In Workflow

1. **REGISTRAR**
2. **Dept 18**
3. **Dept 6**
4. **Dept 1**
5. **SOCR**
6. COC
7. FPC
8. Academic Council
9. Faculty

Approval Path

1. Mon, 26 Nov 2018 17:40:00 GMT
   Jennifer Donath (jconnoll): to Initiator
2. Wed, 05 Dec 2018 17:31:11 GMT
   Jennifer Donath (jconnoll): for REGISTRAR
3. Fri, 07 Dec 2018 14:34:10 GMT
   Barbara Peskin (bpeskin): for Dept 18
4. Fri, 07 Dec 2018 19:01:42 GMT
   Lisa Bella (isabell): for Dept 6
5. Fri, 11 Jan 2019 15:42:16 GMT
   Sarah Smith (ssmith1): for Dept 1

New Program Proposal

Date Submitted:Mon, 03 Dec 2018 15:44:15 GMT

Viewing:SB-22-ENG : Bachelor of Science in Engineering as Recommended by the Department of Nuclear Science and Engineering (Course 22-ENG)

Last edit:Mon, 04 Mar 2019 20:12:03 GMT

Changes proposed by: brandyb

Is this a substantial revision?

No

Sponsor(s)/Author(s)

Name	E-mail	Phone
Brandy Baker	brandyb@mit.edu	617-253-3814

Name	E-mail	Phone
Mike Short	hereiam@mit.edu	617-347-7763
Dennis Whyte	whyte@psfc.mit.edu	617-253-1748

Effective Catalog
2019 - 2020

Academic Level
Undergraduate

Program Type
Degree

Degree
Bachelor of Science (SB)

Name of Program
Bachelor of Science in Engineering as Recommended by the Department of Nuclear Science and Engineering (Course 22-ENG)

Name for Diploma
Bachelor of Science in Engineering as Recommended by the Department of Nuclear Science and Engineering

Administrative Department
Nuclear Science and Engineering (22)

Is this program Interdisciplinary?

No

Course Designation
22-ENG

Is this a program that is or will be accredited?

No

Explain the educational rationale for the program and its context with respect to the evolving intellectual trends in the relevant field(s). Identify any alternatives you may have considered and how they measured up to your educational objectives.

This new curriculum will allow students to select an area of focus within the broad realm of nuclear engineering applications that our regular program is not flexible enough to offer. There has been a notable trend across departments toward flexible degree programs, in order to meet the demands of students who are interested in careers outside of traditional nuclear industry jobs, including nuclear medicine, clean energy technologies, fusion, quantum engineering, and modeling/simulation to name a few. We have students who do research in our labs, but are not students in our department because our Course 22 degree does not offer them the flexibility to pursue their research interests and career goals. We hope that offering a flexible option will draw more students into our department as majors, and will allow students to pursue a wider range of careers.

Describe the professional demand for this program and your general expectations regarding student enrollment in each of its first five years of operation.

We believe that our program will benefit students looking for interdisciplinary careers, including energy or nuclear policy, nuclear medicine, the replacement of fossil fuels with clean energy systems, fusion and plasma science, modeling and simulation, and the design and development of innovative technologies with a base in nuclear science and engineering (some examples from our department include satellite technology, novel power systems, medical technologies, and extra-strong concrete made from irradiated

recycled plastic). We are hoping to have a significant increase in our student enrollment (in the major and most especially in our classes) after we advertise the new program.

Identify any existing MIT programs whose enrollment could potentially be affected by the availability of this program. Describe the consultation process you have followed in reaching out to the departments or academic units and faculty responsible for these programs. How is this proposed program unique from these other programs?

Course 22 might experience a shift from the regular major to the flex major. We expect we may get more double majors, which should not have a negative impact on the partner programs. Our program is very small, and we don't expect that even doubling the size of our undergraduate population will have a significant impact on other departments. That said, we have reached out to Course 2 and 8, who are most likely to be impacted, so that they can review our new degree program and give us feedback, allow us to address any concerns, or give us the opportunity to further build on our partnerships with these departments. Our flexible major requires students to submit a plan for approval, which must relate broadly to the nuclear field, so we will not be duplicating the efforts of other departments.

Additional resources needed to implement this proposal and plans for confirming such resources, including any indirect effects on existing programs.

Resource categories:
None

Describe the program, including its structure and coherence, its educational objectives, and any other relevant aspects of the overall educational experience. If the sponsoring entity does not currently offer this type of program (degree or minor), include the rationale for establishing a program within the unit.

