointment would be by email. Please make sure you include CEE431 in your subject heading.**

GSI: TBD

Department of Civil & Environmental Engineering

Room ----

E-mail: -----

Office Hours: Th 10:30 AM –11:30 AM or By appointment

II. COURSE DESCRIPTION

As technological integration and construction complexity increase, so does construction lead time and budget constraints. To stay competitive, companies seek to shorten the construction duration of new project, and to remain within budget by managing construction development efforts effectively. This is typically achieved by using different project management tools. ***In this class, you will learn three important aspects of construction contracting: (1) what are the theory, methods and quantitative tools used to effectively plan, organize, manage and control construction projects; (2) what efficient management methods are revealed through practice and research; (3) how to apply hands-on, practical project management knowledge from real life situations.***

To achieve this, we will use a basic construction contracting framework in which the project construction life-cycle is broken into organizing, evaluating, planning, monitoring, controlling and learning from prior and current construction projects. Within the framework, you will learn about the methodologies and tools necessary for each aspect of the process as well as the theories upon which these are built. By the end of the term you will be able to adapt and apply the framework to effectively manage a construction project in an Architecture/Engineering/Construction (A/E/C) organization.

In addition to providing students with the ability to address basic concepts in construction contracting, in this class you will also learn the concepts and processes of construction surety, insurance and financial evaluation, and their importance to construction project risk control.

The material in the course is divided into five major segments: project organization, project evaluation, project planning, project monitoring and control, and project risk prevention.

III. COURSE ORGANIZATION

The following paragraphs detail the organization of the lectures, readings as well as the evaluation of the students' work and involvement in the class.

Lectures

The course materials will be taught through a series of lectures and discussions. Lectures are scheduled for Mondays and Wednesdays from 10:30 AM to Noon in Room 2147 GGB. Lecture time will be used for teaching course materials, class discussion and other activities. In addition, this class has a lab session scheduled for Fridays from 10:30 AM to 11:30 AM in Room 2147 or 1105 GGB (Construction Lab). You will be notified by email where the lab meeting will occur. The lab session will be led by the GSI and will be used to reinforce concepts learnt in class. It is designed to allow students opportunity to discuss class material and readings with the GSI. In addition, lab sessions will be used to discuss the term project sets (see below for more details) and answer student questions prior to submission deadlines.

All lecture notes will be posted on the class website. However, there will be discussion material and/or problems that we will do together during the class time. Therefore, your attendance and wholehearted participation in all class activities is required for success and good performance in the course.

Required Readings

Material for this class comes from several different sources. That is why there is no assigned text book for the class. Required readings for each class will be posted on the course website. Students must download and review the posted required readings corresponding to each week's in-class topics.

Most of the class material comes from the following four books:

- 1) Construction Contracting: A Practical Guide to Company Management by Richard H. Clough, Glenn A. Sears and S. Keoki Sears. **Available on reserve at UM library**
- 2) Professional Construction Management: Including CM, Design-Construct and General Contracting by Donald S. Barrie and Boyd C. Paulson. **Available on reserve at UM library**
- 3) Project Management – A Managerial Approach by Jack R. Meredith and Samuel J. Mantel. **Available online through UM library at: <http://mirlyn.lib.umich.edu/Record/013616104>**
- 4) Project Management for Construction by Chris Hendrickson and Tung Au. **Available to download for free at: <http://pmbook.ce.cmu.edu/>**

Term Project

The term project is divided into five distinct sub parts that we call "sets" as follows:

- TP1 (Project Delivery Methods): Group Submission. Report.
- TP2 (Cost Estimation of Ann Arbor Fire Department Building) Group submission. Report.
- TP 3 (Contracts and Legal Issues): Group submission. Report and class presentation.
- TP 4 (Scheduling): Individual Submission
- TP 5 (Resource Planning/Earned Value Analysis): Individual Submission

All term project sets will be posted on Canvas unless otherwise noted.

For full credit, each term project set should be submitted as a PDF file on Canvas on its due date. Please make sure the scanned pages of your PDF files are readable, pages properly oriented and in order. 5 Points will be deducted for files submitted that do not meet this criteria.

Partial credit will be given for late submissions up to 1 day maximum. Any problem set submitted late, but within the 1 day grace period, will receive a 20 % penalty. Please discuss any extenuating circumstances preventing you from submitting the term project sets on time with Prof. Menassa.

We will allocate time in the lab session for you to work on the term project sets and discuss them with your peers or with the GSI. Please come to the lab session assigned for this activity prepared to make the most use of this time. It is designed to help you complete the term project sets efficiently and effectively.

Term project sets are not all team assignments unless specifically identified as such. Collaboration among students on the term project sets to be completed **INDIVIDUALLY** is limited to discussing concepts and clarifying issues during the lab session. Each student is expected to produce her/his **OWN SOLUTIONS** to the term project sets. You may not copy or otherwise share other students' work or copy or otherwise use past students' solutions.

If any violation of the honor code is suspected, it will be promptly addressed by reporting to the College of Engineering Honor Council: <https://ossa.engin.umich.edu/honor-council/>.

Exams

There will be two exams for this class. Exams will be offered during the regular class time on the assigned dates given below. Students are expected to take the exams on the assigned dates.

Exam 1: Wednesday October 25, 2017 (During class time in 2147 GGB)

Exam 2: Monday December 18, 2017 (1:30-3:30 pm – Location TBD)

Any extenuating circumstances that might prevent you from taking an exam on the assigned date should be discussed with Prof. Menassa. You are expected to share a doctor's note or similar evidence in case of an emergency.

The two exams are closed book, closed notes, and closed electronic devices.

Grading

The term project sets, exams and class participation account for 100% of the grade. Your final grade will be calculated as follows:

| | |
|-----------------------|-----|
| ○ Term Project Sets | 50% |
| ○ Exam 1 | 20% |
| ○ Exam 2 | 20% |
| ○ Class Participation | 10% |

Class participation involves regular attendance, graded drop quizzes and self-initiated participation and engagement in lectures and in-class/lab discussions.

The grading in the class will roughly follow the rubric below:

A+: 100-97
 A: 97-93
 A-: 92-88
 B+: 88-85
 B: 84-81
 B-: 80-77
 C+: 77-75
 C: 74-71
 C-: 70-65
 D: 64-60
 D-: <60

IV. ACADEMIC INTEGRITY AND ACADEMIC MISCONDUCT - HONOR CODE

The Department of Civil and Environmental Engineering at the University of Michigan adheres to the strictest standards of academic honesty. An important aspect of achieving these standards is to be sure that students are aware of faculty expectations regarding academic honesty. This statement clarifies these expectations as they apply to this course.

Term project sets, exams and quizzes serve the following two purposes:

- 1) They are seen as educational devices to help students master the course material. This includes the concepts, theories, methodologies, and tools presented in class and recitation.
- 2) They help the faculty evaluate how well each student has mastered the course material.

Students currently taking this class can work together to conceptualize general approaches to the term project sets. However, unless otherwise specified for a particular term project set, the work you submit must be done completely on your own. This includes text, numerical calculations, mathematical derivations, diagrams, graphs, computer programs and output. You are also expected to properly reference the source of any information used in a submission that is not your own. This includes any book, article, web page, MS PowerPoint presentation or personal correspondence from someone in the industry that you used to create your work. It is recommended to use the American Society of Civil Engineers (ASCE) publications guidelines to properly reference all types of resources. This document is available on Canvas for your easy reference.

It is also inappropriate to use term project sets submitted in previous years as a source. Academic honesty rules will be strictly implemented in this case.

If you have any questions about how these policies relate to a specific situation, please speak to Professor Menassa for clarification. Just remember, when you have doubts, err on the side of caution or ask the Professor for assistance.

Please refer to University policy regarding academic misconduct. Academic misconduct (cheating, plagiarism, etc.) on term project sets, exams and quizzes, and such works will be given a score of zero, and reported to the Honor Council in the College of Engineering. More information can be found at the following link: <http://honorcode.engin.umich.edu/>.

Class Topics

| Module | Title |
|--------|--|
| 1 | Introduction to Construction Projects |
| 2 | Project Delivery Systems |
| 3 | Financial Contract Types |
| 4 | Project Procurement Methods |
| 5 | Insurance and Surety Bonds for Construction Projects |
| 6 | Project Cost Estimation |
| 7 | Introduction to Project Scheduling |
| 8 | Introduction to Resource Planning |
| 9 | Earned Value Analysis |
| 10 | Contracts and Legal Issues in Construction |

Lab Schedule

| Week | Activity |
|------|--|
| 1 | <p>Introduction to Building Information Modeling (BIM) Software and Autodesk Revit</p> <ul style="list-style-type: none"> • Learn about BIM • Learn about BIM software, Autodesk Revit • Learn about different types of drawing views (e.g., plan, section, elevation) • Learn and practice navigating through an example BIM model in Revit • Learn and practice measuring items in the example BIM model in Revit • Learn and practice isolating details in the example BIM model in Revit • Learn and practice finding information in the example BIM model in Revit |
| 2 | <p>Introduction to Construction Quantity Estimation Software and Bluebeam Revu</p> <ul style="list-style-type: none"> • Learn about quantity estimation markup software, Bluebeam Revu • Learn and practice navigating through an example PDF drawing in Revu • Learn and practice calibrating PDF drawings to match BIM model scale in Revu • Learn and practice measuring areas using the area tool and an example PDF drawing in Revu • Learn and practice measuring piecewise continuous distances using the polylength tool and an example PDF drawing in Revu • Learn and practice measuring areas using the dynamic fill tool and an example PDF drawing in Revu • Learn and practice editing markup display properties using an example PDF drawing in Revu • Learn and practice grouping measurements using an example PDF drawing in Revu • Learn and practice exporting measurement data in CSV format using an example PDF drawing in Revu |
| 3 | <p>TP1: Construction Project Delivery Methods</p> <ul style="list-style-type: none"> • Learn how to use decision matrices to make project acquisition strategy recommendations to clients • Practice extracting important project characteristics, criteria, and goals from a narrative description of an owner's needs using a case study example • Practice ranking the importance of evaluation criteria based on a description of owner needs using a case study example • Learn the pros and cons of the various construction project delivery methods • Practice translating descriptions of owner needs into evaluation criteria for selecting construction project delivery methods using a case study example • Practice identifying which construction project delivery methods best meet owner requirements using a case study example • Learn the pros and cons of the various construction project financial contract types • Practice translating descriptions of owner needs into evaluation criteria for selecting construction project financial contract types using a case study example • Practice identifying which construction project financial contract types best meet owner requirements using a case study example • Learn the pros and cons of the various construction project procurement methods • Practice translating descriptions of owner needs into evaluation criteria for selecting construction project procurement methods using a case study example • Practice identifying which construction project procurement methods best meet |

| | |
|---|---|
| | owner requirements using a case study example |
| 4 | <p>TP2: Construction Project Estimation: TP2 Project Introduction</p> <ul style="list-style-type: none"> • Receive introduction to a real construction project • Explore a real construction project's BIM model • Explore a real construction project's bid documents and contract documents, such as the performance bond, labor and material bond, instructions to bidders, qualifications of bidders, general conditions of the contract, supplementary general conditions of the contract, drawings, specifications, addenda, and change orders • Learn about the Center Line Method and the Short Wall – Long Wall Method for estimating the total lengths of continuous construction features • Learn about estimating volumes of symmetric, uniform, continuous construction features using cross-sectional areas and total lengths • Learn about precedence (flow) of activities in construction processes related to excavation, foundation work, backfill, and flatwork |
| 5 | <p>TP2: Construction Project Estimation: Construction and Estimation of Concrete Structures</p> <ul style="list-style-type: none"> • Learn about construction processes and quantity estimation related to concrete foundations, and practice estimating foundation quantities using an example BIM model • Learn about construction processes and quantity estimation related to concrete slabs, and practice estimating slab quantities using an example BIM model • Learn about construction processes and quantity estimation related to concrete thickened slabs, and practice estimating thickened slab quantities using an example BIM model • Learn about construction processes and quantity estimation related to vapor barrier installation, and practice estimating vapor barrier quantities using an example BIM model • Learn about concrete finishing and curing processes, and practice estimating finishing and curing quantities for concrete slabs using an example BIM model • Learn about concrete column quantity estimation and practice estimating column quantities using an example BIM model |
| 6 | <p>TP2: Construction Project Estimation: Construction and Estimation of Concrete Reinforcement</p> <ul style="list-style-type: none"> • Learn about construction processes and quantity estimation related to rebar for concrete footings, and practice estimating footing rebar quantities using an example BIM model • Learn about rebar lap splice joints (overlap) along long spans and corners, and practice estimating footing rebar overlap quantities using an example BIM model • Learn about construction processes and quantity estimation related to rebar cages for concrete columns, and practice estimating column rebar quantities using an example BIM model • Learn about rebar lap splice joints (overlapping) in stirrups, and practice estimating stirrup rebar overlap quantities using an example BIM model • Learn about construction processes and quantity estimation related to rebar for concrete slabs and thickened slabs, and practice estimating slab rebar quantities using an example BIM model • Learn about rebar lap splice joints (overlap) along long spans, and practice estimating |

