Course Bulletin

103583	Chemical Process Principles			
Subject:	Catalog Nbr:			
CHBE	0010			
2017 FALL	Primary	James Van Deventer	James.Van_Deventer@tufts.edu	
Introduction to chemical and biological process calculations emphasizing unit operations, process stoichiometry, material and energy balances, states of matter, and continuous steady state and transient processes. Introduction to computational tools for process engineering calculations.				

103643	Chemical Engineering Thermodynamics			
Subject:	Catalog Nbr:			
CHBE	0011			
2018 SPRG	Primary	Matthew Panzer	Matthew.Panzer@tufts.edu	
Thermodynamic concepts - first and second laws, heat, work, energy, entropy, equilibrium, reversibility, equations of state - are introduced in process contexts. Phase equilibria, chemical potential, fugacity, and colligative properties are also discussed.				

103699	Transport Phenomena I			
Subject:	Catalog Nbr:			
CHBE	0021			
2018 SPRG	Primary	Nikhil Nair	Nikhil.Nair@tufts.edu	
Fundamentals of fluid mechanics and their applications to the design and understanding of flow phenomena in industrial and biological processes. Analysis and design of steady-state and non-steady-state heat conduction and convective heat transfer in industrial and biological processes.				

103757	Transport Phenomena II			
Subject:	Catalog Nbr:			
CHBE	0022			
2018 FALL	Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu	
2018 SPRG	Primary	Derek Mess	Derek.Mess@tufts.edu	
Principles of heat and mass transfer. Steady-state conduction and diffusion processes. Convective transport of heat and mass in laminar and turbulent flows in conduits and over various surfaces. Applications to design of heat exchangers. Natural convection. Combined heat and mass transfer applications. Recommendations: CHBE 10, 11; MATH 42 (formerly MATH 13).				

103906	Applied Numerical Methods For Chemical & Biological Engineering			
Subject:	Catalog Nbr:			
CHBE	0039			
2018 FALL	Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu	
Numerical analysis methods and their implementation using commercially available software are reviewed.				

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Scientific programming methodology. Application of commercial process simulation software to the analysis of chemical and biological process models.

103945	Chemical And Biological Separations
Subject: CHBE	Catalog Nbr: 0045
2018 FALL	Primary Ayse Asatekin Ayse.Asatekin@tufts.edu
Design and analysis of separation processes. Equilibrum-stage processes, stagewise separation processes, mass transfer operations, and rate-controlled separations. Fundamental study of distillation, extraction, adsorption, membrane separation, and precipitation & crystallization processes. Pre-Requisite: CHBE 22	

103965	Chemical And Biological Engineering Laboratory
Subject: CHBE	Catalog Nbr: 0051
2018 FALL	Primary Derek Mess Derek.Mess@tufts.edu
Laboratory experiments related to fundamental concepts characterizing chemical and biological systems and processes. Experience is gained in planning and executing the experiments and critically analyzing the collected data to achieve a deeper understanding of the underlying concepts. Oral presentations and written reports are an integral part of this laboratory course.	

103986	Chemical And Biological Engineering Laboratory
Subject: CHBE	Catalog Nbr: 0052
2018 SPRG	Primary Derek Mess Derek.Mess@tufts.edu
Open-ended laboratory projects in an area of applied and industrial interest of chemical and biological engineering. Students work in groups and choose one project for the whole term. They are asked to not only analyze the results of a given experiment but also decide what are the important experiments to perform as part of their overall plan to bring their project to a successful conclusion Oral presentations and written reports are an integral part of this laboratory course.	

104016	Various Topics In Computer Science
Subject: COMP	Catalog Nbr: 0009
Please see departmental website for detailed information. Recommendations: A sincere interest in learning more about computer science and no prior programming experience.	

104031	Product & Process Design

Course Bulletin

Subject:	Catalog Nbr:			
CHBE	0060			
	2018 SPRG	Primary	Daniel Ryder	daniel.ryder@tufts.edu

This is a capstone design course covering the principles of design and economic evaluation through the preliminary design of a commercial project related to a product or a process. Working in groups on assigned or selected portions of the overall project , students are required to make integrated use of a wide variety of fundamentals and principles gained from previous courses. Computational laboratories are supplemented by lectures. Use of design software.