The new flexible degree major is based upon the structure of other flex majors at MIT, notable Course 8 and 2A. Our faculty have selected a set of core subjects, consistent with our current regular degree program, and removed the subjects that teach specific areas of knowledge that are specialties within the department, but not essential to more interdisciplinary studies like nuclear medicine or energy systems, or more specialized studies like fusion. Our educational objectives will be the same as our regular major, simply with a larger emphasis on allowing students the flexibility to specialize in an area not currently supported by our regular degree program.

The department's undergraduate programs (Course 22 and Course 22-ENG) offer a strong foundation in science-based engineering, providing the skills and knowledge for a broad range of careers, with an emphasis on hands-on exploration of the subject matter. The programs develop scientific and engineering fundamentals in the production, interactions, measurement, and control of radiation arising from nuclear processes. In addition, the programs introduce students to thermal-fluid engineering, and computational methods. Building upon these fundamentals, students understand the principles, design, and appropriate application of nuclear-based or nuclear-related systems that have broad societal impacts in energy, human health, and security—for example, reactors, imaging systems, detectors, and plasma confinement. In addition, they develop professional skills in quantitative research, written and oral technical communication, team building, and leadership. The program provides excellent preparation for subsequent graduate education and research in a broad range of fields. In the nuclear field, there is high demand for nuclear engineers around the world as the nuclear energy industry continues to expand. Other nuclear and radiation applications are increasingly important in medicine, industry, and government.

A characteristic of the curriculum is the development of practical skills through hands-on education. This is accomplished through a laboratory subject on radiation physics, measurement, and protection (22.09 Principles of Nuclear Radiation Measurement and Protection), and through the laboratory components and exercises of the electronics (22.071 Electronics, Signals, and Measurement), ionizing radiation, and computational subjects. Even foundational courses in nuclear unit processes (22.01 Introduction to Nuclear Engineering and Ionizing Radiation) and neutronics (22.05 Neutron Science and Reactor Physics) include hands-on activities and analyses of real objects/systems. Examples include burning 1,000 bananas to measure their radioactivity, predicting and measuring the criticality of a six-foot graphite/uranium pile, and

analyzing trace impurities in various foods, minerals, or even toenails in our nuclear reactor. The concept of hands-on learning is continued with a 15-unit design subject focusing on nuclear-centric design and prototyping, and/or a 12-unit undergraduate thesis that is normally organized between the student and a faculty member of the department. Thesis subjects can touch on any area of nuclear science and engineering, including nuclear energy applications (fission and fusion) and nuclear science and technology (medical, physical, chemical, security, and materials applications).

Does this proposal include any non-residential components?

No

Please describe how any new or revised subjects impact this proposal.

No new or revised subjects - all subjects are already part of the Course 22 degree program.

Does the program include any required or recommended subjects that are offered by other departments?

Yes

List any required or recommended subjects in this program that are offered by other departments. Describe the consultations that have taken place with the department responsible for each subject and the conclusions that have been reached regarding potential impact on enrollments.

Department Code	Subject(s)	Consultations undertaken	Potential impact on enrollments	Rationale
2	2.005	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	fundamental NSE subject for foundational knowledge in heat transfer, fluid flow, thermodynamics, used heavily in nuclear systems design courses (22.06, 22.033)
18	18.03 or 18.034	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	fundamental NSE subject for foundational knowledge in differential equations, used in almost all NSE advanced undergraduate subjects (22.01, 22.09)
18	18.04	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Mathematics elective.
18	18.05	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Mathematics elective.

Department Code	Subject(s)	Consultations undertaken	Potential impact on enrollments	Rationale
18	18.0751	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Mathematics elective.
18	18.600	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Mathematics elective.
6	6.0001 + 6.0002	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Computation elective
6	6.041	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Computation elective
2	2.086	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Computation elective
1	1.000	Already part of the existing major's requirements.	A slight enrollment increase, no different from an increase in the number of majors in the regular degree program.	Computation elective

If there are proposed subjects in this program offered by other departments, describe the consultations that have taken place with the department responsible for each subject and the conclusions that have been reached regarding potential impact on enrollments.

For the subjects listed above, describe the resource implications for those units. Summarize how these resource issues will be addressed, and describe the consultation process you followed with the departments and faculty who are responsible for these subjects.

No change.

Based on current policy, students may not pursue a second major in the same area as their primary major. Specify any majors that will be disallowed for students to combine as a double major with this program.

Course 22 (and vice versa)

Based on current policy, students may not pursue a minor in the same area as their major(s). Specify any minors that will be disallowed for students who pursue this major.

Course 22 minor

Degree Chart (published in Catalog)

General Institute Requirements (GIRs)

The General Institute Requirements include a Communication Requirement that is integrated into both the HASS Requirement and the requirements of each major; see details below.