| | |
|---|--|
| | <p>slab rebar overlap quantities using an example BIM model</p> <ul style="list-style-type: none"> • Learn about construction processes and quantity estimation related to Welded Wire Fabric (WWF) for concrete slabs, and practice estimating slab WWF quantities using an example BIM model • Learn about WWF lap splice joints (overlap) between sheets, and practice estimating slab WWF overlap quantities using an example BIM model |
| 7 | <p>TP2: Construction Project Estimation: Construction and Estimation of Concrete Formwork</p> <ul style="list-style-type: none"> • Learn how to estimate formwork quantities, such as Square Foot of Contact Area (SFCA), and practice estimating formwork quantities using an example construction project • Learn about traditional timber formwork construction and estimation, and practice designing and estimating formwork for concrete footings, columns, walls, and slabs using an example construction project • Learn how to convert nominal lumber volume into units of Foot Board Measure, and practice estimating lumber volumes for given formwork designs in an example construction project • Learn how to estimate the unit material cost for timber formwork from a given design, and practice estimating formwork unit costs for an example construction project • Learn how to apply total formwork quantity estimates to formwork unit material costs to determine total formwork material costs, and practice performing such material cost estimates for concrete footings, columns, walls, and slabs using an example construction project |
| 8 | <p>TP2: Construction Project Estimation: Construction Process and Estimation of Excavation Work</p> <ul style="list-style-type: none"> • Learn about excavation, backfill, and tamping (compaction) methods • Learn about foundation trench profiles and how to estimate excavation quantities, and practice estimating excavation quantities for foundation work and slab work using an example construction project • Learn how to estimate trench backfill quantities, and practice estimating trench backfill quantities for foundation work and slab work using an example construction project • Learn how to estimate tamping quantities, and practice estimating trench backfill tamping quantities for foundation work and slab work using an example construction project • Learn how to convert between various forms of earthwork material volume, namely Bank Cubic Yards (BCY), Loose Cubic Yards (LCY), and Compacted Cubic Yards (CCY), and practice converting between such units to estimate excavation, backfill, and tamping quantities |
| 9 | <p>TP2: Construction Project Estimation: Cost Estimation Using RS Means Cost Dataset</p> <ul style="list-style-type: none"> • Learn how estimate construction productivities, such as daily output and labor hours using RS Means Construction Cost Data, and practice estimating construction productivities for such items as concrete structures, concrete reinforcement, concrete formwork, and excavation using an example construction project • Learn how to adjust labor unit crew costs by adjusting crew configurations, and practice adjusting labor unit crew costs for various construction items using an example construction project |

| | |
|----|---|
| | <ul style="list-style-type: none"> Learn how to calculate direct labor, material, and equipment costs using construction quantities and RS Means unit costs, and practice calculating such costs for various construction items using an example construction project |
| 10 | <p>TP3: Construction Project Dispute Resolution</p> <ul style="list-style-type: none"> Read an example case study in which unfortunate circumstances arose during a construction project that led to several disputes between an owner and a contractor Assume the role of owner or contractor and assemble and present a mock case to argue eligibility for compensation based on the case study and contract documents provided (e.g., general conditions of the contract for construction, specific conditions of the contract for construction, as-planned schedule, etc.) Assume the role of arbitrator, jury, or judge and listen to testimonies, evaluate evidence, and render a decision for the mock arbitration or litigation cases |
| 11 | <p>TP4: Construction Project Activity Scheduling</p> <ul style="list-style-type: none"> Learn how to draw Activity on Arrow (AOA) and Activity on Node (AON) network diagrams illustrating precedence relationships between activities in construction projects, and practice drawing such networks for a mock construction project Learn how to determine the early start times, late start times, early finish times, late finish times, total floats, and free floats of activities in construction project scheduling, and practice determining such values for a mock construction project Learn how to determine the critical activity path when scheduling a construction project, and practice determining the critical path for a mock construction project Learn how to apply the Linear Scheduling Method (LSM) for scheduling linear construction projects (e.g., highway or high-rise projects), and practice implementing LSM for a mock highway construction project |
| 12 | <p>TP5: Construction Project Resource Allocation</p> <ul style="list-style-type: none"> Learn how to develop cash flow and cumulative cash flow (S-Curve) diagrams for a construction project, and practice developing such diagrams for a mock construction project Learn how to crash (expedite) activities in a construction project as a means of reducing the project's total duration, and practice crashing a mock construction project to its least possible duration Learn how to find the project duration of optimal cost when considering such factors as the project's un-crashed direct cost, crash costs, overhead costs, and liquidated damages, and practice finding the optimal duration (optimal cost) for a mock construction project Learn how to allocate resources for a construction project for a given schedule, and practice allocating resources for a mock construction project Learn how to apply the "As Soon as Possible" method for leveling resources in a construction project to mitigate situations in which resource demands exceed resource availability, and practice applying the "As Soon as Possible" resource leveling method to a mock construction project |
| 13 | <p>Review and Ask Questions About Lab Content</p> <ul style="list-style-type: none"> Review lab content taught throughout the course Ask any remaining questions related to lab content |

CEE Departmental Course Outcomes Evaluation

Course: CEE 331

Term: FA --

To meet degree accreditation requirements, each undergraduate course in the Department has specific outcomes that it seeks to achieve. The Department must also periodically assess its success in achieving these goals. In the form below we welcome your assessment of the extent to which the outcomes of this course have been met. Your candid evaluation will be helpful in allowing the instructor to determine where improvements are needed.

The evaluation results will be given only to the instructor and only after final grades for the course are reported. It is not necessary to provide your name on the survey. Thank you for participating in this important process.

| Course Outcomes | To what degree has this outcome been met | | | |
|--|--|------|------|------|
| | Strong | Fair | Weak | None |
| 1 To understand the construction industry, and classify different types of construction (residential, commercial etc.); as well as, define a project, its attributes and understand project life cycle. | | | | |
| 2 To understand project delivery methods (e.g., Design Bid Build, Pure Construction Management, and Design Build), and the relationships (e.g., contractual and communicational), and advantages/disadvantages of each method. | | | | |
| 3 To understand and differentiate between the different financial contract types (e.g., fixed price/lump sum, unit price, cost plus fee and Guaranteed Maximum Price). | | | | |
| 4 To learn about construction claims and disputes, and differentiate the alternative dispute resolution methods. | | | | |
| 5 To learn construction cost estimating methods (e.g., ENR Building Cost Index, RS Means Parameter costs), and introduce project planning and scheduling processes (e.g., Critical Path Method). | | | | |
| 6 To understand construction insurance, bonds and bidding process. | | | | |



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-07-31

Effective Term: Fall 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|--------------------------|---|---------|----------------|--|---------|----------------|
| <input type="checkbox"/> | Dept (Home): Chemical Engineering | | | Dept (Home): Chemical Engineering | | |
| <input type="checkbox"/> | Subject: CHE | | | Subject: CHE | | |
| <input type="checkbox"/> | Catalog: 488 | | | Catalog: 488 | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| <input type="checkbox"/> | Course Title (full title) Chemical Product Design I | | | Course Title (full title) Chemical Product Design I | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Chem Product Design1 | | | Abbreviated Title (20 char) Chem Product Design1 | | |
| <input type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Part one of a two-semester chemical product design sequence. Teams develop the process for a new chemical product that meets industrial, federal and local regulations. Survey development, literature research, and development of an appropriate manufacturing process. Oral and written technology and economic feasibility reports. Safety, environmental and ethical issues. | | | | | |
| <input type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| <input type="checkbox"/> | Undergraduate Min: 2 | | Graduate Min: | Undergraduate Min: | | Graduate Min: |
| <input type="checkbox"/> | Undergraduate Max: 2 | | Graduate Max: | Undergraduate Max: | | Graduate Max: |
| <input type="checkbox"/> | Course Credit Type Undergraduate Student | | | | | |
| <input type="checkbox"/> | Repeatability | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Repeatable for Credit | | | <input checked="" type="checkbox"/> Course is Y graded | | |
| <input type="checkbox"/> | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

Subject: Chemical Engineering Catalog: 488

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

| CURRENT LISTING | REQUESTED LISTING |
|---|--|
| <input type="checkbox"/> Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) |
| <input checked="" type="checkbox"/> Enforced Prerequisite (254 char) CHE 360, CHE 344, CHE 485 and MATSCIE 220 or 250. I, II Minimum grade requirement: | Enforced Prerequisite (254 char) CHE 344, preceded or accompanied by ChE 360 Minimum grade requirement: C- |
| <input type="checkbox"/> Credit Exclusions | Credit Exclusions |
| <input type="checkbox"/> Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | <input checked="" type="checkbox"/> Graded Component <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Laura Hirshfield Cognizant Faculty Member Title: ChE Lecturer | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Barbara Mintz

Email: bgmintz@umich.edu

Phone: 734-647-9876

Curriculum Committee:

Date:

Dept Chair(s):

Home Department: 

Date: 8/7/19

Cross-Listed Department:

Date:

Cross-Listed Department:

Date:

Cross-Listed Department:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Part one of a two-semester chemical product design sequence. Teams develop the process for a new chemical product that meets industrial, federal and local regulations. Survey development, literature research, and development of an appropriate manufacturing process. Oral and written technology and economic feasibility reports. Safety, environmental and ethical issues.

Course Description

Part one of a two-semester chemical product design sequence. Teams develop the process for a new chemical product that meets industrial, federal and local regulations. Survey development, literature research, and development of an appropriate manufacturing process. Oral and written technology and economic feasibility reports. Safety, environmental and ethical issues.

Class Length

Full term

Class Length

Full term

Contact hours (lecture):

2

Contact hours (lecture):

2

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

Home dept

Describe how this course fits with the degree requirements:

Core Course

ABET departmental program outcomes for undergraduate courses:

2,3,4,5,6

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

Originally, students submitted an essay to get into ChE 488 and accepted students received an override. The essay is no longer required and enrollment is open, so we need to be more specific on prerequisites. Half of the students have not taken ChE 360 at the start of Fall term, and ChE 485 and MSE 220/250 are not necessary until the 2nd semester of this 2 semester sequence class, so we are updating the prerequisites to reflect this.



