

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, February 8, 2022

Attending: Fred Terry (Chair), Robert Bordley, Yavuz Bozer, Saadet Guralp, Odest Chadwicke Jenkins, Eric Johnsen, Amir Kamil, Leena Lalwani, Xiaogan Liang, Paige Lighthammer, Cameron Loutitt, Frank Marsik, Radoslaw Michalowski, Lisa Parisi, Roxanne Pinsky, Kevin Pipe, Ken Powell, Rachael Schmedlen, Katie Snyder, Steven Yalisove, Won Sik Yang

Support Staff: Kerry Beers, Betsy Dodge, Matthew Faunce, Stacie Vaughn

Call to Order: 1:34pm

Adjourned: 3:01pm

AGENDA

1. Approval of 1.25.2022 Meeting Minutes (Page 2) – Action Item, APPROVED by CCC
2. Mechanical Engineering Undergraduate Concentration in Robotics Proposal (Page 4) – Proposal Passes
 - a. Proposal was drafted with about 20 Mechanical Engineering faculty involved, approved by ME undergrad program committee and ME faculty meeting.
 - b. Motivation for this new concentration is to train ME students in Robotics in a way that positions them to succeed in a Robotics related field based on their ME skills
 - c. Students would take 12 or more credits (one Linear Algebra course, at least one core ME Robotics course, and remaining credits from a list of about 20 courses relevant to Robotics)
 - d. No ROB courses as of yet within proposal, as they are waiting to see the total ROB offerings available prior to adding them into their course list.
 - e. CoE Curriculum Committee voted to approve the proposal.
3. Discussion of Enforced Prerequisites with a C Grade and Students Taking the Course P/F (Page 7)
 - a. Question was asked regarding the minimum grade requirements for a Pass using Pass/Fail grading. LSA Policy states that a “C-“or higher grade earns a P grade using their P/F grading standards. Clarification from the University Registrar will be requested in between the return of this agenda item to the 2.22.2022 CoE Curriculum Committee meeting.
4. CoE Policy for Engineering Minors Proposal (Page 9)
 - a. Proposal will return to 2.22.2022 meeting for a vote.
 - b. CoE CC members will vote on whether we should adopt LSA’s policy of: “Students may not add, complete, or declare a minor after graduation.”

CARF SUMMARIES

PAGE	SUBJECT	COURSE #	ACTION	SUMMARY	EFFECTIVE TERM	MIN. GRADE REQ. FOR ENF. PREPRREQ	APPROVED	NOTES & REVISIONS	TABLED
13	MATSCIE	293	MOD	Changing full-term credit hours from 2-4 to 1-4 and adding Repeatability.	FT 2022	NO	CONDITIONAL APPROVAL	Add check to box for “Can be taken more than once in the same term”	

16	MATSCIE	593	MOD	Adding Repeatability.	SP 2022	NO	APPROVED		
19	MECHENG	545	NEW		FT 2022	NO	CONDITIONAL APPROVAL	Cross-listed with ISD 546 and CEE 577. Edit Course Description to remove “is considered.” Edit second sentence to “Students will build models” and have faculty member update language to distinguish from ROB 535/NAVARCH 535 Ask MECHENG faculty member associated with this course why they aim to cross-list this course and plans for department assistance with management/instruction of the course with cross-listed departments.	

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, February 8, 2022

Attending:

Support Staff:

Call to Order:

Adjourned:

AGENDA

1. Approval of 1.25.2022 Meeting Minutes (Page 2)
2. Mechanical Engineering Undergraduate Concentration in Robotics Proposal (Page 4)
3. Discussion of Enforced Prerequisites with a C Grade and Students Taking the Course P/F (Page 7)
4. CoE Policy for Engineering Minors Proposal (Page 9)

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16	MATSCIE	593	MOD	Adding Repeatability.	SP 2022	NO			
19	MECHENG	545	NEW		FT 2022	NO		Cross-listed with ISD 546 and CEE 518.	

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, January 25, 2022

Attending: Fred Terry (Chair), Robert Bordley, Yavuz Bozer, Gokcin Cinar, Saadet Guralp, George Halow, Amir Kamil, Pei-Cheng Ku, Leena Lalwani, Xiaogan Liang, Paige Lighthammer, Cameron Loutitt, Frank Marsik, Radoslaw Michalowski, Yulin Pan, Roxanne Pinsky, Kevin Pipe, Ken Powell, Rachael Schmedlen, Katie Snyder, Leung Tsang, Steven Yalisove, Won Sik Yang