104049 **Molecular Biotechnology**

Subject:	Catalog Nbr:			
CHBE	0062			
	2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu
	2018 SPRG	Primary	Niall Lennon	No Email on file.
	2018 SUMR	Primary	Dana Cairns	Dana.Cairns@tufts.edu
	2018 SUMR	Primary	Nina Dinjaski	Nina.Dinjaski@tufts.edu

(Cross-listed as BIO 62 and BME 62.) Overview of key aspects of molecular biology and engineering aspects of biotechnology. Lecture topics include molecular biology, recombinant DNA techniques, immunology, cell biology, protein purification, fermentation, cell culture, combinatorial methods, and bioinformatics. (May be taken at 100 level.)
Recommendations: CHEM 1, BIO 13, or permission of instructor.

104066 **Independent Study**

Subject:	Catalog Nbr:
CHBE	0093

Guided Individual study of an approved topic. Designed to develop self- teaching skills of the advanced undergraduate. Appraisal of the student's knowledge in the chosen topic based on written and and/ or oral examination. Please see departmental website for specific details.
Recommendations: Permission of department .

104086 **Independent Study**

Subject:	Catalog Nbr:			
CHBE	0094			
	2018 SPRG	Primary	Derek Mess	Derek.Mess@tufts.edu

Guided individual study of an approved topic. Designed to develop self-teaching skills of the advanced undergraduate. Appraisal of the student's knowledge in the chosen topic based on written and/or oral examination. Prerequisite: consent of the department. Please see departmental website for specific details.

104132 **Undergraduate Research**

Subject:	Catalog Nbr:

Course Bulletin

CHBE	0095			
2017 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu
2018 SPRG		Primary	Darryl Williams	No Email on file.

Preparation of a report based on personal research, design, or experiment.Please see departmental website for specific details.

104192	**Honors Thesis Research A**

Subject:	Catalog Nbr:			
CHBE	0096			
2017 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

Supervised research in chemical and biological engineering leading to the completion of the undergraduate honors thesis. Please see the Departmental website for specific program details and qualification requirements.

104248	**Internship In Chemical & Biological Engineering**

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Subject:	Catalog Nbr:			
CHBE	0099			
	2017 SUMR	Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
	2018 SUMR	Primary	James Van Deventer	James.Van_Deventer@tufts.edu

A mentored professional experience in engineering at an off-site organization. The internship must conform to all the requirements of the School of Engineering Internship Program. The department will grant course credit for internships if all of the following conditions are met: 1) The project is approved in advance by the department, 2) a faculty mentor has supervisory and technical control of any work that receives credit, and 3) a written report is submitted that is evaluated by the faculty adviser and the outside institutional supervisor.
Recommendations: Junior or senior standing.

104290	**Reactor Design**

Subject:	Catalog Nbr:			
CHBE	0102			
	2018 SPRG	Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
	2018 SPRG	Primary	Simon Steel	Simon.Steel@tufts.edu

Treatment of chemical reaction equilibrium and kinetic fundamentals and application of them to the design of reactors. Topics include interpretation of reaction-rate data, establishment of reaction mechanism and rate-controlling steps, sizing, and optimization of reactors. Use of personal computer software is encouraged.

104334	**Separation Processes**

Subject:	Catalog Nbr:
CHBE	0104

Material on mass-transfer separation processes beyond that covered by the undergraduate unit operations course. Computational techniques employing digital computers are emphasized.
Recommendations: CHBE 45

104353	**Membrane Separation Processes**

Subject:	Catalog Nbr:
CHBE	0107

Fundamentals of liquid/solid, liquid mixture, and gas mixture separations using synthetic membranes. Processes include microfiltration, ultrafiltration, reverse osmosis, electrodialysis, and gas permeation, with applications to industrial process streams, bioprocessing, water purification, and hazardous waste control; also novel membrane reactors and membrane extraction. Emphasis on application of mass transfer and fluid flow principles; also process configuration selection, to design and scale-up.
Recommendations: CHBE 45.

104372	**Various Topics In Computer Science**

Subject:	Catalog Nbr:
COMP	0010

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	2018 SPRG	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
Please see departmental website for detailed information.				

104399	Process Dynamics And Control			
Subject:	Catalog Nbr:			
CHBE	0109			
	2017 FALL	Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
	2018 FALL	Primary	Daniel Ryder	daniel.ryder@tufts.edu
Mathematical modeling of chemical processes with ordinary differential equations. Feedback, feedforward, and environmental control. Block diagrams. Laplace transformation. Linearization techniques. Frequency response. Laboratory exposure to instrumentation.				

104420	Introduction Optimization
Subject:	Catalog Nbr:
CHBE	0110
Intorduction to fundamental method of optimization with application to problems related to chemical and biological systems and processes; nature of optimization problem; one-dimensional and multivaribale unconstrianed optimization; linear programming; non-linear programming with constriants; mixed-integer programming; selected applications.	