Course Approval Request Form

Office of the Registrar, University of Michigan

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500 S. State Street

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Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-04-18

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input checked="" type="checkbox"/> | Dept (Home): Subject: Catalog: | Dept (Home): Elec Engin & Computer Sci Subject: EECS Catalog: 507 | | | | | | | | | | | | |
|-------------------------------------|--|---|---------|----------------|--|--|--|--|------------|---------|----------------|--|--|--|
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) | Course Title (full title) Introduction to Embedded System Research | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) | Abbreviated Title (20 char) Intro Embed Sys Res | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Establish a foundation in research related to embedded system analysis, design, and synthesis. Lectures, assigned reading, and student presentations used to survey fundamental embedded systems topics. The second half-semester focuses on an important and timely research topic. Survey-only (3 credit) and project (4 credit) versions. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 3 Graduate Min: 3 Undergraduate Max: 4 Graduate Max: 4 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student, Rackham Graduate Student with Additional Work | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | <input checked="" type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | |

| | | | | | | | |
|---|---|---|--|---|--|--|--|
| Subject: | Catalog: | | | | | | |
| <input checked="" type="checkbox"/> | <table style="width:100%; border: none;"> <tr> <td style="width:33%;"> Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration </td> <td style="width:33%;"> Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> <td style="width:33%;"> Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> </tr> <tr> <td colspan="3"> Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only </td> </tr> </table> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | | |
| Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | | | | | |
| Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | | | | | | | |

| | CURRENT LISTING | REQUESTED LISTING | | | |
|---|--|---|--|---|--|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) A prior >= 400-level course on computer system or sensor design and analysis. Sufficient time to read and understand two 30-page research papers per week. | | | |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: C | | | |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | |
| <input checked="" type="checkbox"/> | <table style="width:100%; border: none;"> <tr> <td style="width:33%;"> Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study </td> <td style="width:33%;"> Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td style="width:33%;"> Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer </td> </tr> </table> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | |
| Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | | | |
| Cognizant Faculty Member Name: Robert Dick | | Cognizant Faculty Member Title: | | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: _____ Email: _____ Phone: _____

Curriculum Committee: _____ Date: _____

Dept Chair(s): Heath Hofman Date: 10/8/19

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

| |
|--------------------------------------|
| DEPARTMENTAL/COLLEGE USE ONLY |
|--------------------------------------|

Current:**Requested:**Course DescriptionCourse Description

Establish a foundation in research related to embedded system analysis, design, and synthesis. Lectures, assigned reading, and student presentations used to survey fundamental embedded systems topics. The second half-semester focuses on an important and timely research topic. Survey-only (3 credit) and project (4 credit) versions.

Class LengthClass Length

Full term

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

3

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

Home dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:Special resources of facilities required for this course:Supporting statement:

Need for Course

The EECS department currently has no general research survey course for students specializing in embedded systems, and there is a need for such a course. The Embedded Systems ECE area currently has 21 students, and the courses permitted within the area have for the most part been pieced together from somewhat-related courses from other fields or more highly relevant undergraduate (and therefore not research-oriented) courses such as EECS 473. Graduate students specializing in several other areas work on topics related to embedded systems, and would benefit from a broad introduction to the area. There are also several undergraduate students, particularly those in the Computer Engineering program, who are interested in an introduction to embedded systems related research. I believe there is a need for a general survey course introducing the field of embedded systems.

Course Goals

Introduction to Embedded Systems Research is designed to prepare graduate and advanced undergraduate students with a foundation in, and head start on, research related to embedded system analysis, design, and synthesis. The first half of the course consists of lectures and assigned reading material on fundamental embedded systems topics on which future research will generally build. The second half of the course focuses on a specific, and possibly new, topic within the field. Part of the reason for this structure is ensure that a broad range of relevant topics will be covered each time the course is offered, and to make it customizable enough for teaching it to be attractive to several faculty, thereby permitting it to be offered regularly, and ideally once per year.

Involvement of Other Faculty

During the design of the course, I solicited input from the following faculty: Hun-Seok Kim, Zhengya Zhang, Ronald Dreslinski, Kevin Fu, Alanson Sample, and Kang Shin, who are qualified to teach the course in the future. Some provided feedback, based on which I revised the syllabus. I also spoke with Mark Brehob about the connection of the course with the undergraduate curriculum, as I do intend for the course to be accessible to advanced undergraduates interested in research.

Status and Plans

The course is currently being taught as EECS 598-13. I am scheduled to teach it again in Winter 2020. There are currently 32 students. The midterm evaluation scores for the “understanding of the subject matter” question was 4.5. The score for the “excellent teacher” question was 4.8.

Risks and Caveats

It is very appealing for faculty to use their graduate teaching slots on special topics courses on areas of current interest. Although this course permits half of the semester to be spent on such a topic, it does require broad coverage of the field during the first half-semester. As a result, it may be challenging to find faculty to teach it yearly. Even if it can only be taught every other year, I still argue that it should be registered and given a number.

Kang Shin pointed out that the course topics overlap with his “EECS 571: Principles of Real-Time Embedded Systems”. Based on the outline of that course at <https://www.eecs.umich.edu/courses/eecs571/>, it appears that there are substantial differences between the courses, although it is possible that the real-time embedded systems course has evolved to become a more general embedded systems course over time. I asked Kang Shin whether the information at the (above) website reflected the current state of the course but received no reply.

Introduction to Embedded Systems Research

Robert Dick

Semester: Winter 2019

Time: Tu, Th, 10:30am–12pm

Course number: EECS 598-13

Summary

This course is designed to prepare graduate and advanced undergraduate students with a foundation in, and head start on, research related to embedded system analysis, design, and synthesis. The first half of the course consists of lectures and assigned reading material on fundamental embedded systems topics on which future research will generally build. The second half of the course focuses on a specific, and possibly new, topic in the field. This semester, the focus is embedded machine learning in the Internet-of-Things (IoT).

1 Survey Topics

1. Specification languages and models;
2. scheduling, allocation, and assignment: problem definitions and optimization techniques;
3. embedded (real-time) operating systems;
4. embedded signal processing and machine learning hardware and software;
5. energy- and temperature-aware design and embedded power supplies;
6. wireless communication and its impact on power consumption;
7. sensors and actuators;
8. reliability-aware design, formal methods, and testing;
9. embedded system security; and
10. applications including the IoT, wireless sensor networks, autonomous vehicles, wearables, and smartphones.

2 Focus Topic

Shortly, every human will be served by hundreds or thousands of sensing, decision making, and actuating machines. These smart things will be connected to each other, and the rest of the world. For the many that operate on battery or scavenged power, communication will impose severe energy consumption penalties. Local computation will need to convert sparse data to dense information and decisions at higher levels in the network will be based on processed data from the sensors; those local decisions will be critical to the quality of the results produced by the network. This implies new approaches to the design of machine learning hardware and algorithms, in which energy efficiency joins accuracy as a central optimization objective, and the communication and computation implications of partitioning machine learning algorithm components among embedded systems and higher-performance servers must be explicitly considered. We will cover efficient embedded machine learning algorithms and hardware, LPWAN communication, as well as security, privacy, and reliability in the IoT.

3 Grading

| Without Project | |
|------------------------------------|-----|
| Summaries of assigned reading: | 35% |
| Presentation and critique quality: | 35% |
| Exams: | 30% |
| With Project | |
| Summaries of assigned reading: | 30% |
| Presentation and critique quality: | 30% |
| Exams: | 20% |
| Project: | 20% |



UNIVERSITY OF
MICHIGAN

Winter 2019 Instructor Report of EECS 598-013: Special Topics for Robert Dick

Project Title: **Winter 2019 Teaching Evaluation**

Course Audience: **34**

Responses Received: **8**

Response Ratio: **23.5%**

Report Comments

This report is a summary that tabulates all quantitative ratings on a single page. Ratings are from the Winter 2019 teaching evaluations of EECS 598-013: Special Topics.

Prepared by: **Office of the Registrar**

Creation Date: **Sunday, May 5, 2019**

Responses to the University-wide questions about the course:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|--|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| This course advanced my understanding of the subject matter. (Q1631) | 4 | 2 | 0 | 2 | 0 | 0 | 4.5 | 4.5 | 4.6 |
| My interest in the subject has increased because of this course. (Q1632) | 3 | 3 | 0 | 1 | 1 | 0 | 4.2 | 4.2 | 4.4 |
| I knew what was expected of me in this course.(Q1633) | 3 | 2 | 1 | 1 | 1 | 0 | 4.0 | 4.5 | 4.4 |
| Overall, this was an excellent course.(Q1) | 5 | 1 | 0 | 2 | 0 | 0 | 4.7 | 4.2 | 4.5 |
| I had a strong desire to take this course.(Q4) | 3 | 3 | 1 | 1 | 0 | 0 | 4.2 | 4.0 | 4.4 |
| As compared with other courses of equal credit, the workload for this course was... (SA=Much Lighter to SD=Much Heavier) | 1 | 0 | 4 | 2 | 1 | 0 | 2.8 | 3.0 | 2.9 |

Responses to the University-wide questions about the instructor:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|--|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| Overall, Robert Dick was an excellent teacher. | 5 | 1 | 1 | 1 | 0 | 0 | 4.7 | 4.5 | 4.6 |
| Robert Dick seemed well prepared for class meetings. | 6 | 1 | 1 | 0 | 0 | 0 | 4.8 | 4.8 | 4.7 |
| Robert Dick explained material clearly. | 5 | 2 | 1 | 0 | 0 | 0 | 4.7 | 4.6 | 4.6 |
| Robert Dick treated students with respect. | 6 | 1 | 1 | 0 | 0 | 0 | 4.8 | 4.8 | 4.8 |

Responses to additional questions about the course:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median |
|--|----|---|---|---|----|-----|-------------|------------------------|
| Prerequisites provided adequate preparation for this course. (Q61) | 5 | 1 | 1 | 0 | 1 | 0 | 4.7 | 4.3 |
| The textbook made a valuable contribution to the course. (Q340) | 1 | 0 | 0 | 1 | 1 | 5 | 2.0 | 3.6 |
| I developed confidence in my abilities as an engineer. | 3 | 2 | 2 | 0 | 1 | 0 | 4.0 | 4.0 |
| I developed the ability to solve real world engineering problems. | 2 | 3 | 2 | 1 | 0 | 0 | 3.8 | 4.0 |

The medians are calculated from Winter 2019 data. University-wide medians are based on all UM classes in which an item was used. The school/college medians in this report are based on classes that are graduate level with enrollment of 16 to 74 in College of Engineering.



Course Approval Request Form

Office of the Registrar, University of Michigan

LS&A Suite 5000
 500 S. State Street
 Ann Arbor, MI 48109-1382
 Phone: 734.763.2113
 Fax: 734.936.3148
 ro.curriculum@umich.edu
 ro.umich.edu

↓ CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 04/26/2019
 Effective Term: Fall 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|--------------------------|---|---------------|----------------|--|---------------|----------------|
| <input type="checkbox"/> | Dept (Home): Biomedical Engineering | | | Dept (Home): Biomedical Engineering | | |
| <input type="checkbox"/> | Subject: Biomede | | | Subject: Biomede | | |
| <input type="checkbox"/> | Catalog: 499. | | | Catalog: 442 | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| <input type="checkbox"/> | | | | | | |
| <input type="checkbox"/> | Course Title (full title) Introduction to Biomedical Imaging | | | Course Title (full title) Introduction to Biomedical Imaging | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Intro. Imaging | | | Abbreviated Title (20 char) Intro. Imaging | | |
| <input type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Imaging is used in a wide range of biomedical application, from basic science to clinical care. Biomedical imaging is a mature field with a large job market, and this field is kept moving forward rapidly with constant innovations. This course will be an undergraduate introduction course on biomedical imaging, covering all the major biomedical imaging modalities, such as ultrasound imaging, magnetic resonant imaging (MRI), optical imaging, X-ray, computed tomography (CT), and nuclear imaging. This course will include both lectures and visits to imaging laboratories and the UM hospital. | | | | | |
| <input type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| <input type="checkbox"/> | Undergraduate Min: 3.00 | Graduate Min: | | Undergraduate Min: | Graduate Min: | |
| <input type="checkbox"/> | Undergraduate Max: 3.00 | Graduate Max: | | Undergraduate Max: | Graduate Max: | |
| <input type="checkbox"/> | Course Credit Type Undergraduate | | | | | |
| <input type="checkbox"/> | Repeatability | | | Repeatability | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Repeatable for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| <input type="checkbox"/> | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

| | | | | | | | | | |
|---|---|--------------------|---------------------|---|---|---|---|-------------------------------------|-------------------------------------|
| Subject: | Catalog: | | | | | | | | |
| <input type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | | | | | | | | |
| | <table style="width:100%;"> <tr> <td style="width:33%;">Add Consent</td> <td style="width:33%;">Drop Consent</td> </tr> <tr> <td><input type="checkbox"/> Department Consent</td> <td><input type="checkbox"/> Department Consent</td> </tr> <tr> <td><input type="checkbox"/> Instructor Consent</td> <td><input type="checkbox"/> Instructor Consent</td> </tr> <tr> <td><input type="checkbox"/> No Consent</td> <td><input type="checkbox"/> No Consent</td> </tr> </table> | Add Consent | Drop Consent | <input type="checkbox"/> Department Consent | <input type="checkbox"/> Department Consent | <input type="checkbox"/> Instructor Consent | <input type="checkbox"/> Instructor Consent | <input type="checkbox"/> No Consent | <input type="checkbox"/> No Consent |
| Add Consent | Drop Consent | | | | | | | | |
| <input type="checkbox"/> Department Consent | <input type="checkbox"/> Department Consent | | | | | | | | |
| <input type="checkbox"/> Instructor Consent | <input type="checkbox"/> Instructor Consent | | | | | | | | |
| <input type="checkbox"/> No Consent | <input type="checkbox"/> No Consent | | | | | | | | |