Support Staff: Kerry Beers, Betsy Dodge, Matthew Faunce, Stacie Vaughn

Call to Order: 1:32pm

Adjourned: 3:00pm

AGENDA

1. Approval of 1.11.2022 Meeting Minutes (Page 2) - APPROVED
2. ECE MEng Proposal – Master of Engineering in Microelectronics and Integrated Circuits (Page 5) – Action Item
 - a. The proposal is for the third concentration with the Master of Engineering program for ECE, concentrating in Microelectronics and Integrated Circuits.
 - b. This program is not a pathway into CoE Ph.D. programs, if students wish to pursue the Ph.D. program after completion of their master's degree, they are required to reapply to the university.
 - c. The curriculum was reviewed by three areas of ECE faculty and voted on by ECE faculty prior to bringing the proposal to the CoE Curriculum Committee. Feedback was received from ECE faculty that this is a strong proposal.
 - d. Note made regarding Ross School of Business at times not allowing CoE students into their courses.
 - e. Master's programs are typically 30 credits, it was asked why this program is 26 credits.
 - i. This program is outside of Rackham, which does not have the strict requirement to be 30 credits or more. Competing programs at various institutions have been found to be less than 30 credits as well. It was noted that despite the credit count being lower, faculty who reviewed the proposal have vouched for the curricular strength in the major concentration requirements and the curriculum overall.
 - f. Vote proposed and passed to approve the proposal within the CoE Curriculum Committee. The proposal will appear for a vote at the College faculty meeting on 2.15.2022.
3. CoE Policy for Engineering Minors Proposal (Page 10)
 - a. Discussion was had surrounding the implications of what scenarios would be permissible (if any) for a student to return to complete or earn a CoE minor.
 - b. A point was proposed to compare CoE to LSA policy. The current LSA Policy states that students are unable to return to complete a minor. Additionally, LSA will not graduate a student with their major until they know how their minor is being handled. Whereas in CoE, we will remove the minor and graduate a student if we do not receive communication back from them on how they wish to proceed.
 - c. A perspective was shared that a minor is intended to be an addition to an undergraduate degree, not a standalone curricular component, and thus should not be justified as a legitimate academic decision to return to complete a minor.
 - d. A question was asked regarding whether or not this may impact those required to obtain post-secondary education or returning education for their employment. It was noted that students in these situations would likely pursue graduate and professional education as an extension past their undergraduate coursework in place of returning for an undergraduate minor.
 - e. After discussion, it was proposed to take a straw-poll to gauge committee opinions prior to a final vote (which will occur at the 2.8.2022 meeting).
 - f. The questions from the straw poll and results are as follows:
 - i. 1. Are students allowed to return to the university to declare a minor after they have

- ii. graduated and then to complete coursework for the minor?
 - 1. Yes (1/19, 5%)
 - 2. No (18/19, 95%)
 - iii. 2. Are students allowed to return to the university to complete a minor that they declared during their degree program but did not complete before graduating from the major program?
 - 1. Yes (3/19, 16%)
 - 2. No (16/19, 84%)
 - iv. 3. Are students allowed to return to the university to declare a minor that they have already completed the coursework for (and neglected to declare the minor prior to graduation)?
 - 1. Yes (11/19, 58%)
 - 2. No (8/19, 42%)
 - v. 4. Are students who completed all of the requirements of their minor but neglected to turn in their release allowed to retroactively receive their minor?
 - 1. Yes (18/19, 95%)
 - 2. No (1/19, 5%)
- g. The CoE Policy for Engineering Minors will return at the 2.8.2022 meeting for a vote.

CARF SUMMARIES

PAGE	SUBJECT	COURSE #	ACTION	SUMMARY	EFFECTIVE TERM	MIN. GRADE REQ. FOR ENF. PREPREQ	APPROVED	NOTES & REVISIONS	TABLED
14	AEROSP	288	NEW		FT 2022	NO	CONDITIONAL APPROVAL	Remove from Course Description “A comprehensive introductory course”	
20	AEROSP	388	NEW		WT 2023	B	APPROVED		
26	AEROSP	488	NEW		FT 2023	B	CONDITIONAL APPROVAL	Remove from Course Description “transformational course on” and edit last sentence to read “Student will be involved with coaching and mentorship...”	
51	NAVARCH	321	MOD	Changing Course Description and reducing Full Term Credit Hours from 4 to 3 credits	WT 2023	NO	CONDITIONAL APPROVAL	CARF submitted per conditionally approved NAVARCH Curriculum Change Proposal at 1.11.2022 meeting. Update Course Description to remove the syntax error in the word ‘testing’	



To: College of Engineering Curriculum Committee
From: Eric Johnsen, Associate Chair of Undergraduate Education, Mechanical Engineering Department
Subject: Proposal for the creation of a new undergraduate concentration in Robotics in the Mechanical Engineering Department
Date: Thursday, February 3, 2022

I am writing this memo to request review from the College of Engineering Curriculum Committee of the attached proposal to create a new undergraduate concentration in Robotics in the Mechanical Engineering (ME) Department.

Mechanical engineers have the opportunity to play a key role in the sensing, reasoning and acting strategies underlying robotics by leveraging their training in dynamics/control, mechatronics/design/manufacturing, and mathematics. By enhancing their expertise in these topics in relation to robotics, ME students will be uniquely positioned to contribute to the conception, design, development, control, and use of robots in a way that sets them apart from students from any other major or field, whether pursuing a career or graduate studies in mechanical engineering or robotics. The goal of the proposed Robotics Concentration is to provide an opportunity to ME students to increase their knowledge in mechanical engineering topics related to robotics. The concentration is designed to provide flexibility and allow students to emphasize breadth or depth within robotics. The concentration is not intended to be an abridged version of a robotics major or minor, but rather emphasize mechanical engineering principles underlying robotics. Prof. Tilbury will be the point of contact for this concentration.