104459	Thermal-fluid Transport I			
Subject:	Catalog Nbr:			
CHBE	0111			
	2017 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
	2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
(Cross-listed as ME 111). Advanced topics in fluid mechanics. Viscous and inviscid flows. Strain rate, vorticity and streamline coordinates. Differential conservation laws for mass, momentum and energy. Dimensional analysis. Lubrication flows. Momentum and thermal laminar boundary layers. Laminar-turbulent transition. Reynolds stress and turbulence modeling. Turbulent boundary layers. Flow modeling. Recommendations: ES 8 - Fluid Mechanics or permission of instructor.				

104481	Thermal-fluid Transport II			
Subject:	Catalog Nbr:			
CHBE	0112			
	2018 SPRG	Primary	Marc Hodes	Marc.Hodes@tufts.edu
(Cross-listed as ME 112). Multi-dimensional conduction. Transient conduction including moving boundary problems. External forced and natural convection. Internal forced and natural convection. Developing flows and transition to turbulence. Condensation and boiling heat transfer. Radiation and conjugate heat transfer involving radiation. Temperature and heat flux measurements. Numerical techniques. Recommendations: ME 111 Thermal-Fluid Transport I or equivalent.				

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104507	Introduction To Computer Science

Subject:	Catalog Nbr:			
COMP	0011			
2017 FALL		Primary	Megan Monroe	Megan.Monroe@tufts.edu
2017 SUMR		Primary	Michael Shah	No Email on file.
2018 FALL		Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL		Primary	Elena Strange	Elena.Strange@tufts.edu
2019 SPRG		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu

The study of computer science centers on two complementary aspects of the discipline. First, computer science is fundamentally concerned with the problem-solving methodologies it derives from its foundational fields: the design principles of engineering, mathematical theory, and scientific empirical study. Second, these methodologies are applied in the complex context of a modern day computing system. In this course we will address both of these important aspects. As a means for developing your design skills, we will discuss the fundamental features of a high level, general purpose programming language — namely C++ — and learn how to use it as a tool for problem solving. We will also consider the performance of solutions, and how to apply both analytical and empirical assessment techniques. Finally, we will explore the Unix operating system as a context for problem solving. (Additional weekly lab time scheduled at first class meeting.)
Recommendations: High school algebra. No prior programming experience is necessary.

104569	Principles Of Polymerization

Subject:	Catalog Nbr:			
CHBE	0121			
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu

Synthesis of polymeric materials. Three major types of polymerization--step, chain, and ring-opening--are reviewed with emphasis on reaction mechanisms, kinetics, and thermodynamics of the reactions, and their relationships to molecular weight and molecular structures of macromolecules.
Recommendations: Physical and organic chemistry

104592	Physical Chemistry Of Polymers

Subject:	Catalog Nbr:			
CHBE	0122			
2018 SPRG		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu

Physicochemical properties of polymeric materials with emphasis on the relationship between molecular architecture and physical properties. Topics include polymer solution theories, thermal transitions, conformational analysis, polymer microstructure, crystallinity and morphology, the rubbery and glassy states, rheology, and statistical thermodynamics.
Recommendations: CHBE 11

104621	Data Structures

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Subject:	Catalog Nbr:			
COMP	0015			
2017 FALL		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL		Primary	Matias Korman	Matias.Korman@tufts.edu
2018 SUMR		Primary	Partha Biswas	Partha.Biswas@tufts.edu
2019 SPRG		Primary	Elena Strange	Elena.Strange@tufts.edu

A second course in computer science. Data structures and algorithms are studied through major programming projects. Topics include linked lists, trees, graphs, dynamic storage allocation, and recursion.
Recommendations: COMP 11 or permission of Instructor.

104635	Air Pollution Control

Subject:	Catalog Nbr:
CHBE	0136

(Cross-listed as CHBE136.) A study of health and environmental effects from air pollution, dispersion modeling, air pollution laws and regulations, fate and transport of air pollution, and design of pollution control equipment and processes. Recommendations: (ES 8 & CEE 32) or CHBE 22

104656	Hazardous Waste Treatment Technologies

Subject:	Catalog Nbr:			
CHBE	0138			
2017 FALL		Primary	Larry Cohen	No Email on file.

(Cross-listed as CEE 138.) Hazardous waste treatment options based on physical, chemical, biological, and thermal processing technologies. Brief review of definitions and appropriate hazardous waste legislation. Introduction to pollution prevention. Traditional end-of-pipe treatment technologies. Applications to include solvent recovery, chemical fixation, land disposal, biodegradation, and special wastes. Incineration and associated environmental discharges constitute a major portion of course. Emerging technologies and evaluation of technical/economic process viability.
Recommendations: Senior standing or consent of instructor.