CURRENT LISTING

REQUESTED LISTING

| | | |
|--------------------------|---|--|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) None | Advisory Prerequisite (254 char) Eng 101 |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) None Minimum grade requirement: None | Enforced Prerequisite (254 char) Eng 101 Minimum grade requirement: Engineering student |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | Terms Typically Offered (Please select only one) Winter or [blank] | |
| Instructor Name: Zhen Xu | | Instructor Title: Associate Professor |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Rachel Patterson Email: rjpatt@umich.edu Phone: 734-763-5290

| | |
|---|----------------------|
| Curriculum Committee: | Date: |
| Dept Chair(s): | |
| Home Department: <u><i>Rachel Schmiedle</i></u> | Date: <u>9/18/19</u> |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |

BME 499.006 FALL 2019 INFORMATION SHEET

Instructor: Zhen Xu, Ph.D.
Associate Professor, Department of Biomedical Engineering
Office: Rm 2115 Gerstacker Building
734-647-4961, zhenx@umich.edu

Lectures: Tues/Thurs: 9:00 – 10:30 am, 1123 LBME

Office Hour: Tues: 10:30-11:30am and Thu 10:30-11:30 pm, 2115 Gerstacker

Required Textbook: *Introduction to Medical Imaging: Physics, Engineering and Clinical Applications* by Nadine Barrie Smith and Andrew Webb (for Modules 1-4)

Access to Matlab software (The Mathworks, Inc.) is required.

Optional Textbook: *Optical Imaging Techniques in Cell Biology* by Guy Cox (for Module 5)

Course Web Site: Canvas

Course Announcements: In class and by Canvas announcement and email

Course Description: Imaging is used in a wide range of biomedical application, from basic science to clinical care. Biomedical imaging is a mature field with a large job market, and this field is kept moving forward rapidly with constant innovations. This course will be an undergraduate introduction course on biomedical imaging, covering all the major biomedical imaging modalities, such as ultrasound imaging, magnetic resonant imaging (MRI), optical imaging, X-ray, computed tomography (CT), and nuclear imaging. We will discuss from the basic mechanisms to clinical applications of established and novel imaging methods. This course will include lectures and visits to imaging labs and the University Hospital. External speakers from industry and clinics will also be invited to give presentations to provide the latest update in the trenches.

Grading: Homework assignments (32%) – 8 homework sets with 4% each, midterm (25%), final (40%), University Hospital and lab visit points (3%).

Syllabus

Class Schedule:

Module 1: Introduction to Medical Imaging

Topics: Medical Imaging intro, ROC and specificity/sensitivity, spatial resolution, SNR/CNR, Filtering and PSF, data acquisition, image artifacts, Fourier transform

W1 9/3: Class logistics, Medical Imaging Intro, specificity, sensitivity, ROC curve, spatial resolution (Chapter 1.1 – 1.3)

W1 9/5: Signal-to-noise ratio, contrast-to-noise-ratio, image filtering, data acquisition, Imaging artifacts, Fourier Transform (Chapter 1.4 – 1.9)

Module 2: Ultrasound

Topics: Wave propagation, acoustic impedance, transducer arrays, clinical scanning modes, image characteristics, Doppler ultrasound, US contrast agents, clinical applications

W2 9/10: Introduction, wave propagation, acoustic impedance (Chapter 4.1-4.2)

W2 9/12: Reflection, scattering, absorption, and attenuation (Chapter 4.3 – 4.4)

W3 9/17: Instrumentation, single element ultrasound transducers (bandwidth, beam geometry, lateral resolution, axial resolution, focusing) (Chapter 4.5-4.6)

W3 9/19: transducer arrays, beam-forming and steering (Chapter 4.7)

W4 9/24: Time gain compensation, multi-dimensional arrays, clinical scanning modes, Imaging characteristics, Doppler, contrast agents, elastography (Chapter 4.8 – 4.14)

W4 9/26: K-wave simulation

Module 3: Magnetic Resonance Imaging

Topics: Effects of magnetic fields and RF on protons, MR signal detection, T1 and T2 relaxation, spatial encoding and MR imaging, data acquisition and k-space, MR image reconstruction, basic imaging sequences, MR instrumentation, fast imaging, fMRI, image characteristics and artifacts, clinical applications

W5 10/1: Introduction, magnetic field, radiofrequency pulse (Chapter 5.1 – 5.5)

W5 10/3: Faraday Induction, T1 and T2 relaxation times, gradient coils (Chapter 5.4-5.5)

W6 10/8: **Visit to ultrasound lab**

W6 10/10: **Guest Lecture (John Seamens – Currently Delphinus and previously GE, has experience on US and CT)**

W7 10/15: Fall Break

W7 10/17: Review

W8 10/22: **Midterm**

W8 10/24: Image acquisition, MRI pulse sequence (Chapter 5.8 – 5.9)

W9 10/29: k-space and image reconstruction, Multiple-slice imaging, basic imaging sequences, clinical imaging (Chapter 5.10-5.23)

Module 4: Imaging with ionization: X-Ray and CT

Topics: X-ray production, energy spectra, x-ray absorption, scattering, instrumentation, spatial resolution, contrast agents, clinical applications, principles of CT, instrumentation, helical and multislice CT, image reconstruction, radiation dose, clinical applications of CT, SPECT, PET

W9 10/31: Intro to X-ray, X-ray tube, X-ray interaction with the body, X-ray attenuation coefficient, (Chapter 2.1 – 2.5)

W10 11/5: X-ray detector, quantitative characteristics, X-ray contrast agents, imaging techniques, clinical applications (Chapter 2.6 – 2.11)

W10 11/7: Intro to CT, Radon Transform and Central Section Theorem (Chapter 2.12 and 1.10)

W11 11/12: Backprojection, Filtered backprojection (Chapter 1.10)

W11 11/14: Spiral CT, CT Instrumentation, image reconstruction, CT Radiation dose, CT clinical application (Chapter 2.13 – 2.18)

W12 11/19: *Visit to MRI lab Industry*

W12 11/21: Introduction, Light microscopy, fluorescence microscopy

Module 5 Optical Imaging

Topics: Light microscopy, fluorescence microscopy, confocal microscopy, endoscope, optical coherence tomography.

Text book: Optical Imaging Techniques in Cell Biology by Guy Cox (optional)

W13 11/26: Confocal microscopy, endoscope, optical coherence tomography.

W13 11/28: **Thanksgiving**

W14 12/3: Review

W14 12/5: *Research lecture: Noninvasive, image-guided ultrasound therapy*

W14 12/10: *Visit to University Hospital Radiology Unit*

Final 12/12 9 AM – 11 AM



UNIVERSITY OF
MICHIGAN

Fall 2018 Instructor Report With Comments for BIOMEDE 499-006: Special Topics (Zhen Xu)

66

Project Title: **Central Campus Fall 2018 Evaluation**

Course Audience: **12**
Responses Received: **8**
Response Ratio: **66.7%**

Report Comments

This report is a summary that tabulates all quantitative ratings on a single page. Results from the open-ended questions appear at the end of the report. Ratings are from the Fall 2018 teaching evaluations of BIOMEDE 499-006: Special Topics.

Prepared by: **Office of the Registrar**
Creation Date: **Thu, Jan 03, 2019**

Responses to the University-wide questions about the course:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|--|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| This course advanced my understanding of the subject matter. | 4 | 4 | 0 | 0 | 0 | 0 | 4.5 | 4.5 | 4.6 |
| My interest in the subject has increased because of this course. | 5 | 2 | 0 | 1 | 0 | 0 | 4.7 | 4.1 | 4.3 |
| I knew what was expected of me in this course. | 4 | 2 | 1 | 1 | 0 | 0 | 4.5 | 4.4 | 4.5 |
| Overall, this was an excellent course. | 3 | 3 | 2 | 0 | 0 | 0 | 4.2 | 4.2 | 4.3 |
| I had a strong desire to take this course. | 3 | 4 | 0 | 0 | 0 | 0 | 4.4 | 4.0 | 4.2 |
| As compared with other courses of equal credit, the workload for this course was... (SA=Much Lighter to SD=Much Heavier) | 1 | 2 | 5 | 0 | 0 | 0 | 3.3 | 3.0 | 2.9 |

Responses to the University-wide questions about the instructor:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|--|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| Overall, Zhen Xu was an excellent teacher. | 4 | 4 | 0 | 0 | 0 | 0 | 4.5 | 4.5 | 4.6 |
| Zhen Xu seemed well prepared for class meetings. | 7 | 1 | 0 | 0 | 0 | 0 | 4.9 | 4.8 | 4.8 |
| Zhen Xu explained material clearly. | 4 | 2 | 2 | 0 | 0 | 0 | 4.5 | 4.6 | 4.6 |
| Zhen Xu treated students with respect. | 6 | 2 | 0 | 0 | 0 | 0 | 4.8 | 4.8 | 4.8 |

Responses to additional questions about the instructor:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median |
|--|----|---|---|---|----|-----|-------------|------------------------|
| Zhen Xu acknowledged all questions insofar as possible. (Q216) | 6 | 2 | 0 | 0 | 0 | 0 | 4.8 | 4.7 |

The medians are calculated from Fall 2018 data. University-wide medians are based on all UM classes in which an item was used. The school/college medians in this report are based on classes that are upper division with enrollment of 1 to 15 in College of Engineering.

Written Comments

Comment on the quality of instruction in this course. (Q900)

| Comments |
|---|
| I thought this was a good course to get an introduction to medical imaging. I thought the course provided a good background of the different imaging modalities and I also found the tours throughout the semester interesting and helpful. |
| Professor Xu was an amazing professor! She was very eager and passionate about the course topic and it rubbed off on the students. She was always willing to help and genuinely wanted us to succeed. It was very easy to communicate with her and get help if needed. |
| I like how Zhen Xu engage us by bringing us to lab and hospital visits to enhance our understanding and interest in this course. Maybe she could go through some practice questions in class before exams. |
| Dr. Xu brought a lot of enthusiasm to every class and did a pretty decent job of explaining complicated subjects to students who had no prior knowledge. She was very reasonable about the workload, but I wish she provided more materials in preparation for each exam such as more practice problems we could work on with answers we could refer to. This would help me learn the material better and have more confidence in preparation for the exam. |
| Great Class! |
| Prof Xu was a great instructor. She really cared for the students and took an interest in us as people as well as students. She always has our best interest in mind. My one complaint about this class was that I felt like she assumed we had some of the prior knowledge that she did which at times made it hard to follow. overall a great course |
| Great Professor! I would highly recommend this class |

Course Approval Request Form

Office of the Registrar, University of Michigan

1210 SA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2112

Fax: 734.636.3148

rcourricul@umich.edu

rcourmicu@umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course

Date of Submission: 2019-10-02

Effective Term: Winter 2020

Course

- Deletion of Existing Course

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

CURRENT LISTING

REQUESTED LISTING

| <input checked="" type="checkbox"/> | Dept (Home): Subject: Catalog: | Dept (Home): Industrial & Operations Engin Subject: IOE Catalog: 525 | | | | | | | | | | | | |
|-------------------------------------|---|--|---------|----------------|--|--|--|---|------------|---------|----------------|--|--|--|
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 25%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 25%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) | Course Title (full title) Lean Principles and Scientific Thinking in Organizations | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) | Abbreviated Title (20 char) Lean Princ/Sci Think | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) This course will focus on the application of lean principles and scientific thinking methods to continuously improve the use of machines, materials, and methods in manufacturing and service industries. Students are taught a way of approaching challenging goals through kata (practice routines) to iteratively improve processes. Classroom lectures are reinforced by projects in the field. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: Graduate Min: 3 Undergraduate Max: Graduate Max: 3 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

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

| | CURRENT LISTING | REQUESTED LISTING |
|-------------------------------------|---|---|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) IOE 425 |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: C- |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |

Cognizant Faculty Member Name: Joi-Lynn Mondisa Cognizant Faculty Member Title: Assistant Professor

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Wanda Dobberstein Email: wldobber@umich.edu Phone: 734-764-3297

Curriculum Committee: _____ Date: _____
 Dept Chair(s): Brian *RD* _____ Date: 10/11/2019
 Denton Home _____ Date: _____
 Department: IOE _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course DescriptionCourse Description

This course will focus on the application of lean principles and scientific thinking methods to continuously improve the use of machines, materials, and methods in manufacturing and service industries. Students are taught a way of approaching challenging goals through kata (practice routines) to iteratively improve processes. Classroom lectures are reinforced by projects in the field.