Starting in July 2021, Prof. Dawn Tilbury and I worked on developing the attached proposal. Along with the help of 20 other ME faculty (most working in the field of Robotics), we generated this proposal draft, which was discussed and approved by both the ME Undergraduate Program Committee and the ME Advisory Committee to the Chair. On January 24, 2022, the proposal was presented to the ME faculty, who discussed the proposal and voted 41-0-0 (yes-no-abstained) in favor of approving the creation of this potential concentration.

While full details are provided in the attached proposal, I would like to include my response to a question Prof. Terry had regarding the fact that no ROB courses are included on the list. At various levels throughout this proposal generation process, ME faculty expressed interest in including ROB courses, but also hesitation in doing so before more clarity would be provided regarding ROB courses and offerings. Additionally, our goal was to design the concentration such that additional coursework beyond a usual degree would not be necessary; all 300-level ROB courses presently have at least one pre-requisite that is not currently on our list.

I would like to convey ME's excitement about this project, which we believe will have a great positive impact on our students. We hope the committee will agree. I will be happy to answer any questions that might arise. Thank you for your consideration.

Attachment: Robotics Concentration proposal document



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Motivation for a New ME Undergraduate Concentration in Robotics

Poised to transform society, robotics is a multi-disciplinary field in which the goal is to develop and deploy robots that can *sense, reason* with, and *act* on their environment. Mechanical engineers have the opportunity to play a key role in the *sensing, reasoning* and *acting* strategies underlying robotics by leveraging their rigorous training in dynamics/control, mechatronics/design/manufacturing, and mathematics. By enhancing their expertise in these topics in relation to robotics, ME students will be uniquely positioned to contribute to the conception, design, development, control, and use of robots in a way that sets them apart from students from any other major or field, whether pursuing a career or graduate studies in mechanical engineering or robotics.

The goal of the proposed Robotics Concentration is to provide an opportunity to ME students to increase the depth of their knowledge in mechanical engineering topics related to robotics. Since linear algebra lies at the foundation of multiple sub-areas of robotics (sensing, kinematics, machine learning), this subject is required for the concentration. Students must also take one or more advanced undergraduate elective courses in core ME topics relevant to robotics to provide depth in their understanding of fundamental principles at the intersection of mechanics and robotics, namely dynamics (ME 440), control (ME 461), and mechatronics (ME 499). Students may additionally select courses from a list to complete the required credits as a means to specialize in a robotics-relevant focus area; these courses contain various elements of sensing, reasoning, and/or acting that are important for robotics.

The concentration is designed to provide flexibility and allow students to emphasize breadth or depth within robotics. There is evidence that some ME students already fashion a robotics concentration for themselves, based on electives they take, so creating a concentration is a means for these students to be recognized. The concentration is not intended to be an abridged version of a robotics major or minor, but rather emphasize mechanical engineering principles underlying robotics; in fact, the proposed concentration has only a small overlap with the proposed undergraduate curriculum in the Robotics Department.

Robotics Concentration (What students would see)

Mechanical engineers have a tremendous opportunity to play a key role in the transformation that robotics will bring to our society. Given their knowledge of dynamics/control, mechatronics/design/manufacturing, and mathematics, mechanical engineers are well positioned to contribute to the *sensing, reasoning, and acting* paradigm underlying robotics. The Robotics Concentration will enable students to enhance their expertise in one or more of these areas, thus positioning them to contribute to the conception, design, development, control, and use of robots in the future, whether pursuing a career in Mechanical Engineering or Robotics.

Open to Mechanical Engineering undergraduates, the Robotics concentration consists of 12 credit hours, with details below. For additional information, contact the advisors in the Academic Services Office. Student must be in good standing to declare the concentration. Classes must be taken for a letter grade and passed with satisfactory grades. For more information, contact the advisors in the Academic Services Office or Professor Tilbury (tilbury@umich.edu). Students may petition to have alternate courses considered by emailing me-aso@umich.edu.

Concentration Requirements (with number of credits and pre-reqs in parentheses):

- A. Choose one course among the following linear algebra courses:

- Math 214 Applied Linear Algebra (4 cr, Math 116)
- Math 217 Linear Algebra (4 cr, Math 215)
- Math 417 Matrix Algebra I (3 cr, three math courses beyond Math 110)
- Math 419 Linear Spaces and Matrix Theory (3 cr, four math courses beyond Math 110)
- ME 564 Linear Systems Theory (4 cr, graduate standing)

B. Choose at least one course among the following core ME robotics-related courses:

ME 440 Intermediate Dynamics and Vibrations (4 cr, ME 240)

ME 461 Automatic Control (3 cr, ME 360)

ME 499 Mechatronics and Robotics (3 cr, ME 350) or ME 552 Mechatronic Systems Design (4 cr, advised pre-reqs: ME 350, 360 or EECS 314)