104659	Web Programming

Subject:	Catalog Nbr:			
COMP	0020			
2019 SPRG		Primary	Ming Chow	ming.chow@tufts.edu

An introduction to techniques, principles, and practices of writing computer programs for the World Wide Web. Server and browser capabilities and limits. Media types, handlers, and limitations. Web programming languages and techniques. Web security, privacy, and commerce. Lectures augmented with programming projects illustrating concepts and current practice.

104678	Surface And Colloid Chemistry

Subject:	Catalog Nbr:

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CHBE	0140			
2018 SPRG		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu

Emphasis on fundamental concepts: attractive and repulsive forces between particles in a dispersion; stabilization and flocculation of a dispersion, electrokinetic phenomena; surfactants; contact angle and wetting; phenomena at curved interfaces; capillarity; rheology of suspensions; drying of coatings; emulsions. For students in chemical engineering and other disciplines in which surface chemistry plays an important role.
Prerequisites: CHBE 21 and CHEM 31

104699	**Biochemical Engineering**			
Subject:	Catalog Nbr:			
CHBE	0160			
2018 FALL		Primary	Gautham Sridharan	Gautham.Sridharan@tufts.edu

Thermodynamics of biological reactions, principles of fermentation processes, and chemical engineering applications to bioreactor analysis are studied.
Recommendations: CHBE 102.

104720	**Game Development**
Subject:	Catalog Nbr:
COMP	0023

Principles, design, and development of games. Game structure, engineering, physics, testing, 2D and 3D rendering, user interfaces, sound, and animation. Security of online games. Applications of Economics, Music, and Psychology in crafting games. Projects include writing game design documents, developing an interactive fiction game, and building a functional game in a team.
Recommendations: COMP15.

104760	**Protein Purification**			
Subject:	Catalog Nbr:			
CHBE	0161			
2018 SPRG		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu

Methods of purifying proteins at a large scale for therapeutic or industrial uses. Focus on unit operations found in a typical process flowsheet including centrifugation, membrane filtration, most modes of chromatography, and lyophilization. Topics include introduction to protein chemistry and analytical methods, effects of production host choice, and protein stability. Process economics, GMP operations and validation, and case studies of biotechnology industry separations.

104783	**Molecular Biotechnology**			
Subject:	Catalog Nbr:			
CHBE	0162			
2018 SPRG		Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG		Primary	Niall Lennon	No Email on file.

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	2018 SUMR	Primary	Dana Cairns	Dana.Cairns@tufts.edu
	2018 SUMR	Primary	Nina Dinjaski	Nina.Dinjaski@tufts.edu

(Cross-listed as BIO 162 and BME162.) Overview of key aspects of molecular biology and engineering aspects of biotechnology. Lecture topics include molecular biology, recombinant DNA techniques, immunology, cell biology, protein purification, fermentation, cell culture, combinatorial methods, and bioinformatics. Includes a semester-long technical project and oral presentation. (Also offered as lower-level.)

104806	**Recombinant Dna Techniques**

Subject:	Catalog Nbr:			
CHBE	0163			
	2018 SUMR	Primary	Wenwen Huang	Wenwen.Huang@tufts.edu
	2018 SUMR	Primary	Zaira Martin Moldes	Zaira.Martin_Moldes@tufts.edu

(Cross-listed as BIO 163 and BME 163.) This lecture and laboratory course is designed to familiarize students with methods used to produce recombinant products. The lectures cover fundamental aspects of recombinant DNA methodologies used in the laboratory as well as some of the commercial applications of these techniques. The laboratory provides hands-on experience with the key skills used in genetic engineering, including DNA isolation, restriction enzyme mapping, cloning and selection, protein expression, gel electrophoresis, polymerase chain reaction, DNA sequencing, and related techniques. Cannot be taken for credit if BIO 50 is taken for credit.
Recommendations: CHBE 21 and 22, or permission of instructor.