Summary of Subject Requirements	Subjects
Science Requirement	6
Humanities, Arts, and Social Sciences (HASS) Requirement [can be satisfied by 22.04[J] in the Departmental Program]; at least two of these subjects must be designated as communication-intensive (CI-H) to fulfill the Communication Requirement.	8
Restricted Electives in Science and Technology (REST) Requirement [can be satisfied from among 1.00, 2.086, 6.0001/6.0002, 18.03, 18.05, 18.600, and 22.01 in the Departmental Program]	2
Laboratory Requirement (12 units) [can be satisfied by 22.09 in the Departmental Program]	1
Total GIR Subjects Required for SB Degree	**17**

Physical Education Requirement

Swimming requirement, plus four physical education courses for eight points.

Departmental Program

Choose at least two subjects in the major that are designated as communication-intensive (CI-M) to fulfill the Communication Requirement.

Core Requirements		Units
2.005	Thermal-Fluids Engineering I	12
18.03	Differential Equations	12
22.01	Introduction to Nuclear Engineering and Ionizing Radiation	12
22.03	Introduction to Nuclear Design	6
22.04[J]	Social Problems of Nuclear Energy (CI-M)	12
22.09	Principles of Nuclear Radiation Measurement and Protection (CI-M)	12
System Specialization		
22.06	Engineering of Nuclear Systems	12
or 22.061	Fusion Energy	
Computational Elective		
Select one of the following:		12
1.000	Computer Programming for Engineering Applications	
2.086	Numerical Computation for Mechanical Engineers	
6.0001 & 6.0002	Introduction to Computer Science Programming in Python and Introduction to Computational Thinking and Data Science	
12.010	Computational Methods of Scientific Programming	
Mathematics Elective		
Select one of the following:		12
6.041A & 6.041B	Introduction to Probability I and Introduction to Probability II	
18.04	Complex Variables with Applications	
18.05	Introduction to Probability and Statistics	
18.075	Methods for Scientists and Engineers	
18.600	Probability and Random Variables	
Senior Project		

Select one of the following:		15
22.033	Nuclear Systems Design Project	
22.THT	Undergraduate Thesis Tutorial	
& 22.THU	and Undergraduate Thesis(CI-M)	
Focus Area		
A program of 72 units of electives from a proposal of study approved by the department		72
Units in Major		189
Unrestricted Electives		48
Units in Major That Also Satisfy the GIRs		(48)
Total Units Beyond the GIRs Required for SB Degree		189

The units for any subject that counts as one of the 17 GIR subjects cannot also be counted as units required beyond the GIRs.

Program narrative to be published in the Catalog

Undergraduate Study

The department's undergraduate programs offer a strong foundation in science-based engineering, providing the skills and knowledge for a broad range of careers, with an emphasis on hands-on exploration of the subject matter. The programs develop scientific and engineering fundamentals in the production, interactions, measurement, and control of radiation arising from nuclear processes. In addition, the programs introduce students to thermal-fluid engineering, and computational methods. Building upon these fundamentals, students understand the principles, design, and appropriate application of nuclear-based or nuclear-related systems that have broad societal impacts in energy, human health, and security—for example, reactors, imaging systems, detectors, and plasma confinement. In addition, they develop professional skills in quantitative research, written and oral technical communication, team building, and leadership. The program provides excellent preparation for subsequent graduate education and research in a broad range of fields. In the nuclear field, there is high demand for nuclear engineers around the world as the nuclear energy industry continues to expand. Other nuclear and radiation applications are increasingly important in medicine, industry, and government.

A characteristic of the curriculum is the development of practical skills through hands-on education. This is accomplished through a laboratory subject on radiation physics, measurement, and protection (22.09Principles of Nuclear Radiation Measurement and Protection, a departmental requirement), and through the laboratory components and exercises of the electronics (22.071Electronics, Signals, and Measurement, an elective), ionizing radiation, and computational subjects. Even foundational courses in nuclear unit processes (22.01Introduction to Nuclear Engineering and Ionizing Radiation, a departmental requirement) and neutronics (22.05Neutron Science and Reactor Physics, a Course 22 requirement and 22-ENG elective) include hands-on activities and analyses of real objects/systems. Examples include burning 1,000 bananas to measure their radioactivity, predicting and measuring the criticality of a six-foot graphite/uranium pile, and analyzing trace impurities in various foods, minerals, or even toenails in our nuclear reactor. The concept of hands-on learning is continued with a 15-unit design subject focusing on nuclear-centric design and prototyping, and/or a 12-unit undergraduate thesis that is normally organized between the student and a faculty member of the department. Thesis subjects can touch on any area of nuclear science and engineering, including nuclear energy applications (fission and fusion) and nuclear science and technology (medical, physical, chemical, security, and materials applications).