Class LengthClass Length

Full term

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

3

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

Home dept

Describe how this course fits with the degree requirements:

Elective course for graduate students

ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

The application of lean principles is central to improving and enhancing the operations, services, and efficiency of various manufacturing and service industries. Currently, there is not a COE graduate-level course that exists which incorporates the use and application of lean principles, especially kata, in a real-world client setting. This course allows students to learn and practice lean and kata principles through experimental applications with a client company (e.g., Zingerman's Mail Order, Dunning Toyota, Menlo Innovations, etc.). In this class, I cover lean principles used in various industries and engage students in examples and exercises that support their experience with their clients. This course will provide students with a sound foundation in lean principles and practice applying these principles in real-world applications.

IOE 591 – *Lean Principles and Scientific Thinking in Organizations*

3 Credit Hours

Time and Place: Fridays, 10:30am-1:30pm, 224 GFL

Instructor: **Dr. Joi Mondisa**, 2785 IOE Building Email: jmondisa@umich.edu
 Office Hours: Fridays 9:15am – 10:15am & by appointment
 Office Phone: 734-647-8720

Required Material: IOE 591 on Canvas (readings, assignments)

Web Page: <https://jmondisa.engin.umich.edu/>

Course Description: This course will focus on the application of lean principles and scientific thinking methods to continuously improve the use of machines, materials, and methods in manufacturing and service industries. Students are taught a way of approaching challenging goals through kata (practice routines) to iteratively improve processes. Classroom lectures are reinforced by projects in the field.

After taking this course, students should be able to:

- Explain and apply elements of the Improvement Kata and Coaching Kata
- Use and apply value-stream mapping and storyboarding principles
- Define and apply Plan, Do, Check, Act (PDCA) and A3 report principles
- Define standard work, kaizen, and kanban principles and apply in exercises and practice
- Define and assess change, leadership, and lean principles in organizational cultures
- Present lean manufacturing and continuous improvement concepts using a project example
- Deliver well-structured, technically sound written and oral reports
- In the context of a team-based project, conduct effective team meetings and document team activities

Class Format: *Lecture*

Prerequisites: It is highly desirable that you have some background in lean, preferably IOE 425, prior to taking this course. IOE 421 also provides great background. Direct experience can help substitute for formal coursework in the area, but be prepared for the course to challenge your assumptions of what lean is.

Reading Assignments: All reading assignments are at the course web site or on the internet. I suggest you download the complete *Improvement Kata and Coaching Kata Practice Guide* (it is free) as there are a number of assignments from this guide book:

http://www-personal.umich.edu/~mrother/Handbook/Practice_Guide.pdf

Assignments and Exams: Grades will be based on a combination of individual and group assignments as well as participation. Students are encouraged to discuss their performance with the instructor at any time during the semester. The course grade will be based on four components

○ **Individual Assignments**

- **Individual Journal Entries:** Every week you will write a journal entry (individual essay of max 2 pages) that summarizes key insights from the readings and the class session that will be due the end of the day Tuesday after the class. The first journal entry will summarize the content of week 2. You will answer two questions: What are the key points I got from the readings? What are the key points I got from class? These can be in bullet form—complete essays not needed.
- **Grading Journal Entries-**Your papers are to be uploaded into course web site by 5pm on the Tuesday after the class the topic is covered.
0 (not turned in or unacceptable), *C (several weaknesses)*, *B (okay, some weakness)*, *A (good job)*.
- **Late papers** will not be accepted; you will receive a zero unless there is a bona fide emergency or you get advance permission (at least night before class one) to hand in the assignment late.

- **Group Project Proposal and Status Reports** – These are group assignments. You will work in a group you select of 3-4 students and do an improvement project in a real organization. You will follow the pattern of Toyota Kata. The due dates of reports and a sample schedule are at the end of this document.

- **Group Final Paper** –Final report summarizing the group project.

- **Class and Group Participation** - You will be rewarded for participating in class. We will emphasize quality, not quantity. This will include on-time class attendance, and how active you are in listening and participating. A quiet student who listens intently and participates actively can get a good grade.

In addition, you are expected to conduct weekly meetings with your group and your client sponsor. This includes participating in on-site visits. To help ensure participation, there will be three CATME surveys administered throughout the semester. Your team's assessment and feedback of your performance will be factored into your final grade.

Grade Breakdown

| | |
|-------------------------------|------|
| Individual Weekly Journals | 25% |
| Intermediate Group reports | 25% |
| Final Group Paper | 30% |
| Class and Group Participation | 20% |
| | 100% |

Policy on Written Assignments: All individual written assignments in this course are to be completed on your own. You are allowed to consult with other students in the current class during the conceptualization of a problem but all written work, whether in scrap or final form, is to be generated by you working alone. Similarly, all group assignments should be worked on only by members of your group. You are not allowed to possess, look at, use, or in anyway derive advantage from the existence of papers prepared by students in prior years. Violation of this policy is grounds for me to initiate an action that would be filed with the Dean's office and would come before the College of Engineering's Honor Council.

Overview of Agenda:

Part I: Tools and Methods of Lean Thinking

- 1 1/11 What is Lean, Toyota Way, and Toyota Kata?
--Hand out Toyota Kata Course Project Assignment
2. 1/18 The Toyota Way and Toyota Kata: The Strategic Direction and Challenge
1/22 **First Journal entry due, then due every week after.**
- 3 1/25 Challenge Revisited, Using Value Stream Maps to Set Direction, and Project Charter
1/29 - **1-page project charter: Client, project, student team, initial problem definition, POC**
- 4 2/1 Understanding the Current Condition and Setting Target Conditions (paper car exercise)
2/6 - **CATME survey #1 Due**
- 5 2/8 Toyota Kata: PDCA Experimentation and the Coaching Kata (coaching exercise & paper car exercise continues)
2/12 - **Interim Report 1: Progress to date with photographs of process and storyboard**
- 6 2/15 Problem Solving, Toyota Kata, and the A3 Report
3/13 - **CATME survey #2 Due**
- 7 2/22 Exceptional Processes: Standard Work and Job Instruction Training

Part II: The Social System of Lean Thinking

- 8 3/1 Work Groups and Daily Kaizen

Week 9 ~~~ **WINTER BREAK - March 8** ~~~

Part III: Transforming to Lean Thinking

- 3/12 - **Interim Report 2: Overview of challenge, current condition, obstacles, coaching and PDCA cycles with photos and initial results**
- 10 3/15 Lean in Services
- 11 3/22 Lean Culture
- 12 3/29 Lean Site Visit – Zingerman’s Mail Order
4/2 - **Interim Report 3: Overview of challenge, current condition, obstacles, coaching and PDCA cycles with photos and initial results**
- 13 4/5 How can we effectively manage change?

3/15, Week 10 – Lean in Services

1. Richard Sheridan, *Joy Inc.*, Penguin Books, 2014, Chapters 1 -- 4
2. Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer*. New York, McGraw-Hill. Chapter 21.

3/22, Week 11 – Lean Culture

1. Schein, E. H. (1984). "Coming to a New Awareness of Organizational Culture." *Sloan Management Review* 25(2).
2. Liker, J. K., M. Hoseus. *Toyota culture: the heart and soul of the Toyota way*. New York, McGraw-Hill. 2008.
3. *Brelis, M. "Herb's Way: Chairman's Unconventional Business Strategy has made Southwest Airlines a Model for Success," *Boston Globe*, 11/5/2000.

3/29 Week 12 – Lean Site Visit

4/5, Week 13 - How Can We Effectively Manage Change?

1. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, chapters 19 and 20.
2. Rock, D. and Schwartz, J., "The Neuroscience of Leadership," *Strategy and Business*, No. 43, 2006.
3. <http://www.slideshare.net/mike734/how-to-deploy-the-improvement-kata?related=1>

4/12, Week 14 - Lean Leadership

1. Liker, J. K. and Convis, G. (2012). *The Toyota way to Lean Leadership*. NY: McGraw-Hill., chapter 1.
2. Collins, Jim, *Good to Great*, 2001: Chapter 2, pp 17-40
 --Take the abbreviated form of the Meyers-Briggs Personality Inventory and read results:
<http://www.16personalities.com/free-personality-test>
<http://media-cache-ak0.pinimg.com/originals/3b/d3/dc/3bd3dc21d6eeb1742976dc496e41d0ab.jpg>

4/19, Week 15 - Final Group Project Presentations

4/23 Final Group Paper Due

Sample Group Project Schedule

(it probably will not be exactly like this)

Week of

- 1/11 Meet at project site with client and coach for initial overview and planning
- 1/18 Understand strategic direction, select focus area, define challenge
- 1/29 - 1-page proposal: Client, project, student team, initial problem definition, POC
- 1/25 Current situation analysis—set up kata storyboard and post information
- 2/1 1st target condition, define obstacles, first PDCA cycle
- 2/12 - Interim Report 1: Progress to date with photographs of process and storyboard
- 2/8 1st coaching cycle and 2nd PDCA cycle
- 2/15 3rd coaching cycle and PDCA cycle
- 2/22 4th coaching cycle and PDCA cycle
- 3/1 If reached 1st target condition, current state analysis, and plan 2nd target condition
- 3/12 - Interim Report 2: Overview of challenge, current condition, obstacles, coaching and PDCA cycles with photos and initial results
- 3/15 5th coaching cycle and PDCA cycle
- 4/2 - Interim Report 3: Overview of challenge, current condition, obstacles, coaching and PDCA cycles with photos and initial results
- 3/22 6th coaching cycle and PDCA cycle
- 3/29 7th coaching cycle and PDCA cycle
- 4/5 Planning session to sustain improvement process

4/23 Final Group Paper Due

4/10 - CATME survey #3 Due

14 4/12 Lean leadership

15 4/19 Group Project Presentations and Feedback

4/23 Final Group Paper Due

Weekly Reading Assignments:

1/11, Week 1, What is Lean, Toyota Way, and Toyota Kata?

1. Collins, J. Great by Choice, Chapter 2- "10Xers," Harper Business, 2011.

1/18, Week 2, The Toyota Way and Toyoda Kata: The Strategic Direction and Challenge

1. Watch these videos in preparation for Friday's class (you will be tested!):
https://www.youtube.com/watch?v=es3hYCMMmc&ab_channel=MikeRother
2. *Improvement Kata and Coaching Kata Practice Guide* (Understand the direction/Challenge)
3. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, Chapter 2.

1/25, Week 3, Value Stream Mapping/Process Flow Diagram to Set Direction

1. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, chapter 3.

2/1, Week 4, Understanding the Current Condition and Setting Target Conditions

1. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, Chapter 4.
2. *Improvement Kata and Coaching Kata Practice Guide* (Grasp the Current Condition and Establish the Next Target Condition)

2/8, Week 5, Toyoda Kata: PDCA Experimentation and the Coaching Kata

1. Rother, Mike, *Toyota Kata*, NY: McGraw Hill, 2010, pp 129 to 169 (Chap 6 and Summary)
2. *Improvement Kata and Coaching Kata Practice Guide* (Guidelines for Improvement Kata Coaches and How to do a Coaching Cycle)

2/15, Week 6, Problem Solving, Toyota Kata, and the A3 Report

1. *Shook, J., "Toyota's Secret: The A3 Report," *Sloan Management Review*, Summer, 2009.
2. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, chapter 18.
3. http://www.slideshare.net/mike734/a3-and-the-improvement-kata?qid=e608ac96-06f9-4caa-8e6a-36efa3f19360&v=qf1&b=&from_search=2

2/22, Week 7, Exceptional Processes: Standard Work and Job Instruction Training

1. Liker, J. and Meier, D. *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, chapter 6.
2. Liker, J. K., M. Hoseus. *Toyota culture: the heart and soul of the Toyota way*. New York, McGraw-Hill. 2008, Chapter 5.
3. O'Connell, V. (2008). Stores Count Seconds to Trim Labor Costs. *Wall Street Journal*. New York.