C. Choose any of the remaining credits from any of the following specialization courses:

Dynamics and control

ME 540 Intermediate Dynamics (3 cr, ME 240) or ME 541 Mechanical Vibrations (3 cr, ME 440)

ME 543 Analytical and Computational Dynamics (3cr, ME 440)

ME 560 Modeling Dynamic Systems (3 cr, ME 360)

ME 561 Design of Digital Control Systems (3 cr, ME 461)

ME 567 Robot Kinematics and Dynamics (3 cr, instructor permission)

Mechatronics, Design, and Manufacturing

ME 483 Manufacturing System Design (3 cr, ME 250)

ME 584 Advanced Mechatronics for Manufacturing (3 cr ME 461)

Math, Computation, Machine Learning, and Data-Driven Modeling

ME 499 Introduction to Computation and Machine Learning for Engineering (3 cr, Math 216)

ME 599 Computational and Data-Driven Methods in Engineering (3 cr, no pre-req)

Other courses

ME 490 Research, Innovation, Service, Entrepreneurship in Robotics (3 cr, two 300-level ME courses)

ME 542 Vehicle Dynamics and Automation (3 cr, ME 440 or ME 540)

ME 545 Dynamics and Control of Connected Vehicles (3 cr, ME 360)

ME 565/499 Battery Systems and Control (3 cr, ME 360; advised co-req: ME 461)

ME 566 Modeling, Analysis, and Control of Hybrid Electric Vehicles (3 cr, ME 461)

ME 569 Control of Advanced Powertrain Systems (3 cr, ME 360, co-req: ME 461)

BME 442 Introduction to Biomedical Imaging (3 cr, ENGR 101)

EECS 464 Hands-on Robotics (4 cr, ME 360)

NAVARCH 565 Self Driving Cars: Perception and Control

*BME 517 Neural Engineering (3 cr, EECS 216)

*EECS 460 Embedded Control Systems (4 cr, EECS 216)

**These courses have non-trivial pre-reqs*

For illustrative purposes, below are examples of specific paths within the present concentration:

Robot dynamics and control: ME 440, ME 461, ME 567 + linear algebra,

Autonomous vehicles: ME 440, ME 542, NAVARC 565 + linear algebra,

Robot design and systems: ME 499, ME 483, ME 584 + linear algebra.

Fundamental Mechanical Engineering robotics: ME 440, ME 461, ME 499 + linear algebra

Course ID	Descr	Subject	Catalog	Descr
040188	Sediment Transport	CEE	522	CEE 325 or MECHENG 330 or CHE 341 or NAVARCH 320 or AOSS 401; (C or better)
040617	Intro Atm Radiation	CLIMATE	380	MATH 216 or 256 or 286 or 316; (C or better)
040617	Intro Atm Radiation	SPACE	380	MATH 216 or 256 or 286 or 316; (C or better)
040754	Atm Thermo	CLIMATE	350	MATH 216 or 256 or 286 or 316; (C or better)
040754	Atm Thermo	SPACE	350	MATH 216 or 256 or 286 or 316; (C or better)
041340	Ugrad Res Exper II	CLIMATE	381	[CLIMATE/SPACE 280; (C or better)] or (Junior or Senior Standing)
043009	Space Wthr Modeling	SPACE	477	SPACE 370; (C or better)
020383	Behav Matls	MECHENG	382	MECHENG 211; (C or better) AND Fewer than 2 previous elections of MECHENG 382 (incl. grades of W & I) [(PHYSICS 140 or 160) & (141 or 161) & (MATH 116 or 119 or 121 or 156 or 176 or 186 or 296); (C or better)] AND [Fewer than 2 previous elections of MECHENG 211 (incl. grades of W & I)]
004434	Intro to Solid Mech	MECHENG	211	[MECHENG 211 and 240; (C or better)] AND [MECHENG 250; (C- or better)] AND [Fewer than 2 previous elections of MECHENG 350 (incl. grades of W & I)]
016044	Des & Mfg II	MECHENG	350	(MATH 215 and PHYSICS 240; C or better) or graduate standing
044574	Intro Transp Engr	CEE	450	MATH 215 and 216; (C or better)
041701	Statistical Methods	CEE	373	[CHEM 130 & (125 or 126)] or [210 & 211] AND (MATH 116 or 119 or 121 or 156 or 176 or 186 or 296); (C or better)] AND [Fewer than 2 previous elections of MECHENG 235 (incl. grades of W & I)]
040102	Thermodynamics I	MECHENG	235	MECHENG 320; (C or better) AND Fewer than 2 previous elections of MECHENG 335 (incl. grades of W & I)
040604	Heat Transfer	MECHENG	335	[Prereq of PHYSICS (140 or 160) and (141 or 161); C or better] AND [Co-req of MATH 216, 256, 286, or 316] AND [Fewer than 2 previous elections of MECHENG 240 (incl. grades of W & I)]
004437	Dynamics&Vibrations	MECHENG	240	[MATH 215 or 255 or 285; (C or better)] AND [MECHENG 235 & 240; (C or better)] AND [Fewer than 2 previous elections of MECHENG 320 (incl. grades of W & I)]
040189	Fluid Mech I	MECHENG	320	[Pre-req MECHENG 240; (C or better)] AND [Co-req EECS 314 or 215] AND Fewer than 2 previous elections of MECHENG 360 (incl. grades of W & I)
004443	Dynamic Sys	MECHENG	360	PHYSICS 240 or 260; (C or better) or Graduate Standing
046781	Rad Therapy Physics	NERS	581	