Bachelor of Science in Nuclear Science and Engineering (Course 22)

This degree program prepares students for a broad range of careers, from practical engineering work in nuclear and other energy industries to graduate study in a wide range of technical fields, as well as entrepreneurship, law, medicine, and business. The degree program includes foundational subjects in physics, mathematics, and programming, leading to core subjects in the areas of nuclear energy (fission and fusion), as well as nuclear energy policy, quantum engineering, radiation physics, and product design.

The Course 22 degree program is accredited by the Engineering Accreditation Commission ofABET.

Bachelor of Science in Engineering, as recommended by the Department of Nuclear Science and Engineering (Course 22-ENG)

The 22-ENG degree program is designed to offer flexibility within the context of nuclear science and engineering applications. This program is designed to enable students to pursue a deeper level of understanding in a specific nuclear application or interdisciplinary field related to the nuclear science and engineering core discipline. The degree requirements include core subjects relevant to a broad array of nuclear and related interdisciplinary areas, a specialization subject in energy systems, and a senior project, as well as a focus area consisting of 72 units of additional coursework.

A significant part of the 22-ENG degree program consists of focus area electives chosen by the student to provide in-depth study in a field of the student's choosing. Focus areas should complement a foundation in nuclear science and engineering and General Institute Requirements. Some examples of potential focus areas include nuclear medicine, energy or nuclear policy, fusion energy or plasma science, clean energy technologies, nuclear materials, modeling and simulation of complex systems, and quantum engineering, or an area of study within one of thedepartmental focus areas. Focus areas are not limited to these examples. Advising on students' development of focus areas is available from the Undergraduate Officer or the Academic Office. Students enrolled in the flexible major must submit a proposal to the Academic Office no later than Add Date of the second term in the program, to be reviewed by the Undergraduate Committee.

Combined Bachelor's and Master's Programs

The five-year programs leading to a joint Bachelor of Science in Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Nuclear Science and Engineering, or Physics and a Master of Science in Nuclear Science and Engineering are designed for students who decide relatively early in their undergraduate career that they wish to pursue a graduate degree in nuclear science and engineering. Students must submit their application for this program during the second term of their junior year and be judged to satisfy the graduate admission requirements of the department. The normal expectations of MIT undergraduates for admission to the five-year program are an overall MIT grade point average of at least 4.3, and a strong mathematics, science, and engineering background with GPA of at least 4.0.

The nuclear science and engineering thesis requirements of the two degrees may be satisfied either by completing both an SB thesis and an SM thesis, or by completing an SM thesis and any 12 units of undergraduate credit.

For further information, interested students should contact either their undergraduate department or the Department of Nuclear Science and Engineering.

Identify the core faculty who will be responsible for the development and supervision of the program, including intellectual content, curriculum development, advising, and degree recommendations.

The NSE Undergraduate Committee. Current membership includes: Michael Short, Benoit Forget, R. Scott Kemp, Bilge Yildiz. Advisory members: Dennis Whyte (Department Head), Jacopo Buongiorno (Associate Department Head), Anne White.

Describe the academic and advising infrastructure for the program.

The same as our current degree program – undergraduate advisors will know the program requirements and will be able to advise, also forming the Undergraduate Committee which reviews and evaluates the undergraduate programs.

Summarize any long-term plans for further developing the curriculum and/or expanding student enrollment beyond the initial years of operation.

We intend to further develop our list of sample focus areas, to fully represent the breadth of fields and careers related to nuclear science and engineering. We hope that as we advertise the new program, we will get more students who develop concentrations in novel new areas, which in turn will help us to recruit freshmen from a broader range of interests. We will evaluate the curriculum and enrollments, along with our the Course 22 major, regularly in order to make adjustments if needed.

Questions for Subcommittee of the Communication Requirement (SOCR)

Describe the general content, objectives, and structure of the communication component of the proposed program.

Identical to the Course 22 major. We currently have 3 CI-M subjects, and students will choose at least two.

List the number and title of all the CI-M subjects in the program proposal. If more than two subjects are listed, identify any subjects that are expressly required in the degree program and illustrate the subject options that satisfy the communication portion of the degree program.

Same as the existing Course 22 degree program.

22.04 Social Problems of Nuclear Energy (required)
22.09 Principles of Nuclear Radiation Measurement and Protection (required)
22.ThU Undergraduate Thesis (optional)

Describe how the CI-M program will provide a balance of instruction and practice in oral and written communication across the two-subject sequence.