3/1, Week 8- Work Groups and Daily Kaizen

1. Liker, J. and Meier, D., *The Toyota Way Fieldbook*, NY: McGraw Hill, 2006, chapters 10 and 11.
2. Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer*. New York, McGraw-Hill. Chapter 16

3/8, Week 9 **WINTER BREAK******



Instructor Report

2018-04-04 - 2018-04-18 Report ID: MSR04732

Instructor: **Mondisa, Joi-Lynn**
IOE 591 003

| | Responses from your Students** | | | | | | | | | | Other Users of This Item* | | | | | | | | | | | | | |
|---|--------------------------------|---|---|---|---|---|----|----|----|----|---------------------------|--------------|------|--------------|------|--------------|------|--------------|----|--------------|----|--------------|----|----|
| | 5 | | 4 | | 3 | | 2 | | 1 | | Your Median | 75% Above | | 50% Above | | 25% Above | | 75% Above | | 50% Above | | 25% Above | | |
| | SA | A | A | N | D | D | SD | SD | SD | SD | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4 | 12 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.79 | 3.67 | 4.17 | 4.67 | 4.30 | 4.63 | 4.79 | | | | | | | |
| 891 | 5 | 5 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 3.80 | 2.83 | 3.12 | 3.46 | | | | | | | | | | |
| I had a strong desire to take this course. As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). | | | | | | | | | | | | | | | | | | | | | | | | |
| 1631 | 11 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.73 | 4.12 | 4.50 | 4.75 | | | | | | | | | | |
| This course advanced my understanding of the subject matter. | | | | | | | | | | | | | | | | | | | | | | | | |
| 1632 | 9 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 3.79 | 4.25 | 4.67 | | | | | | | | | | |
| My interest in the subject has increased because of this course. | | | | | | | | | | | | | | | | | | | | | | | | |
| 1633 | 7 | 7 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4.29 | 4.02 | 4.40 | 4.71 | | | | | | | | | | |
| I knew what was expected of me in this course. (SA=Almost Always, A= Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever). | | | | | | | | | | | | | | | | | | | | | | | | |
| 230 | 9 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 4.52 | 4.81 | 4.93 | | | | | | | | | | |
| The instructor seemed well prepared for class meetings. (SA= Almost Always, A= Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | | | | | | | | | | | | | | | | | | | | | | | | |
| 199 | 10 | 5 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4.65 | 4.30 | 4.70 | 4.88 | | | | | | | | | | |
| The instructor explained material clearly. (SA=Almost Always, A= Frequently, N=Sometimes, D=Occasionally, SD=Hardly Ever) | | | | | | | | | | | | | | | | | | | | | | | | |
| 217 | 12 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.79 | 4.68 | 4.87 | 4.95 | | | | | | | | | | |
| The instructor treated students with respect. | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 9 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 3.90 | 4.33 | 4.75 | | | | | | | | | | |
| Overall, this was an excellent course. | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 11 | 4 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4.73 | 4.38 | 4.75 | 4.92 | | | | | | | | | | |
| Overall, the instructor was an excellent teacher. | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 8 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.44 | 4.00 | 4.40 | 4.75 | | | | | | | | | | |
| I learned a great deal from this course. | | | | | | | | | | | | | | | | | | | | | | | | |
| 121 | 9 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 4.00 | 4.29 | 4.64 | | | | | | | | | | |
| I gained a good understanding of concepts/principles in this field. | | | | | | | | | | | | | | | | | | | | | | | | |
| 140 | 9 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 3.99 | 4.31 | 4.67 | | | | | | | | | | |
| I deepened my interest in the subject matter of this course. | | | | | | | | | | | | | | | | | | | | | | | | |
| 160 | 11 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.73 | 3.89 | 4.20 | 4.63 | | | | | | | | | | |
| I participated actively in class discussion. | | | | | | | | | | | | | | | | | | | | | | | | |
| 201 | 10 | 5 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4.65 | 4.25 | 4.67 | 4.86 | | | | | | | | | | |
| The instructor gave clear explanations. | | | | | | | | | | | | | | | | | | | | | | | | |
| 202 | 11 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.73 | 4.31 | 4.67 | 4.85 | | | | | | | | | | |
| The instructor made good use of examples and illustrations. | | | | | | | | | | | | | | | | | | | | | | | | |
| 205 | 10 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.65 | 4.33 | 4.70 | 4.86 | | | | | | | | | | |
| The instructor put material across in an interesting way. | | | | | | | | | | | | | | | | | | | | | | | | |
| 207 | 10 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4.65 | 4.69 | 4.87 | 4.95 | | | | | | | | | | |
| The instructor appeared to have a thorough knowledge of the subject. | | | | | | | | | | | | | | | | | | | | | | | | |
| 211 | 10 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.65 | 4.25 | 4.65 | 4.86 | | | | | | | | | | |
| The instructor was sensitive to student difficulty with course work. | | | | | | | | | | | | | | | | | | | | | | | | |
| 218 | 11 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.73 | 4.38 | 4.67 | 4.84 | | | | | | | | | | |
| The instructor encouraged constructive criticism. | | | | | | | | | | | | | | | | | | | | | | | | |
| 219 | 10 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.65 | 4.50 | 4.79 | 4.92 | | | | | | | | | | |
| The instructor was willing to meet and help students outside class. | | | | | | | | | | | | | | | | | | | | | | | | |
| 229 | 10 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.65 | 4.29 | 4.69 | 4.88 | | | | | | | | | | |
| The instructor used class time well. | | | | | | | | | | | | | | | | | | | | | | | | |
| 232 | 8 | 6 | 2 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4.42 | 4.00 | 4.40 | 4.67 | | | | | | | | | | |
| Work requirements and grading system were clear from the beginning. | | | | | | | | | | | | | | | | | | | | | | | | |
| 241 | 9 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.56 | 4.33 | 4.67 | 4.83 | | | | | | | | | | |
| The instructor set high standards for students. | | | | | | | | | | | | | | | | | | | | | | | | |
| 319 | 6 | 7 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4.14 | 3.71 | 4.13 | 4.50 | | | | | | | | | | |
| Writing assignments were interesting and stimulating. | | | | | | | | | | | | | | | | | | | | | | | | |
| 327 | 5 | 7 | 4 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 4.00 | 3.61 | 4.00 | 4.50 | | | | | | | | | | |
| Reading assignments were interesting and stimulating. | | | | | | | | | | | | | | | | | | | | | | | | |
| 340 | 4 | 6 | 3 | 1 | 0 | 3 | 1 | 0 | 3 | 0 | 4.00 | 3.28 | 4.00 | 4.50 | | | | | | | | | | |
| The textbook made a valuable contribution to the course. | | | | | | | | | | | | | | | | | | | | | | | | |
| 365 | 7 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4.31 | 4.00 | 4.33 | 4.70 | | | | | | | | | | |
| Grades were assigned fairly and impartially. | | | | | | | | | | | | | | | | | | | | | | | | |

* The quantiles are calculated from Winter 2018 data. The university-wide quantiles are based on all UM classes in which an item was used. The school/college quantiles in this report are based on graduate level students in College of Engineering.

** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.



Winter 2019 Instructor Report of IOE 591-003: Special Topics for Joi-Lynn Mondisa

81

Project Title: **Winter 2019 Teaching Evaluation**

Course Audience: **14**

Responses Received: **13**

Response Ratio: **92.9%**

Report Comments

This report is a summary that tabulates all quantitative ratings on a single page. Ratings are from the Winter 2019 teaching evaluations of IOE 591-003: Special Topics.

Prepared by: **Office of the Registrar**
Creation Date: **Sunday, May 5, 2019**

Responses to the University-wide questions about the course:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|--|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| This course advanced my understanding of the subject matter. (Q1631) | 6 | 4 | 1 | 1 | 1 | 0 | 4.4 | 4.5 | 4.7 |
| My interest in the subject has increased because of this course. (Q1632) | 4 | 4 | 1 | 2 | 1 | 0 | 4.0 | 4.2 | 4.6 |
| I knew what was expected of me in this course.(Q1633) | 5 | 5 | 2 | 0 | 1 | 0 | 4.2 | 4.5 | 4.5 |
| Overall, this was an excellent course.(Q1) | 4 | 5 | 1 | 2 | 1 | 0 | 4.0 | 4.2 | 4.5 |
| I had a strong desire to take this course.(Q4) | 5 | 3 | 4 | 0 | 1 | 0 | 4.0 | 4.0 | 4.5 |
| As compared with other courses of equal credit, the workload for this course was... (SA=Much Lighter to SD=Much Heavier) | 0 | 0 | 2 | 7 | 4 | 0 | 1.9 | 3.0 | 3.0 |

Responses to the University-wide questions about the instructor:

| | SA | A | N | D | SD | N/A | Your Median | University-Wide Median | School/College Median |
|---|----|---|---|---|----|-----|-------------|------------------------|-----------------------|
| Overall, Joi-Lynn Mondisa was an excellent teacher. | 4 | 4 | 3 | 2 | 0 | 0 | 3.9 | 4.5 | 4.7 |
| Joi-Lynn Mondisa seemed well prepared for class meetings. | 3 | 7 | 2 | 1 | 0 | 0 | 4.0 | 4.8 | 4.8 |
| Joi-Lynn Mondisa explained material clearly. | 3 | 6 | 3 | 1 | 0 | 0 | 3.9 | 4.6 | 4.7 |
| Joi-Lynn Mondisa treated students with respect. | 9 | 3 | 1 | 0 | 0 | 0 | 4.8 | 4.8 | 4.9 |

The medians are calculated from Winter 2019 data. University-wide medians are based on all UM classes in which an item was used. The school/college medians in this report are based on classes that are graduate level with enrollment of 1 to 15 in College of Engineering.