018517	Med Rad Hlth Eng	BIOMEDE	582	[(MATH 216 or 256 or 286) and (PHYSICS 240 or 260); (C or better)] or Graduate Standing
046782	Radiol Phys Dosim	NERS	555	NERS 312; (C or better) or Graduate Standing
049590	NERS Design II	NERS	492	NERS 491; (C or better)
049639	NERS Design I	NERS	491	Co-requisite: NERS 441; (C or better)
004550	Radiat Shield	NERS	554	NERS 441 or 484; (C>) or Graduate Standing
045731	Fund Heat/Mass Trans	NERS	444	NERS 344; (C or better) or graduate standing [MATH 116 or 119 or 121 or 156 or 176 or 186 or 296; (C or better)] AND [ENGR 101 or EECS 183; (C or better)] AND [Fewer than 2 previous elections of MECHENG 250 (incl. grades of W & I)]
018293	Des & Mfg I	MECHENG	250	[(MATH 216 or 256 or 286) and (PHYSICS 240 or 260); (C or better)] or Graduate Standing
009444	Rad Assess Response	NERS	583	EER 601; (C or better)
048890	Research Design EER	EER	603	NERS 250; (C or better)
007859	N E Rad Sci II	NERS	312	PHYSICS 240; (C or better)
004537	N E & Rad Sci I	NERS	311	(ENGR 101 or 151 or EECS 183) and (MATH 216 or 256 or 286); (C or better) or Graduate Standing
049683	Scientific Computing	NERS	570	CEE 431; (C or better) or Graduate Standing
048266	Build Info Modeling	CEE	435	NERS 315; (C or better) or Graduate Standing
049219	Nuclear Safeguards	NERS	532	NERS 441; (C or better) or Graduate Standing
007861	Nucl Power Reactors	NERS	442	ENGR 260; (C or better)
050353	Eng Acr Cultures II	ENGR	460	EER 601 and EER 602; (C or better)
050446	EER Practicum	EER	610	EECS 281; (C or better)
049844	SysDes Search Engine	EECS	440	[PHYSICS 240 or 260; (C or better)] AND [PHYSICS 241 or 261; C or better] AND [MECHENG 211 and 235 and 240; (C or better) AND [Co-req of MECHENG 382]
017883	Lab I	MECHENG	395	

CoE Departments involved: BIOMEDE, CEE, CLIMATE, EECS, EER, ENGR, MECHENG, NERS, SPACE

CoE Policy for Engineering Minors Proposal

CoE has a policy in place for LSA Academic Minors earned by CoE students in which, "Minors cannot be completed and added to the transcript after a student has graduated." The CoE Bulletin page is [linked here](#) to the site which states this policy.

Additionally, LSA also has a minor policy ([linked here](#)) which states, "Students may not add, complete, or declare a minor after graduation. Students are, however, permitted to use the credits earned towards a minor in the completion of an additional major after graduation. Upon completion of this additional major, the minor will be removed from the student's transcript and be replaced by the major."

However, in the [CoE Policy for Engineering Minors](#), there is no added statement in the policy regarding the completion of minors after a student has graduated.

The CoE Curriculum Committee will propose a vote at the 11.23 CoE CC meeting regarding an addition to the CoE Policy for Engineering Minors, either to enable (12 a.) or disable (12 b.) students to earn a CoE minor after graduation.

Therefore, the new CoE Policy for Engineering Minors would read as follows (see new addition possibilities in yellow highlight):

College of Engineering Policy for Engineering Minors

Undergraduate students enrolled in a College of Engineering degree program can often benefit from study and practice at some depth outside of their major. An Engineering minor is a coherent program of study, but with requirements far less comprehensive than those of a BS or BSE degree. Engineering minors can be sponsored by CoE departments, programs, or, for the purpose of supporting cross-departmental programs, sponsored by the Office of the Associate Dean for Undergraduate Education. An Engineering minor is not intended to provide specialization within a student's major field.

Rules:

1. Completion of an academic minor is optional; no student can be required to complete an Engineering minor.
2. A student can complete one or more Engineering minors, along with one or more LSA minors. However, a minor is not intended to provide

specialization within a student's major field. Therefore, the posted rules for each minor will outline any restrictions on the availability of a minor for students in particular program, e.g. "A student seeking a BSE in NERS cannot earn the minor in NERS."