Identically to the current Course 22 degree program.

If any CI-M subject is offered by another department, attach a letter of support from the head of that department. (For program revisions, letters are only needed for subjects being added to the program.)

Questions for Committee on the Undergraduate Program (CUP)

Identify the core faculty who will be responsible for the day-to-day operation of the program, and of any broader advisory group that may be required to provide ongoing oversight and assure continuity over time.

The NSE Undergraduate Committee. Current membership includes: Michael Short, Benoit Forget, R. Scott Kemp, Bilge Yildiz. Advisory members: Dennis Whyte (Department Head), Jacopo Buongiorno (Associate Department Head), Anne White. The NSE faculty and the Visiting Committee routinely provide broad advising for our educational programs.

Describe the plan to oversee, monitor, and evaluate the program. Interdisciplinary and joint programs must identify a primary academic unit through which the program will be administered. At a minimum, a review must be conducted every five years.

We will evaluate the 22-Flex major alongside the Course 22 major, which we tend to do annually. A more in-depth evaluation is done alternate years, in conjunction with our departmental Visiting Committee evaluation.

Additional information

Attachments

Letters of Support
MechE_support_nseflex.pdf
NSE_DeptHead_DGW_Flex22_support.pdf
NSE_Flex_SOE.pdf
Physics_support_nseflex.pdf
CUP_22F_02282019.pdf
20190227 CoC re Course 22 flex.pdf

Roadmaps
Course 22 Flexible Degree Sample Schedules.pdf

Reviewer Comments
Jennifer Donath (jconnoll) (Mon, 26 Nov 2018 17:40:00 GMT): Rollback: Per department request, returning for additional edits.
Jennifer Donath (jconnoll) (Mon, 04 Mar 2019 19:58:58 GMT): Uploaded letters of approval from the CoC and CUP.
Jennifer Donath (jconnoll) (Mon, 04 Mar 2019 20:13:39 GMT): With authorization from NSE, changed degree code from 22-F to 22-ENG, in keeping with the current standard for coding flexible engineering degrees.

Key: 233

Maria C. Yang
Associate Professor
MacVicar Faculty Fellow
Undergraduate Officer

Massachusetts Institute of Technology
77 Massachusetts Avenue, Building 3-449B
Cambridge, Massachusetts 02139

Department of Mechanical Engineering

Phone 617–324–5592
Fax 617–258–6427
Email mcyang@mit.edu
Web ideation.mit.edu

November 8, 2018

Dear Colleagues,

Course 22 is in the process of putting together a proposal for a new Course 22 Flex degree, based partly on the Course 2A and 8 Flex degree programs. This degree program may impact Course 2A enrollments, though the impact will likely be small and could increase double majors for both departments. The Mechanical Engineering Undergraduate Committee has reviewed this proposal, and Mechanical Engineering fully supports this effort for this new degree.

Sincerely,

Maria C. Yang
Undergraduate Officer
Department of Mechanical Engineering

Dennis Whyte
Hitachi America Professor of Engineering, and Head
Department of Nuclear Science and Engineering
Director, Plasma Science and Fusion Center
Massachusetts Institute of Technology

NSE
Nuclear Science and Engineering
science : systems : society
web.mit.edu/nse/

77 Massachusetts Avenue
Room 24-107
Cambridge, MA 02139
617.253.1748
whyte@mit.edu

November 9, 2018

Committee on Curriculum
MIT

CoC members:

I would like to express my strong endorsement on behalf of the Department of Nuclear Science and Engineering for the new Course 22 flexible degree program. This new education program will allow us to engage with students with a wider range of interests and career goals, which we hope will spur more interest not only for our department, but for the fields utilizing NSE applications across the globe.

This new program was designed to provide the fundamentals needed for any career related to nuclear applications, to expose students to a nuclear energy system, and to provide flexibility for students to delve deeper into a particular nuclear application. We anticipate some of these applications to be in the areas of nuclear medicine, fusion, computation and modeling, clean energy industries, and quantum engineering, to name a few. This new program will allow students ~6 subjects (72 units) in order to customize their degree program to match their career or research interest, particularly for students interested in interdisciplinary fields.

The program was reviewed and supported by the NSE faculty. There is a strong balance here between foundational subjects, the opportunity to explore our curriculum, and the need for flexibility for those areas in which our traditional program simply doesn't have room. We feel that adding this option will strengthen our undergraduate program, adding students with a wide variety of interests and programs into our classes and our community.

I'm delighted to support this exciting new degree program.