Course Approval Request Form

Office of the Registrar, University of Michigan

1710 TSA Building
 530 S. State Street
 Ann Arbor, MI 48109-1381
 Phone: 734.763.2113
 Fax: 734.936.3148
 to: curriculum@umich.edu
 to: umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2019-10-07
 Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input type="checkbox"/> | Dept (Home): Industrial & Operations Engin Subject: IOE Catalog: 545 | Dept (Home): Industrial & Operations Engin Subject: IOE Catalog: 545 | | | | | | | | | | | | |
|-------------------------------------|--|--|---------|----------------|---------------------------|--|--|---|------------|---------|----------------|---------------------------|--|--|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td colspan="3" style="text-align: center;">Manufacturing - MFG - 545</td> </tr> </tbody> </table> | Department | Subject | Catalog Number | Manufacturing - MFG - 545 | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td colspan="3" style="text-align: center;">Manufacturing - MFG - 545</td> </tr> </tbody> </table> | Department | Subject | Catalog Number | Manufacturing - MFG - 545 | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| Manufacturing - MFG - 545 | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| Manufacturing - MFG - 545 | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Course Title (full title) Stochastic Networks and Operations | Course Title (full title) Stochastic Networks and Operations | | | | | | | | | | | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Stoch Network & Ops | Abbreviated Title (20 char) Stoch Network & Ops | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Introduction to queueing networks and their use in modeling and analysis of operational systems. Methodological topics include regenerative processes, Markov processes, embedding, reversibility, quasi-reversibility, approximations for open and closed networks, intro to control of Markov queueing systems. Application of these stochastic models and the "physics" of flow operations with emphasis on services, healthcare, and production. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: Graduate Min: 3 Undergraduate Max: Graduate Max: 3 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

| | |
|--|--|
| Subject: Industrial & Operations Engin Catalog: 545 | |
| <input checked="" type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory Add Consent <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Department Consent Drop Consent <input type="checkbox"/> Business Administration <input type="checkbox"/> Instructor Consent <input type="checkbox"/> Department Consent Grading <input checked="" type="checkbox"/> No Consent <input type="checkbox"/> Instructor Consent <input type="checkbox"/> Not for Credit <input checked="" type="checkbox"/> No Consent <input type="checkbox"/> No Consent <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only |

| CURRENT LISTING | REQUESTED LISTING |
|--|--|
| <input type="checkbox"/> Advisory Prerequisite (254 char) IOE 515 or EECS 501 | <input type="checkbox"/> Advisory Prerequisite (254 char) IOE 515 or EECS 501 |
| <input type="checkbox"/> Enforced Prerequisite (254 char) Minimum grade requirement: C- | <input type="checkbox"/> Enforced Prerequisite (254 char) Minimum grade requirement: C- |
| <input type="checkbox"/> Credit Exclusions | <input type="checkbox"/> Credit Exclusions |
| <input checked="" type="checkbox"/> Course Components <input checked="" type="checkbox"/> Lecture <input checked="" type="checkbox"/> Graded Component <input type="checkbox"/> Seminar <input type="checkbox"/> <input type="checkbox"/> Recitation <input type="checkbox"/> <input type="checkbox"/> Lab <input type="checkbox"/> <input type="checkbox"/> Discussion <input type="checkbox"/> <input type="checkbox"/> Independent Study <input type="checkbox"/> | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Mark VanOyen Cognizant Faculty Member Title: Professor | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Wanda Dobberstein Email: wldobber@umich.edu Phone: 734-764=3297

| | |
|---|------------------|
| Curriculum Committee: | Date: |
| Dept Chair(s): Brian Denton <i>Brian Denton</i> | Date: 10/11/2019 |
| Home Department: IOE | Date: 10/07/2019 |
| <i>JUDY JIN, DIRECTOR</i> Cross-Listed Department: MFG <i>JJ</i> | Date: 10/07/2019 |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

Introduction to queueing networks and their use in modeling and analysis of operational systems. Methodological topics include regenerative processes, Markov processes, embedding, reversibility, quasi-reversibility, approximations for open and closed networks, intro to control of Markov queueing systems. Application of these stochastic models and the "physics" of flow operations with emphasis on services, healthcare, and production.

Class Length

Full term

Contact hours (lecture):

3

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

Introduction to queueing networks and their use in modeling and analysis of operational systems. Methodological topics include regenerative processes, Markov processes, embedding, reversibility, quasi-reversibility, approximations for open and closed networks, intro to control of Markov queueing systems. Application of these stochastic models and the "physics" of flow operations with emphasis on services, healthcare, and production.

Class Length

Full term

Contact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

Supporting Statement:

The course title and description modifications are sought to update the course. The title and description needs to better convey the course in a way that is current and is more understandable to students.

Title: It is advisable to modify the course title to be less abstract; rather to be more self-explanatory and indicate that the course is focused on stochastic network models for the field of "operations engineering."

Description: It is being updated to keep current. Polling systems are out of date and the interest in this area is gone, and healthcare has become a significant interest for our students.. The old technical details on the modeling and analysis methods were not incorrect, but they do not use the best summary keywords to describe this topic/course. The updated wording will give students a better idea that this course integrates the mathematical theory with models appropriate for the current interest in service operations and healthcare, in addition to the traditional topic of manufacturing.

The prerequisites are not changing. As prerequisites, this course clearly builds on IOE 515 (Stochastic Processes) and EECS 501 (Probability and Random Processes). IOE 516 (Stochastic Processes II) is not a prerequisite, Note that IOE

516 was created and approved in Oct. 2003 at a time when IOE 545 had already existed. IOE 516 does not focus on networks of queues, and it is not intended to address applications. IOE 616 Queueing Theory is a course that has existed in addition to IOE 545 for many years, focusing more on theoretical foundations and rigorous proofs, introducing additional stochastic processes and ending with the simplest models of queueing networks, which are less useful in applications. EECS 502 (Stochastic Processes) has existed alongside IOE 545 since the inception of 545. EECS 502 has a broader scope and a different scope, while being restricted to theory,

Course Approval Request Form

Office of the Registrar, University of Michigan

1210 SA Building
 500 S State Street
 Ann Arbor, MI 48109-1387
 Phone: 734.763.2113
 Fax: 734.936.3148
 E-mail: current_forms@umich.edu
umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2019-09-24
 Effective Term: Winter 2020

| | | |
|-------------------------------------|--|---|
| <input checked="" type="checkbox"/> | Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only | DO NOT USE Date Received: Date Completed: Completed By: |
|-------------------------------------|--|---|

CURRENT LISTING

REQUESTED LISTING

| <input type="checkbox"/> | Dept (Home): Industrial & Operations Engin Subject: IOE Catalog: 837 | Dept (Home): Industrial & Operations Engin Subject: IOE Catalog: 837 | | | | | | | | | | | | |
|-------------------------------------|---|--|---------|----------------|--|--|--|---|------------|---------|----------------|--|--|--|
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) SEMINAR IN OCCUPATIONAL HEALTH AND SAFETY ENGINEERING | Course Title (full title) INTERPROFESSIONAL PERSPECTIVES IN OCCUPATIONAL HEALTH AND SAFETY | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) SEM OCC HLTH/SAFETY | Abbreviated Title (20 char) PERS OCC HLTH/SAFETY | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) This seminar is to provide an opportunity for graduate students interested in occupational health and safety engineering problems to become acquainted with various related contemporary research and professional activities, as presented by both staff and guest speakers. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: Graduate Min: 1 Undergraduate Max: Graduate Max: 1 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | | | | | | | |
| <input type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | |

| | | |
|--|---|---|
| Subject: Industrial & Operations Engin Catalog: 837 | | |
| <input checked="" type="checkbox"/> | Grading Basis <input type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input checked="" type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

| | CURRENT LISTING | REQUESTED LISTING |
|--|---|---|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) | Advisory Prerequisite (254 char) |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Graduate Standing Minimum grade requirement: S | Enforced Prerequisite (254 char) Graduate Standing Minimum grade requirement: S |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input type="checkbox"/> Lecture <input checked="" type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Clive D'Souza | | Cognizant Faculty Member Title: Assistant Professor |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: Wanda Dobberstein Email: wldobber@umich.edu Phone: 734 -764 -3297

| | |
|-----------------------------|------------------|
| Curriculum Committee: | Date: |
| Dept Chair(s): Brian Denton | |
| Home Department: IOE | Date: 10/11/2019 |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |
| Cross-Listed Department: | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

This seminar is to provide an opportunity for graduate students interested in occupational health and safety engineering problems to become acquainted with various related contemporary research and professional activities, as presented by both staff and guest speakers.

Class Length

Full term

Contact hours (lecture):

1

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

This seminar is to provide an opportunity for graduate students interested in occupational health and safety engineering problems to become acquainted with various related contemporary research and professional activities, as presented by both staff and guest speakers.

Class Length

Full term

Contact hours (lecture):

1

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

Home dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

Only change is the title of the course.



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

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

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2019-10-02
Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|-------------------------------------|---|---------|----------------|--|---------|----------------|
| <input checked="" type="checkbox"/> | Dept (Home): Elec Engin & Computer Sci | | | Dept (Home): | | |
| | Subject: EECS | | | Subject: | | |
| | Catalog: 510 | | | Catalog: | | |
| | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input checked="" type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) RF MEMS | | | Course Title (full title) | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) RF MEMS | | | Abbreviated Title (20 char) | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) This course covers the principles of operation, design, fabrication, and technology trends of micro-electromechanical devices for high frequency applications with a focus on communications. Micro-devices covered include resonators, switches, filters, tunable passive devices, and reconfigurable modules. The physical phenomena limiting the performance and scaling of RF MEMS devices are discussed. | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 4 Graduate Min: 4 Undergraduate Max: 4 Graduate Max: 4 | | | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student | | | | | |
| <input checked="" type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | | | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | |

| | | | | | | | |
|---|---|---|--|---|--|--|--|
| Subject: Elec Engin & Computer Sci Catalog: 510 | | | | | | | |
| <input checked="" type="checkbox"/> | <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"> Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration </td> <td style="width: 33%;"> Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> <td style="width: 33%;"> Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent </td> </tr> <tr> <td colspan="3"> Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only </td> </tr> </table> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | | |
| Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | | | | | |
| Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | | | | | | | |

| | CURRENT LISTING | REQUESTED LISTING | | | |
|---|--|---|--|---|--|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) EECS 414 | Advisory Prerequisite (254 char) | | | |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: | | | |
| <input checked="" type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | |
| <input checked="" type="checkbox"/> | <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"> Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study </td> <td style="width: 33%;"> Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td style="width: 33%;"> Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer </td> </tr> </table> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | |
| Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer | | | |
| Cognizant Faculty Member Name: Heath Hofmann | | Cognizant Faculty Member Title: | | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|---|--------|---------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: | | Date: |
| Dept Chair(s): Home Department: <i>Heath Hofmann</i> | | Date: 10/5/19 |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

This course covers the principles of operation, design, fabrication, and technology trends of micro-electromechanical devices for high frequency applications with a focus on communications.

Micro-devices covered include resonators, switches, filters, tunable passive devices, and reconfigurable modules. The physical phenomena limiting the performance and scaling of RF MEMS devices are discussed.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

4

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

Home dept

Describe how this course fits with the degree requirements:

Tech Elective

ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

These courses have not been offered in the last 5 years, and there were no plans to offer them in the future. This action was approved at the ECE faculty meeting held on April 26, 2019 with a unanimous vote.



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-10-03

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| <input checked="" type="checkbox"/> | Dept (Home): Elec Engin & Computer Sci Subject: EECS Catalog: 534 | Dept (Home): Subject: Catalog: | | | | | | | | | | | | |
|-------------------------------------|--|---|---------|----------------|--|--|--|--|------------|---------|----------------|--|--|--|
| <input type="checkbox"/> | Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 33%;">Department</th> <th style="width: 33%;">Subject</th> <th style="width: 33%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 33%;">Department</th> <th style="width: 33%;">Subject</th> <th style="width: 33%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Design and Characterization of Microwave Devices and Monolithic Circuits | Course Title (full title) | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) MW Device/IC | Abbreviated Title (20 char) | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Theory and design of passive and active microwave components and monolithic integrated circuits including: microstrip, lumped inductors and capacitors, GaAs FETs, varactor and mixer diodes, monolithic phase shifters, attenuators, amplifiers and oscillators. Experimental characterization of the above components using network analyzer, spectrum analyzer, power and noise meters. Lecture and laboratory. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 4 Graduate Min: 4 Undergraduate Max: 4 Graduate Max: 4 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: | | | | | | | | | | | | | |
| | <input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

| | | | |
|-------------------------------------|---|--|---|
| Subject: Elec Engin & Computer Sci | | Catalog: 534 | |
| <input checked="" type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

| | CURRENT LISTING | REQUESTED LISTING | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|-------------------------|--------------------------------|---|-------------------------------------|--|----------------------------------|--------------------------|---------------------------------|-------------------------------------|--------------------------|---------------------------------|---|--------------------------|---------------------------------|-------------------------------------|--------------------------|--|--|--------------------------|--|--|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) graduate standing, EECS 421 or EECS | Advisory Prerequisite (254 char) | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Credit Exclusions | Credit Exclusions | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | <table style="width:100%; border: none;"> <tr> <td style="width:30%;">Course Components</td> <td style="width:30%;">Graded Component</td> <td style="width:40%;">Terms Typically Offered</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lecture</td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/> Fall</td> </tr> <tr> <td><input type="checkbox"/> Seminar</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Winter</td> </tr> <tr> <td><input type="checkbox"/> Recitation</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lab</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Summer</td> </tr> <tr> <td><input type="checkbox"/> Discussion</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring/Summer</td> </tr> <tr> <td><input type="checkbox"/> Independent Study</td> <td><input type="checkbox"/></td> <td></td> </tr> </table> | Course Components | Graded Component | Terms Typically Offered | <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Fall | <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input type="checkbox"/> Winter | <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | <input checked="" type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | |
| Course Components | Graded Component | Terms Typically Offered | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Lecture | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> Fall | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Seminar | <input type="checkbox"/> | <input type="checkbox"/> Winter | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Recitation | <input type="checkbox"/> | <input type="checkbox"/> Spring | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Lab | <input type="checkbox"/> | <input type="checkbox"/> Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Discussion | <input type="checkbox"/> | <input type="checkbox"/> Spring/Summer | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Independent Study | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | |
| Cognizant Faculty Member Name: Heath Hofmann | | Cognizant Faculty Member Title: | | | | | | | | | | | | | | | | | | | | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|----------------------|---------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: | | Date: |
| Dept Chair(s): | <i>Heath Hofmann</i> | Date: 10/5/19 |
| Home Department: | | |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Theory and design of passive and active microwave components and monolithic integrated circuits including: microstrip, lumped inductors and capacitors, GaAs FETs, varactor and mixer diodes, monolithic phase shifters, attenuators, amplifiers and oscillators. Experimental characterization of the above components using network analyzer, spectrum analyzer, power and noise meters. Lecture and laboratory.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

4

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

Home dept

Describe how this course fits with the degree requirements:

Tech Elective

ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

These courses have not been offered in the last 5 years, and there were no plans to offer them in the future. This action was approved at the ECE faculty meeting held on April 26, 2019 with a unanimous vote.