3. Advanced Placement credits may not be used to meet the requirements of an academic minor, but may be used to meet the prerequisites to a minor.
4. Transfer credit may not be used to fulfill the requirements of a minor unless specifically stated in the minor.
5. Courses taken to satisfy the requirements of a minor must be taken for a grade, unless the course was specifically approved as Pass/Fail within the requirements of that minor.
6. A student must earn an overall GPA of at least 2.0 in courses taken to meet the requirements of an academic minor.
7. Students are responsible for notifying both the sponsoring program and their major department of their intention to pursue a minor. Such notification should take place prior to enrollment in the upper-division courses for the minor.
8. The advisor for each minor is responsible for approving any variance in course requirements for a minor.
9. Responsibility for auditing completion of requirements for a minor lies within the sponsoring unit.
10. Students will always be allowed to count courses towards an approved minor retroactively, as long as the minor is approved before the date of their graduation.
11. Engineering minors will be noted on a student's academic transcript, but not on their diploma.
12.
 - a. Minors can be completed and added to the transcript after a student has graduated.
 - b. Minors cannot be completed and added to the transcript after a student has graduated.

Response from International Center Representative - Scott Manley, Assistant Director for International Student and Scholar Services

"From a practical perspective, the impact on international students is minimum in either scenario. A minor has no impact on an international student's eligibility for Optional Practical Training (OPT) since OPT is only tied to a student's majors at the undergraduate level. The addition of a minor after a student has graduated would potentially be something we might add to the student's SEVIS record, but it does not impact the student's status or eligibility for any additional immigration benefits. It really is an academic decision without an impact on a student's immigration record. The addition of a major after graduation, on the other hand, would have a significant impact. I hope this helps. Please let me know if you have any other questions."

Best regards,
Scott

(Note: "either scenario" mentioned above refers to the two proposed added statements of 12a or 12b. regarding whether or not a student can complete and add to the transcript a minor after graduation.)

Scenarios to Consider

- What should the policy be for students who have completed all of the requirements of their minor, but neglected to turn in their release to formally request the minor prior to graduation?
 - Ex. A situation recently arose where a student completed all of the requirements for a CS minor prior to graduation from a major degree program, but neglected to complete the minor release and did not graduate with the minor. Student is currently in the process of petitioning for this situation to be resolved. ADUE is planning to approve this petition.
- Are students allowed to return to the university to declare a minor after they have graduated and then to complete coursework for the minor? A student in this situation would be returning solely for the pursuit of a minor they declared after graduation from their degree program.
- Are students allowed to return to the university to complete a minor that they declared during their degree program but did not complete before graduating from the major program? A student in this situation would have declared the minor prior to graduation from the university, but did not complete the minor at the same time they decided to finish their degree.
- Are students allowed to return to the university to declare a minor that they have already completed the coursework for (and neglected to declare the minor prior to graduation)? A

student in this situation would have neglected to declare the minor prior to graduation but fulfilled the requirements of the minor prior to graduation from the university.



Course Approval Request Form

Office of the Registrar, University of Michigan

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2022-01-29
Effective Term: Fall 2022

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

<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): Material Science Engineering Subject: MATSCIE Catalog: 293			Dept (Home): Material Science Engineering Subject: MATSCIE Catalog: 293		
<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 type="checkbox"/>						
<input type="checkbox"/>	Course Title (full title) Special Topics in Materials Science and Engineering			Course Title (full title) Special Topics in Materials Science and Engineering		
<input type="checkbox"/>	Abbreviated Title (20 char) MSE Special Topics			Abbreviated Title (20 char) MSE Special Topics		
<input type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Special Topics in Materials Science and Engineering					
<input checked="" type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 1 Undergraduate Max: 4	Graduate Min: Graduate Max:	Half Term Credit Hours Undergraduate Min: Undergraduate Max:	Graduate Min: Graduate Max:		
<input type="checkbox"/>	Course Credit Type Undergraduate Student					
<input checked="" type="checkbox"/>	Repeatability <input checked="" type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: 99	<input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term				

Subject: Material Science Engineering

Catalog: 293

<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
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CURRENT LISTING**REQUESTED LISTING**

<input type="checkbox"/>	Advisory Prerequisite (254 char) None	Advisory Prerequisite (254 char) None	
<input type="checkbox"/>	Enforced Prerequisite (254 char) None Minimum grade requirement:	Enforced Prerequisite (254 char) None 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 checked="" 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: Steve Yalisove		Cognizant Faculty Member Title:	

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

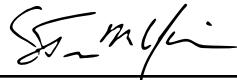
Contact Person:

Email:

Phone:

CoE Curriculum

Committee Representative:



Print: Steven M. Yalisove

Date: 2/1/2022

CoE Curriculum Committee Chair:



Print: Amit Misra

Date: 2/2/2022

Home Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:	Requested:
<u>Course Description</u> Special Topics in Materials Science and Engineering	<u>Course Description</u> Special Topics in Materials Science and Engineering
<u>Class Length</u> Full term	<u>Class Length</u> Full term
<u>Contact hours (lecture):</u> 4	<u>Contact hours (lecture):</u> 4
<u>Contact hours (recitation)</u>	<u>Contact hours (recitation)</u>
<u>Contact hours (lab)</u>	<u>Contact hours (lab)</u>

Additional Info:

Submitted by:
Home dept

Describe how this course fits with the degree requirements:

Special resources of facilities required for this course:

Supporting statement:
MSE feels the need to have a Special Topics course adjusted minimum credit hours from 2 to 1. Per request of Steve Yalisove



Course Approval Request Form

Office of the Registrar, University of Michigan

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2022-01-28
Effective Term: Spring 2022

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

<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): Material Science Engineering Subject: MATSCIE Catalog: 593			Dept (Home): Material Science Engineering Subject: MATSCIE Catalog: 593		
<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 type="checkbox"/>						
<input type="checkbox"/>	Course Title (full title) Special Topics			Course Title (full title) Special Topics		
<input type="checkbox"/>	Abbreviated Title (20 char)			Abbreviated Title (20 char)		
<input type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Special Topics					
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 3 Undergraduate Max: 3	Graduate Min: 3 Graduate Max: 3	Half Term Credit Hours Undergraduate Min: Undergraduate Max:	Graduate Min: Graduate Max:		
<input type="checkbox"/>	Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student					
<input checked="" type="checkbox"/>	Repeatability <input checked="" type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits: 99	<input type="checkbox"/> Course is Y graded <input checked="" type="checkbox"/> Can be taken more than once in the same term				

Subject: Material Science Engineering

Catalog: 593

<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
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CURRENT LISTING**REQUESTED LISTING**

<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)	
<input type="checkbox"/>	Enforced Prerequisite (254 char)	Enforced Prerequisite (254 char) Senior Standing or Graduate Standing	
	Minimum grade requirement:	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 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: Steve Yalisove		Cognizant Faculty Member Title:	

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person:

Email:

Phone:

CoE Curriculum

Committee Representative:



Print: Steven M. Yalisove

Date: 2/1/2022

CoE Curriculum Committee Chair:



Print: Amit Misra

Date: 2/2/2022

Home Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:	Requested:
<u>Course Description</u> Special Topics	<u>Course Description</u> Special Topics
<u>Class Length</u> Full term	<u>Class Length</u> Full term
<u>Contact hours (lecture):</u> 3	<u>Contact hours (lecture):</u> 3
<u>Contact hours (recitation)</u>	<u>Contact hours (recitation)</u>
<u>Contact hours (lab)</u>	<u>Contact hours (lab)</u>

Additional Info:

Submitted by:
Home dept

Describe how this course fits with the degree requirements:

Special resources or facilities required for this course:

Supporting statement:
Students should be able to take more than one special topics as long as they are different subjects



Course Approval Request Form

Office of the Registrar, University of Michigan

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

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

Date of Submission: 2022-01-19
Effective Term: Fall 2022

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

<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): Mechanical Engineering Subject: MECENG Catalog: 545			
<input checked="" type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments		<input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments				
	Department	Subject	Catalog Number	Department	Subject	Catalog Number	
	Integrative Systems and Design - ISD - 546 Civil and Environmental Engineering - CEE - 518						
<input checked="" type="checkbox"/>	Course Title (full title)			Course Title (full title) Dynamics and Control of Connected Vehicles			
<input checked="" type="checkbox"/>	Abbreviated Title (20 char)			Abbreviated Title (20 char) Connected Vehicles			
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Connected vehicle systems consisting of human driven and connected automated vehicles is considered. Models are built in terms of ordinary differential equations and delay differential equations. Controllers are designed to ensure stability and disturbance attenuation. Potential impacts of connectivity on improving safety, energy efficiency, and traffic flow are highlighted.						
<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, Non-Rackham Graduate Student						
<input type="checkbox"/>	Repeatability		<input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> 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"/> 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 <input checked="" type="checkbox"/> 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) MECHENG 360
<input type="checkbox"/> Enforced Prerequisite (254 char)		Enforced Prerequisite (254 char)
Minimum grade requirement:		Minimum grade requirement:
<input type="checkbox"/> Credit Exclusions		Credit Exclusions
Course Components	Graded Component	Terms Typically Offered
<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"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<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: Gabor Orosz		Cognizant Faculty Member Title:

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person:

Email:

Phone:

CoE Curriculum

Committee Representative: *Xiaogan Liang*

Print: XIAOGAN LIANG

Date: 01/31/2022

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:

Print: Ellen M. Arruda

Date: 1/24/2022

Cross-Listed Department Chair:

Print: AMY HORTON

Date: 1/25/2022

Cross-Listed Department Chair:

Print: Yafeng Yin

Date: 1/29/2022

Cross-Listed Department Chair:

Print:

Date:

Current:**Requested:**Course DescriptionCourse Description

Connected vehicle systems consisting of human driven and connected automated vehicles is considered. Models are built in terms of ordinary differential equations and delay differential equations. Controllers are designed to ensure stability and disturbance attenuation. Potential impacts of connectivity on improving safety, energy efficiency, and traffic flow are highlighted.

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

Connected and automated technologies are revolutionizing ground transportation. This course focuses on the fundamental science and engineering enabling such revolution and provides students with the understanding of both the technologies as well as their impact. The course has been offered three times at Michigan and has generated significant interests among the students. Please find below the related data.