Sincerely,

Dennis Whyte

Massachusetts Institute of Technology
Department of Mechanical Engineering
77 Massachusetts Avenue
Cambridge, MA 02139

Anette E. (Peko) Hosoi
Professor of Mechanical Engineering
Room 3-262

Tel 617 253 4337
Fax 617 258 8559
peko@mit.edu

Dear CoC:

November 19. 2018

I am writing on behalf of the School of Engineering to offer our enthusiastic support for the new flexible engineering degree within Nuclear Science and Engineering. This new degree program reflects the changing landscape of education within engineering, as evidenced by the many flexible degree programs already established within the School of Engineering and by NEET. All of these initiatives represent opportunities for students to construct an interdisciplinary curriculum designed to meet their specific career goals. Industry and research are both becoming more interdisciplinary in nature, and programs addressing this need are critical for MIT to stay at the forefront of education in a changing technological landscape.

The Course 22 flexible degree program has sample interdisciplinary studies that would complement, but not replicate, areas in which we do not have an established curriculum at MIT. The Mechanical Engineering and Physics Departments have both endorsed the new degree program, both of which have vibrant flexible degree programs of their own. The addition of this new major can only strengthen the connections between intellectual disciplines for our students.

The example focus areas in the proposal – fusion, nuclear medicine, policy and economics – are all intellectually exciting and tied to urgent societal needs; we are thrilled to see NSE bringing these vital topics and opportunities to our students. In short, we whole-heartedly support this new degree program and thank you for your careful consideration.

Sincerely,

Anette Hosoi
Associate Dean of Engineering
Neil and Jane Pappalardo Professor of Mechanical Engineering

Subject: Letter of support for proposed 22-Flex program
Date: Monday, December 3, 2018 at 10:29:56 AM Eastern Standard Time
From: Catherine A Modica
To: Brandy J Baker
CC: Nergis Mavalvala

Dear Brandy,

I send the letter below on behalf of Physics Associate Head Nergis Mavalvala.

Regards,
Cathy

Catherine Modica
Academic Administrator
MIT Physics
4-315
617 253-4842

To the Committee on Curriculum:

The Physics Department writes in support of the plan by the Department of Nuclear Science and Engineering to add a Flexible major for its undergraduates. Our experience with our own "Physics Flex" major has been a very positive one.

Since the time of its inception in 2001, the Physics Flex major has been a key factor in the growth in the number of our majors overall, and the growth in the number of our double majors (including a good number from Course 22). Students have been able to take advantage of the "focus group" aspect of the Flex major to put together a concentration of Physics and others subjects that are of particular interest to them, giving them the chance to develop a sense of mastery in a sub-area. That these subjects can be those of other departments further enables double-majoring, which is very popular with students.

While the Flex program remains sufficiently rigorous to prepare any Physics major for graduate school, it also has served the needs of the growing number of students who are not necessarily planning to enter academia. This too has been a factor in the growth of our majors.

We believe that these benefits -- an enhanced ability to double major, and the opportunity to pursue areas of particular interest – will accrue to Course 22 through its proposed Flex program, and we wish them every success with it.

Regards,

Nergis Mavalvala
Curtis and Kathleen Marble Professor of Astrophysics
Associate Head, Department of Physics

Duane S. Boning, Chair
Committee on the Undergraduate Program (CUP)

Massachusetts Institute of Technology
77 Massachusetts Avenue, Building 5-133
Cambridge, Massachusetts 02139–4307

February 28, 2019

Professor Mike Short
Professor Dennis Whyte
MIT

Dear Proposal Sponsors,

Thank you for your offer to speak with the Committee on the Undergraduate Program (CUP) about your proposal for a new flexible degree *Bachelor of Science in Engineering as Recommended by the Department of Nuclear Science and Engineering* (22-F). As Chair of the committee, I have reviewed the proposal and the MIT Faculty governance G*uidelines for the Approval of New Undergraduate Degree Programs*, and have determined that a full Committee review is unnecessary. There is precedent for the structure of the proposed 22-F curriculum, administration, and advising. Additionally, we have not been made aware of any related policy questions that have arisen during other committee discussions.

I would like to share some feedback based on previous discussions of flexible majors and minors. The Committee understands that well-defined published tracks are very helpful for and attractive to students in flexible programs. We recommend that you consider developing a concrete definition with examples of subjects that can be used for illustrative and advising purposes for each of the identified potential focus areas, if you have not already done so.

The CUP is available to engage in a full discussion of this new program should any policy questions arise. Please let me know if you have any questions.