104831	**Biomaterials and Regenerative Medicine**

Subject:	Catalog Nbr:			
CHBE	0164			
	2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu
	2018 FALL	Primary	Jonathan Grasman	Jonathan.Grasman@tufts.edu

(Cross-listed as BME 153.) Fundamental concepts of biomaterials and regenerative medicine (biomaterial types, synthesis, properties, mechanisms of degradation, biological interfaces, inflammation and related issues). Specific focus on biomaterials related to regenerative medicine. Course independent of, but complementary to, BME 154. Recommendations: Junior standing, BIO13, CHEM 1, or consent of instructor

104850	**Cell/microbe Cultivation**

Subject:	Catalog Nbr:			
CHBE	0166			
	2018 SPRG	Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu

In-depth examination of microbial and mammalian cell cultivation and concomitant production of commercially important products. Mechanism and methods of measurement and quantitative analysis of growth, product formation, and nutrient utilization kinetics in characterizing and optimizing for cell mass or product formation. Discussion of fundamental parameters controlling bioreactor design and scale-up. Systems studied include production of proteins in recombinant organisms, antibiotics, amino acids, and the cultivation

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of mammalian cells.
Recommendations: Permission of Instructor

104859	Machine Structure & Assembly-language Programming			
Subject:	Catalog Nbr:			
COMP	0040			
2018 FALL		Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2019 SPRG		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu

Structure of machine-level data and code, including memory, cache, registers, machine arithmetic, and bitwise operations. Encapsulating machine functionality through interfaces and abstract data types. Structure of assembly code, relocatable object code, and binary machine code, and the translations between them. Applications of machine-level operations and code translations in programming projects.
Recommendations: COMP 15.

104871	Metabolic&cellular Engin			
Subject:	Catalog Nbr:			
CHBE	0167			
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu

The goal is to present a framework for quantitative analysis of cellular functions, and introduce students to metabolic engineering. Metabolic engineering is a systems-oriented approach to the problem of remodeling and reconfiguring the many molecular components of the cell in order to achieve a desirable phenotype. Unlike molecule-centric approaches, which focus on only the final product-forming reaction, metabolic engineering emphasizes the metabolic pathway in its entirety. Course material analyzes cell-level processes as molecular systems. The processes to be discussed include: metabolism, protein synthesis, and regulation of gene expression. Analyses of these processes will emphasize an engineering, problem solving-oriented perspective, and will be integrated with discussions on core metabolic engineering methods: metabolic modeling, genetic engineering, and analytical biochemistry. Complementary disciplines very recently added to the metabolic engineering toolbox will also be discussed: ¿omics¿ technologies, computational systems biology, and synthetic biology. Selected metabolic engineering applications, including conversion of biomass into fuels, will be further explored through case studies and reviews of the current literature.
Recommendations: Open to graduate students and seniors. Backgrounds in biochemistry, numerical methods, and chemical kinetics is highly recommended.

104914	Biotechnology Processing Projects Lab			
Subject:	Catalog Nbr:			
CHBE	0168			
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu

(Cross-listed as BIO 168 and BME 168.) Laboratory experience with techniques in biotechnology processing: fermentation of recombinant E. coli cells, hybridoma cell culture, purification of proteins and antibodies and related analytical procedures. Laboratories accompanied by lectures and relevant readings to cover the underlying principles. Counts as laboratory course for biology major.

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104935	Seminar In Biotechnology
Subject: CHBE	Catalog Nbr: 0169
(Cross-listed as BIO 169 and BME 169.) Seminar course. Journal articles on current biotechnology-related research are reviewed. Leading researchers in the field present seminars, and students assess future research directions based on in-depth review of articles and presentations.	

104940	Special Topics			
Subject: COMP	Catalog Nbr: 0050			
2017 FALL	Primary	Simon Steel	Simon.Steel@tufts.edu
2018 FALL	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2019 SPRG	Primary	Joshua Wiesman	Joshua.Wiesman@tufts.edu
2019 SPRG	Primary	Jason Wiser	Jason.Wiser@tufts.edu
2019 SPRG	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu
Content and prerequisites to be announced. Please see departmental website for specific details.			

104955	Design And Analysis Of Experiments			
Subject: CHBE	Catalog Nbr: 0170			
2018 SPRG	Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
The course starts with a brief introduction to applied statistics with emphasis to hypothesis testing and, in particular, the Analysis of Variance. It then examines how to design experiments and analyze the data they yield. Various designs are discussed and their respective differences, advantages, and disadvantages are noted. In particular, factorial, fractional factorial, response surface, and optimal designs are examined in detail.			

104978	Clean Energy Technologies And Policy Issues			
Subject: CHBE	Catalog Nbr: 0173			
2018 SPRG	Primary	Simon Steel	Simon.Steel@tufts.edu
(Cross-listed with Fletcher School.) This course considers current issues in power generation, identifying the technologies used to meet Clean Air Act regulations by the electric utilities and automobile manufacturers. Topics include the electric utility deregulation, distributed power sources, new energy markets, fuel efficiency, and global effects of fossil fuel use. Alternative fuels and engines will be examined from the point of view of technology readiness and global market penetration to curb air pollution and decrease carbon emissions. The costs of energy technologies and the global impacts of present policies in the U. S. and abroad will be evaluated.			