Year	Q1	Q2	# of students enrolled
W 2019	4.7	4.9	28
W 2020	4.7	4.9	19
W 2021	5.0	5.0	20

Students from different disciplines enrolled in the course, and consequently, we would like to cross list it with CEE and ISD. Slightly different versions of the course were also offered by the same instructor during spring 2018 at Caltech and during summer 2020 at SJTU.

Instructors:	Prof Gábor Orosz Dept. of Mechanical Engineering Autolab G034 orosz@umich.edu	Xunbi Ji Dept. of Mechanical Engineering Autolab G041 xunbij@umich.edu
Lectures:	Tu 12:00pm - 1:30pm Th 12:00pm - 1:30pm	
Recitation:	Fr 3:30pm - 5:00pm	
Office hours:	M 10:00am - 11:00am Tu 5:00pm - 6:00pm We 10:00am - 11:00am We 4:00pm - 6:00pm	

Prerequisites: You are expected to have knowledge of differential equations, linear algebra, and Laplace or Fourier transform.

Reading: Materials will be provided as the course progresses

Course description: This course focuses on modeling and control of connected vehicle systems consisting of human driven and connected automated vehicles. Models are built in terms of ordinary differential equations and delay differential equations. The stability of uniform flow equilibrium studied at the linear and nonlinear levels. Controllers for connected automated vehicles are designed so that they can ensure stability and disturbance attenuation around the equilibrium. The impacts of utilizing connectivity in order to ensure traffic safety and efficiency are highlighted.

The Engineering Honor Code: <https://elc.engin.umich.edu/honor-council/>

No member of the community shall take unfair advantage of any other member of the community.

Diversity Equity and Inclusion: https://docs.asee.org/public/LGBTQ/Syllabus_Inclusion_Statement.pdf

Assignments: Eight homework assignments will be set during the term that will be posted on the course's website. Homework sets are **due at 11:59pm Thursdays on canvas**. Homework solutions will be available through the course web site.

You are encouraged to discuss and work on homework together but the final document must represent your own understanding of the material.

If you find errors in your graded homework (e.g. scores do not add up, the grader missed a page etc.) you may ask for re-grade. You need to attach a sheet where you write up the issue and resubmit the homework to the professor within one week after receiving the graded homework.

Examinations:	Midterm Exam 1:	Mar 2-4 (Tu-Th)
	Midterm Exam 2:	Apr 6-8 (Tu-Th)

The exams will be open book.

Grading:	Homework	25%
	Midterm Exam 1	25%
	Midterm Exam 2	25%
	Project	25%

Additional rules: no laptops, cell phones, iPods, iPads, etc. during the class

LECTURE	DATE	TOPICS	READING	HW DUE DATES
1	Tu 1/19	Intro, Car-following models		
2	Th 1/21	Plant stability		
3	Tu 1/26	String stability		
4	Th 1/28	Ring configuration		HW#01
5	Tu 2/2	Time delay systems		
6	Th 2/4	Time delay systems		HW#02
7	Tu 2/9	Car-following with reaction time		
8	Th 2/11	Car-following with reaction time (first order lag approximation)		HW#03
9	Tu 2/16	Adaptive cruise control – including physics		
10	Th 2/18	Adaptive cruise control – including physics		HW#04
11	Tu 2/23	From adaptive to connected cruise control – digital effects		
12	Th 2/25	From adaptive to connected cruise control – digital effects		HW#05
13	Tu 3/2	Connected cruise control – acceleration feedback		
Tu-Th		MIDTERM EXAM 1		
3/2-3/4				
14	Th 3/4	Head-to-tail string stability (3-car example)		
15	Tu 3/9	Head-to-tail string stability (network control)		
16	Th 3/11	Connectivity-based energy efficiency		HW#06
17	Tu 3/16	Robust control of connected vehicle systems		
18	Th 3/18	Machine learning for connected vehicle networks		HW#07
Tu 3/23		WELL-BEING BREAK – no class		
19	Th 3/25	Chaozhe He Connected cruise control for heavy duty vehicles		HW#08
20	Tu 3/30	Tulga Ersal Periodic control of connected automated vehicles		
21	Th 4/1	Liren Yang Towards correct-by-construction controller synthesis for self-driving cars		
22	Tu 4/6	Ram Vasudevan Bridging the gap between safety and real-time performance for autonomous systems		
Tu-Th		MIDTERM EXAM 2		
4/6-4/8				

23	Th 4/8	Henry Liu Intelligent driving intelligence test for autonomous vehicles with naturalistic and adversarial environment	Project Proposal
24	Tu 4/13	Yafeng Yin Rhythmic traffic control in a fully automated vehicle environment: a graph coloring approach	
25	Th 4/15	Neda Masoud The sharing economy and the next generation of mobility systems	
26	Tu 4/20	Review and Project Presentation	

HW#01 – Dynamics and control

HW#02 – Plant stability and string stability

HW#03 – Time delay systems

HW#04 – Human car following

HW#05 – Adaptive cruise control

HW#06 – Connected cruise control – digital effects and acceleration feedback

HW#07 – Connected cruise control – networked control design

HW#08 – Connected cruise control – energy efficiency and robustness