Sincerely,

Duane S. Boning
Clarence J. LeBel Professor of Electrical Engineering
and Chair of the CUP

cc: Course 22 (B. Baker)
CoC (D. Vogan, P. Walcott, J. Donath)
FPC (S. Silbey, T. Kaplan)
SOCR (C. Kaiser, R. Williams, K. MacArthur)
SOE (P. Hosoi)

Massachusetts Institute of Technology

Committee on Curricula
Building 5-115

77 Massachusetts Avenue
Cambridge, Massachusetts
02139–4307

Phone 617.258.6435
Fax 617.253.7459

February 27, 2019

Associate Professor Michael Short
Nuclear Science and Engineering
24-204

Dear Michael,

The Committee on Curricula (CoC) reviewed the proposal to establish a new flexible SB program in Engineering as Recommended by the Department of Nuclear Science and Engineering at its meeting on December 11, 2018. Thank you for your patience in awaiting a response. The Committee is very supportive of the proposed curriculum; however, the proposed Course designation of 22-F required further consideration.

When the 16-ENG program was approved in 2010, the School of Engineering planned to standardize the designations by which its new flexible programs are known (*XX-ENG*). Subsequent flexible programs were approved using the established convention in Civil and Environmental Engineering (1-ENG) and Chemical Engineering (10-ENG). The curriculum in Engineering and across the five Schools has evolved significantly in recent years with a proliferation of flexible programs, both in the form of new majors—departmental and joint—and revisions to existing majors. The Registrar's Office is currently conducting an analysis of degree types and designation codes to determine whether there are more appropriate and consistent ways to define MIT's undergraduate and graduate degrees. Any resulting recommendations will be submitted to Faculty governance for consideration. While this process is pending, the CoC will not approve a new Course designation convention (*XX-F*). The Committee believes this degree should follow the established flexible engineering convention and is prepared to endorse your proposal contingent on revision of the Course designation to 22-ENG.

By copy of this letter, I am conveying the Committee's provisional approval to the Faculty Policy Committee (FPC) and the Subcommittee on the Communication Requirement (SOCR).

On behalf of the CoC, I wish to thank you for developing such a thorough proposal. Please do not hesitate to get in touch with me if you have any questions about the Committee's feedback. Best wishes for success as you move the proposal forward.

Sincerely,

David A. Vogan Jr.

David Vogan, Chair
Committee on Curricula

cc: Dean Anantha Chandrakasan
Professor Dennis Whyte, Head, Course 22
Brandy Baker, Academic Administrator, Course 22
CUP (D. Boning, G. Filiault)
FPC (S. Silbey, T. Kaplan)
SOCR (C. Kaiser, R. Williams, K. MacArthur)

Course 22 Flexible Degree
Mainstream Sample Schedule

	Fall					***Spring***			
	Subject #	*Title*	*Units*	*GIR*		*Subject #*	*Title*	*Units*	*GIR*
First Year		Physics I	12	Physics			Physics II	12	Physics
		Calculus I	12	Calc			Calculus II	12	Calc
		Chem or Bio	12	Chem/Bio			unrestricted elective	12	
		HASS CI-H	12	HASS CI-H			HASS	12	HASS
			48					48	
Sophomore	18.03	Differential Equations	12	REST		22.06 or 22.061	Fission or Fusion	12	
Year		Chem or Bio	12	Chem/Bio		2.005	Thermal Fluids	12	
	22.01	Intro to Nuclear	12	REST		math	math restricted elective	12	
	22.03	Design Thinking	6			HASS	HASS CI-H	12	HASS CI-H
	HASS	HASS	12	HASS					
			54					48	
Junior	22.09	Radiation Measurement & Protection	12	LAB, CI-M		Focus Area	Flexible degree subject within the area of focus	12	
Year	computing	computation restricted elective	12			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			elective	unrestricted elective	12	
	HASS	HASS	12	HASS		22.04 (HASS)	Social Problems of Nuclear Energy	12	HASS-S, CI-M
			48					48	
Senior	Focus Area	Flexible degree subject within the area of focus	12			Focus Area	Flexible degree subject within the area of focus	12	
Year	Focus Area	Flexible degree subject within the area of focus	12			elective	unrestricted elective	12	
	22.033*	Nuclear Systems Design Project	15			elective	unrestricted elective	12	
	HASS	HASS	12	HASS		HASS	HASS	12	HASS
			51					48	

Notes: Math and computation electives can be swapped, or shifted earlier if 18.03 is taken in the First Year. NSE Restricted Electives - related graduate subjects can be petitioned. Calc I & II, Physics I & II, Chem & Bio should be completed by the end of Sophomore year.