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104981	Discrete Mathematics			
Subject:	Catalog Nbr:			
COMP	0061			
2018 FALL		Primary	Montserrat Teixidor I Bigas	montserrat.teixidoribigas@tufts.edu
2018 FALL		Primary	Karen Edwards	Karen.Edwards@tufts.edu
2018 SUMR		Primary	Srdjan Divac	Srdjan.Divac@tufts.edu
2019 SPRG		Primary	Zachary Faubion	Zachary.Faubion@tufts.edu
2019 SPRG		Primary	Jessica Dyer	Jessica.Dyer@tufts.edu
2019 SPRG		Primary	Elena Strange	Elena.Strange@tufts.edu

(Cross-listed as MATH 61). Sets, relations and functions, logic and methods of proof, combinatorics, graphs and digraphs.
Recommendations: MATH 32 or COMP 11 or permission of instructor.

104997	Drug Product Formulation			
Subject:	Catalog Nbr:			
CHBE	0185			
2018 SPRG		Primary	Bernardo Perez-Ramirez	No Email on file.

(Cross-listed as BME 185). Drug Product Formulation.

105019	Special Topics			
Subject:	Catalog Nbr:			
CHBE	0193			
2017 SUMR		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu
2018 FALL		Primary	Joel Grodstein	Joel.Grodstein@tufts.edu

Guided individual study of an approved topic to develop the art of self-teaching. Appraisal of the student's knowledge in the approved area will be based on a written and/or oral examination. Arrangements with a department member are required by the student prior to registration in the course. For master's degree candidates. Please see departmental website for specific details.

105039	Special Topics			
Subject:	Catalog Nbr:			
CHBE	0194			
2017 SUMR		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 SPRG		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 SPRG		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 SUMR		Primary	Gautham Sridharan	Gautham.Sridharan@tufts.edu

Guided individual study of an approved topic to develop the art of self-teaching. Appraisal of the student's knowledge in the approved area will be based on a written and/or oral examination. Arrangements with a

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department member are required by the student prior to registration in the course. For master's degree candidates. Please see departmental website for specific details.

105063	Programming Languages
Subject:	Catalog Nbr:
COMP	0080

An overview of language design and implementation, plus programming techniques for particular types of languages. Compilers and interpreters, binding, scope rules, formal semantic models, structure hiding, object-oriented programming, functional programming, and logic programming. Examples and problems from among Pascal, Algol, C++, Java, Scheme, Lisp, Prolog, and others. COMP 80 and COMP105 cannot both be taken for credit. Prerequisite: COMP 15.

105101	Object-oriented Programming For Graphical User Interfaces
Subject:	Catalog Nbr:
COMP	0086

2018 FALL	Primary	Robert Jacob	jacob@cs.tufts.edu

Object-oriented programming and design, including oject-oriented encapsulation, inheritance, and subtype polymorphism. Foundational concepts of graphical user interfaces, including events, callbacks, and widgets. Connections between objects and user interfaces, e.g., interface widgets as objects. Design and programming projects.
Recommendations: COMP 15

105142	Directed Study
Subject:	Catalog Nbr:
COMP	0093

2017 FALL	Primary	Anselm Blumer	ablumer@cs.tufts.edu
2017 FALL	Primary	Benjamin Hescott	No Email on file.
2018 FALL	Primary	Robert Jacob	jacob@cs.tufts.edu
2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu
2018 FALL	Primary	Soha Hassoun	soha.hassoun@tufts.edu
2018 FALL	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2018 FALL	Primary	Ming Chow	ming.chow@tufts.edu
2018 FALL	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu
2018 FALL	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2018 FALL	Primary	Remco Chang	Remco.Chang@tufts.edu
2018 FALL	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2018 FALL	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2018 FALL	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2018 FALL	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu

Course Bulletin

2018 FALL	Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
2018 FALL	Primary	Christopher Gregg	No Email on file.
2018 FALL	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL	Primary	Elena Strange	Elena.Strange@tufts.edu
2018 FALL	Primary	Liping Liu	Liping.Liu@tufts.edu
2018 FALL	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided study of an approved topic. Please see departmental website for specific details.