Course Approval Request Form

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Phone: 734.763.2113
Fax: 734.936.3148
ra.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-10-04

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|-------------------------------------|--|-----------------|----------------|--|---------------|----------------|
| <input checked="" type="checkbox"/> | Dept (Home): Elec Engin & Computer Sci | | | Dept (Home): | | |
| | Subject: EECS | | | Subject: | | |
| | Catalog: 535 | | | Catalog: | | |
| | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| <input checked="" type="checkbox"/> | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Optical Information Processing | | | Course Title (full title) | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Optical Info Proc | | | Abbreviated Title (20 char) | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Theory of image formation with holography; applications of holography; white light interferometry; techniques for optical digital computing; special topics of current research interest. | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| | Undergraduate Min: | Graduate Min: 3 | | Undergraduate Min: | Graduate Min: | |
| | Undergraduate Max: | Graduate Max: 3 | | Undergraduate Max: | Graduate Max: | |
| <input checked="" type="checkbox"/> | Course Credit Type Rackham Graduate Student | | | | | |
| <input checked="" type="checkbox"/> | Repeatability | | | | | |
| | <input type="checkbox"/> Course is Repeatable for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

| | |
|--|---|
| Subject: Elec Engin & Computer Sci Catalog: 535 | |
| <input checked="" type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only |
| | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |
| | Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

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

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|----------------------|---------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: | | Date: |
| Dept Chair(s): | <i>Heath Hofmann</i> | Date: |
| Home Department: | | Date: 10/5/19 |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Theory of image formation with holography; applications of holography; white light interferometry; techniques for optical digital computing; special topics of current research interest.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

These courses have not been offered in the last 5 years, and there were no plans to offer them in the future. This action was approved at the ECE faculty meeting held on April 26, 2019 with a unanimous vote.



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

1710 LSA Building
500 S. State Street
Ann Arbor, MI 48109-1382
Phone: 734.763.2113
Fax: 734.936.3148
ro.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2019-10-03
Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|-------------------------------------|--|-----------------|----------------|--|---------------|----------------|
| <input checked="" type="checkbox"/> | Dept (Home): Elec Engin & Computer Sci | | | Dept (Home): | | |
| | Subject: EECS | | | Subject: | | |
| | Catalog: 536 | | | Catalog: | | |
| | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input checked="" type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Classical Statistical Optics | | | Course Title (full title) | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) Classic Stat Optics | | | Abbreviated Title (20 char) | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Applications of random variables to optics; statistical properties of light waves. Coherence theory, spatial and temporal. Information retrieval; imaging through inhomogeneous media; noise processes in imaging and interferometric systems. | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| | Undergraduate Min: 3 | Graduate Min: 3 | | Undergraduate Min: | Graduate Min: | |
| | Undergraduate Max: 3 | Graduate Max: 3 | | Undergraduate Max: | Graduate Max: | |
| <input checked="" type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student | | | | | |
| <input checked="" type="checkbox"/> | Repeatability | | | | | |
| | <input type="checkbox"/> Course is Repeatable for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

| | | |
|--|---|---|
| Subject: Elec Engin & Computer Sci Catalog: 536 | | |
| <input checked="" type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

| | CURRENT LISTING | REQUESTED LISTING |
|---|---|---|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) EECS 334 or EECS 434, and EECS 301 or MATH 425 | Advisory Prerequisite (254 char) |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: |
| <input checked="" type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Almantas Galvanauskas Cognizant Faculty Member Title: | | |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person: _____ Email: _____ Phone: _____

Curriculum Committee: _____ Date: _____

Dept Chair(s): _____
 Home Department: *Heath Holman* _____ Date: 10/5/19

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

Cross-Listed Department: _____ Date: _____

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Applications of random variables to optics; statistical properties of light waves. Coherence theory, spatial and temporal. Information retrieval; imaging through inhomogeneous media; noise processes in imaging and interferometric systems.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

These courses have not been offered in the last 5 years, and there were no plans to offer them in the future. This action was approved at the ECE faculty meeting held on April 26, 2019 with a unanimous vote.



Course Approval Request Form

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 Fax: 734.936.3148
 ro.curriculum@umich.edu
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CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-10-03
 Effective Term: Winter 2020

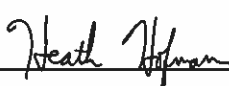
| | | |
|-------------------------------------|--|--|
| <input checked="" type="checkbox"/> | Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only | RO USE ONLY Date Received: Date Completed: Completed By: |
|-------------------------------------|--|--|

| | CURRENT LISTING | REQUESTED LISTING | | | | | | | | | | | | |
|-------------------------------------|--|--|---------|----------------|--|--|--|---|------------|---------|----------------|--|--|--|
| <input checked="" type="checkbox"/> | Dept (Home): Elec Engin & Computer Sci Subject: EECS Catalog: 559 | Dept (Home): Subject: Catalog: | | | | | | | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> Course is Cross-Listed with Other Departments | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | Department | Subject | Catalog Number | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Department | Subject | Catalog Number | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Title (full title) Advanced Signal Processing | Course Title (full title) | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Abbreviated Title (20 char) Adv Sig Proc | Abbreviated Title (20 char) | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Estimators of second order properties of random processes: nonparametric and model-based techniques of spectral estimation, characterization of output statistics for nonlinear systems, time-frequency representations. Performance evaluation using asymptotic techniques and Monte Carlo simulation. Applications include speech processing, signal extrapolation, multidimensional spectral estimation, and beamforming. | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Full Term Credit Hours Undergraduate Min: 3 Graduate Min: 3 Undergraduate Max: 3 Graduate Max: 3 | Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max: | | | | | | | | | | | | |
| <input type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term | | | | | | | | | | | | | |

| | | |
|--|---|---|
| Subject: Elec Engin & Computer Sci Catalog: 559 | | |
| <input checked="" type="checkbox"/> | Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only | Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent |

| | CURRENT LISTING | REQUESTED LISTING |
|--|---|---|
| <input checked="" type="checkbox"/> | Advisory Prerequisite (254 char) EECS 551 and EECS 501 | Advisory Prerequisite (254 char) |
| <input checked="" type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: |
| <input checked="" type="checkbox"/> | Credit Exclusions | Credit Exclusions |
| <input checked="" type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
| Cognizant Faculty Member Name: Al Hero | | Cognizant Faculty Member Title: |

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

| | | |
|--------------------------|---|---------------|
| Contact Person: | Email: | Phone: |
| Curriculum Committee: | | Date: |
| Dept Chair(s): |  | Date: 10/5/19 |
| Home Department: | | |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |
| Cross-Listed Department: | | Date: |

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Estimators of second order properties of random processes: nonparametric and model-based techniques of spectral estimation, characterization of output statistics for nonlinear systems, time-frequency representations. Performance evaluation using asymptotic techniques and Monte Carlo simulation. Applications include speech processing, signal extrapolation, multidimensional spectral estimation, and beamforming.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

3

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

Home dept

Describe how this course fits with the degree requirements:

Tech Elective

ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

These courses have not been offered in the last 5 years, and there were no plans to offer them in the future. This action was approved at the ECE faculty meeting held on April 26, 2019 with a unanimous vote.



Course Approval Request Form

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Ann Arbor, MI 48109-1382

Phone: 734.763.2113

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ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2019-10-11

Effective Term: Winter 2020

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

CURRENT LISTING

REQUESTED LISTING

| | | | | | | |
|--------------------------|--|-----------------|----------------|--|---------------|----------------|
| <input type="checkbox"/> | Dept (Home): Climate & Meteorology | | | Dept (Home): | | |
| | Subject: CLIMATE | | | Subject: | | |
| | Catalog: 462 | | | Catalog: | | |
| | <input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments | | | <input type="checkbox"/> Course is Cross-Listed with Other Departments | | |
| <input type="checkbox"/> | Department | Subject | Catalog Number | Department | Subject | Catalog Number |
| | CLASP-CLIMATE-462 | | | | | |
| <input type="checkbox"/> | Course Title (full title) Instrumentation for Atmospheric and Space Sciences | | | Course Title (full title) | | |
| <input type="checkbox"/> | Abbreviated Title (20 char) Instruments ATM SPA | | | Abbreviated Title (20 char) | | |
| <input type="checkbox"/> | Course Description (Please limit to 50 words and attach separate sheet if necessary) Introduction to fundamentals of atmospheric, space-based, and meteorological instrumentation. Includes basics of electronic sensors, optics, lasers, radar, data acquisition/management, error analysis, and data presentation. Consists of two lectures and one lab each week, and a team-based term project. | | | | | |
| <input type="checkbox"/> | Full Term Credit Hours | | | Half Term Credit Hours | | |
| | Undergraduate Min: 4 | Graduate Min: 4 | | Undergraduate Min: | Graduate Min: | |
| | Undergraduate Max: 4 | Graduate Max: 4 | | Undergraduate Max: | Graduate Max: | |
| <input type="checkbox"/> | Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student | | | | | |
| <input type="checkbox"/> | Repeatability | | | | | |
| | <input type="checkbox"/> Course is Repeatable for Credit | | | <input type="checkbox"/> Course is Y graded | | |
| | Maximum number of repeatable credits: | | | <input type="checkbox"/> Can be taken more than once in the same term | | |

Subject: Climate & Meteorology Catalog: 462

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

CURRENT LISTING

REQUESTED LISTING

| | | |
|--------------------------|--|--|
| <input type="checkbox"/> | Advisory Prerequisite (254 char) CLIMATE 350, SPACE 350 | Advisory Prerequisite (254 char) |
| <input type="checkbox"/> | Enforced Prerequisite (254 char) Minimum grade requirement: | Enforced Prerequisite (254 char) Minimum grade requirement: |
| <input type="checkbox"/> | Credit Exclusions | Credit Exclusions |

| | | | |
|--------------------------|--|--|--|
| <input type="checkbox"/> | Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study | Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Terms Typically Offered <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer |
|--------------------------|--|--|--|

Cognizant Faculty Member Name: Roger DeRoo

Cognizant Faculty Member Title:

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED

Contact Person:

Email:

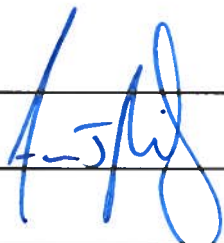
Phone:

Curriculum Committee:

Date:

Dept Chair(s):

Home Department:



Date: 10-11-19

Cross-Listed Department:

Date:

Cross-Listed Department:

Date:

Cross-Listed Department:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Introduction to fundamentals of atmospheric, space-based, and meteorological instrumentation. Includes basics of electronic sensors, optics, lasers, radar, data acquisition/management, error analysis, and data presentation. Consists of two lectures and one lab each week, and a team-based term project.

Course DescriptionClass Length

Full term

Class LengthContact hours (lecture):

5

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

Home dept

Describe how this course fits with the degree requirements:

Core Course

ABET departmental program outcomes for undergraduate courses:

Not ABET accredited

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

Updated CARF in support of new department name and new curriculum.