* Students can choose between 22.033 in Fall, or 22.ThT Thesis Preparation (3 units) in Fall + 12 units of 22.ThU (Undergraduate Thesis) at any time during senior year.

Key

Institute Requirements

NSE Core Subjects

Student Selected Focus

Course 22 Flexible Degree
Sophomore Year Late Entry Sample Schedule

	Fall					***Spring***			
	Subject #	*Title*	*Units*	*GIR*		*Subject #*	*Title*	*Units*	*GIR*
First Year		Physics I	12	Physics			Physics II	12	Physics
		Calculus I	12	Calc			Calculus II	12	Calc
		Chem or Bio	12	Chem/Bio			unrestricted elective	12	
		HASS CI-H	12	HASS CI-H			HASS	12	HASS
			48					48	
Sophomore	elective	unrestricted elective	12			18.03	Differential Equations	12	REST
Year		Chem or Bio	12	Chem/Bio		2.005	Thermal Fluids	12	
	elective	unrestricted elective	12			math	math restricted elective	12	
	HASS	HASS	12			HASS	HASS CI-H	12	HASS CI-H
			48					48	
Junior	22.01	Intro to Nuclear	12	REST					
Year	22.03	Design Thinking	6			22.06 or 22.061	Fission or Fusion	12	
	computing	computation restricted elective	12			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			elective	unrestricted elective	12	
	HASS	HASS	12	HASS		22.04 (HASS)	Social Problems of Nuclear Energy	12	HASS-S, CI-M
			54					48	
Senior	22.09	Radiation Measurement & Protection	12	LAB, CI-M		22.ThU*	Undergraduate Thesis	12	
Year	22.ThT*	Undergraduate Thesis Tutorial	3			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			HASS	HASS	12	HASS
	HASS	HASS	12	HASS					
			51					48	

Notes: Math and computation electives can be swapped, or shifted earlier if 18.03 is taken in the First Year. NSE Restricted Electives - related graduate subjects can be petitioned. Calc I & II, Physics I & II, Chem & Bio should be completed by the end of Sophomore year.

* Students can choose between 22.033 in Fall, or 22.ThT Thesis Preparation (3 units) in Fall + 12 units of 22.ThU (Undergraduate Thesis) at any time during senior year.

Key

Institute Requirements

NSE Core Subjects

Student Selected Focus

Course 22 Flexible Degree
Junior Year Late Entry Sample Schedule

	Fall					*Spring*			
	Subject #	*Title*	*Units*	*GIR*		*Subject #*	*Title*	*Units*	*GIR*
First Year		Physics I	12	Physics			Physics II	12	Physics
		Calculus I	12	Calc			Calculus II	12	Calc
		Chem or Bio	12	Chem/Bio			unrestricted elective	12	
		HASS CI-H	12	HASS CI-H			HASS	12	HASS
			48					48	
Sophomore	elective	unrestricted elective	12			18.03	Differential Equations	12	REST
Year		Chem or Bio	12	Chem/Bio		elective	unrestricted elective	12	
	elective	unrestricted elective	12			Focus Area	Flexible degree subject within the area of focus	12	
	HASS	HASS	12			HASS	HASS CI-H	12	HASS CI-H
			48					48	
Junior	22.01	Intro to Nuclear	12	REST					
Year	22.03	Design Thinking	6			22.06 or 22.061	Fission or Fusion	12	
	computing	computation restricted elective	12			math	math restricted elective	12	
	2.005	Thermal Fluids	12			Focus Area	Flexible degree subject within the area of focus	12	
	HASS	HASS	12	HASS		22.04 (HASS)	Social Problems of Nuclear Energy	12	HASS-S, CI-M
			54					48	
Senior	22.09	Radiation Measurement & Protection	12	LAB, CI-M		22.ThU*	Undergraduate Thesis	12	
Year	22.ThT*	Undergraduate Thesis Tutorial	3			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			Focus Area	Flexible degree subject within the area of focus	12	
	Focus Area	Flexible degree subject within the area of focus	12			HASS	HASS	12	HASS
	HASS	HASS	12	HASS					
			51					48	

Notes: Math and computation electives can be swapped, or shifted earlier if 18.03 is taken in the First Year. NSE Restricted Electives - related graduate subjects can be petitioned. Calc I & II, Physics I & II, Chem & Bio should be completed by the end of Sophomore year.

* Students can choose between 22.033 in Fall, or 22.ThT Thesis Preparation (3 units) in Fall + 12 units of 22.ThU (Undergraduate Thesis) at any time during senior year.

Key

Institute Requirements

NSE Core Subjects

Student Selected Focus