105162 **Mathematical Methods In Chemical Engineering**

Subject: CHBE Catalog Nbr: 0201

2018 FALL	Primary	Daniel Ryder	daniel.ryder@tufts.edu

Solution of algebraic equations, ordinary and partial differential equations, and sets of equations. Linear independence; basis vectors and functions; eigenvalues, eigenvector and eigenfunctions; initial and boundary value problems; generalized Fourier series; Sturm-Louisville problems; Green's function. Application examples in: chemical reaction engineering, and heat conduction and mass diffusion in one, two, or three dimensions at steady state or in transient mode. Emphasis is placed on linear problems but nonlinear ones are also discussed.
Recommendations: Graduate Engineering Student and knowledge of MATLAB, or permission of instructor.

105184 **Advanced Kinetics and Reaction Engineering**

Subject: CHBE Catalog Nbr: 0202

2018 SPRG	Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu

Applied chemical kinetics, reaction rate theories, complex kinetics, reactor stability and sensitivity to operating parameters. The interplay of diffusion and reaction in non-catalytic and catalytic reaction systems. Case studies in reactor design.
Recommendations: Graduate Engineering Student and CHBE 102 or equivalent.

105207 **Advanced Thermodynamics**

Subject: CHBE Catalog Nbr: 0203

2017 FALL	Primary	Jerry Meldon	No Email on file.
2018 FALL	Primary	Derek Mess	Derek.Mess@tufts.edu

Thermodynamics as applied to chemical engineering. Attention is given to the derivation of thermodynamic functions from concepts of statistical mechanics, chemical equilibrium, availability, and computation of vapor-liquid equilibrium compositions.
Recommendations: Graduate Engineering Student or Permission of Instructor

Course Bulletin

105225	Directed Study
Subject: COMP	Catalog Nbr: 0094
Guided study of an approved topic. Please see departmental website for specific details.	

105227	Advanced Transport Phenomena
Subject: CHBE	Catalog Nbr: 0204
2018 SPRG Primary Prashant Deshlahra Prashant.Deshlahra@tufts.edu	
Formulation, solution, and analysis of problems in momentum, energy and mass transport phenomena that occur in chemical and biological processes. Recommendations: Graduate Engineering Student, and CHBE 21 and CHBE 22 or equivalents.	

105244	Senior Capstone Project I
Subject: COMP	Catalog Nbr: 0097
2017 FALL Primary Samuel Guyer Samuel.Guyer@tufts.edu 2018 FALL Primary Ming Chow ming.chow@tufts.edu	
Requirements analysis and design of a senior capstone project. Requirements analysis and elicitation methods, and prototyping. Design principles and methods, including designing for usability, security, testability, performance, and scaling. Project management and planning, including cost and effort estimation. Writing effective documentation. Recommendations: COMP40 and Senior Standing.	

105248	Graduate Seminar
Subject: CHBE	Catalog Nbr: 0291
2018 FALL Primary Matthew Panzer Matthew.Panzer@tufts.edu	
Presentaion of individual reports on basic topics to a seminar for discussion and criticism. Please see departmental website for specific details.	

105261	Senior Capstone Project II
Subject: COMP	Catalog Nbr: 0098
2019 SPRG Primary Samuel Guyer Samuel.Guyer@tufts.edu	
Implementation and testing of the project designed in COMP97. Implementation tools, strategies, and platforms. Testing and debugging methodologies. Maintenance and release management. Legal, ethical, and social impacts of computing. Recommendations: COMP97.	

Course Bulletin

105285	Graduate Seminar			
Subject:	Catalog Nbr:			
CHBE	0292			
2018 SPRG		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
Presentaion of individual reports on basic topics to a seminar for discussion and criticism. Please see departmental website for specific details.				

105303	Disc Grp/do Not Register
Subject:	Catalog Nbr:
COMP	0100

105305	Special Topics
Subject:	Catalog Nbr:
CHBE	0293
Guided individual study of an approved topic. Designed to develop the art of self-teaching. Appraisal of the student's knowledge in the approved area based on a written and/or oral examination. Arrangemnts with a department memeber required prior to registration for the course. For doctoral degree candidates. Please see departmental website for specific details.	

105327	Special Topics
Subject:	Catalog Nbr:
CHBE	0294
Guided individual study of an approved topic. Designed to develop the art of self-teaching. Appraisal of the student's knowledge in the approved area based on a written and/or oral examination. Arrangemnts with a department memeber required prior to registration for the course. For doctoral degree candidates. Please see departmental website for specific details.	

105344	Programming Languages			
Subject:	Catalog Nbr:			
COMP	0105			
2017 FALL		Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2019 SPRG		Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
Principles and application of computer programming languages. Emphasizes ideas and techniques most relevant to practitioners, but includes foundations crucial for intellectual rigor: abstract syntax, lambda calculus, type systems, dynamic semantics. Case studies, reinforced by programming exercises. Grounding sufficient to read professional literature. Recommendations: COMP 15 (Data Structures) and one semester of Discrete Mathematics (COMP 22 or MATH 61 -formerly MATH 22).				

Course Bulletin

105365	Master's Thesis Research			
Subject:	Catalog Nbr:			
CHBE	0295			
2017 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu
Guided research on a topic suitable for a master's thesis. Please see departmental website for specific details.				

105402	Master's Thesis Research			
Subject:	Catalog Nbr:			
CHBE	0296			
2018 SPRG		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 SPRG		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 SPRG		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 SPRG		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 SPRG		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 SPRG		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 SPRG		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 SPRG		Primary	Darryl Williams	No Email on file.
2018 SPRG		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 SPRG		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 SPRG		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 SPRG		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu
Guided research on a topic suitable for a master's thesis. Please see departmental website for specific details.				

105446	Doctoral Thesis Research

Course Bulletin

Subject:	Catalog Nbr:			
CHBE	0297			
2017 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

105467	**Doctoral Thesis Research**

Subject:	Catalog Nbr:			
CHBE	0298			
2018 SPRG		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 SPRG		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 SPRG		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 SPRG		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 SPRG		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 SPRG		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 SPRG		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 SPRG		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 SPRG		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 SPRG		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 SPRG		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 SPRG		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

105468	**Operating Systems**

Subject:	Catalog Nbr:

Course Bulletin

Subject:	Catalog Nbr:			
COMP	0111			
2018 FALL		Primary	Alva Couch	alva.couch@tufts.edu

(Cross-listed as EE 128). Fundamental issues in operating system design. Concurrent processes: synchronization, sharing, deadlock, scheduling. Relevant hardware properties of uniprocessor and multiprocessor computer systems.
Recommendations: COMP 15 and either COMP 40 OR EE 14.

105487	Master Of Engineering Project			
Subject:	Catalog Nbr:			
CHBE	0299			
2017 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

Master of Engineering Project. Please see departmental website for specific details.

105488	Networks			
Subject:	Catalog Nbr:			
COMP	0112			
2019 SPRG		Primary	Fahad Dogar	Fahad.Dogar@tufts.edu

Computer Networks and Protocols. Design and implementation of computer communication networks, protocols, and applications, with an emphasis on the Internet protocol suite. Network architectures and programming interfaces. Data link, transport, and routing protocols. Congestion sources and remedies. Addressing and naming in local area and wide area networks. Network security and network management.
Recommendations: COMP 15 and either COMP 40 or EE 14.

105507	Non Major Credit
Subject:	Catalog Nbr:
CHBE	0310

Course Bulletin

105508	Network And System Administration
Subject: COMP	Catalog Nbr: 0114
A survey of the theory and practice of maintaining reliable, robust, and secure computer networks. Planning, deployment, monitoring, and maintenance of computer systems, networks, network services, and user environments. Dependency analysis and network troubleshooting. Administrative maturity models and best practices. Security, ethics, and legal issues of system administration. Hands-on exercises in deploying network services and infrastructure. Recommendations: Comp 111	

105525	Lower Level Elective Crd
Subject: CHBE	Catalog Nbr: 0320

105547	Upper Level Elective Crd
Subject: CHBE	Catalog Nbr: 0330

105548	Database Systems
Subject: COMP	Catalog Nbr: 0115
2019 SPRG Primary Jack Orenstein Jack.Orenstein@tufts.edu	
Fundamental concepts of database systems, including conceptual design, relational and object-oriented data models, query languages (SQL, QBE), and implementation issues (indexing, transaction processing, concurrent control). The concepts and algorithms covered encompass many of those used in commercial and experimental database systems. Other topics include distributed databases and distributed query processing. Recommendations: COMP 15	

105569	Computer Systems Security
Subject: COMP	Catalog Nbr: 0116
2019 SPRG Primary Ming Chow ming.chow@tufts.edu	
A systems perspective on host-based and network-based computer security. Current vulnerabilities and measures for protecting hosts and networks. Firewalls and intrusion detection systems. Principles illustrated through hands-on programming projects.	

Course Bulletin

Recommendations: COMP 40

105587	Web Engineering
Subject: COMP	Catalog Nbr: 0120
Essentials of designing, building, and analyzing enterprise websites embodying business processes. Correctness, validation, and security. Data models and scaffolding. Templating and view abstraction. Model-View-Controller decomposition and frameworks. Caching, pipelining, and performance tuning. Asynchronous client-server interactions. Web services and service decomposition. Web semantics. Recommendations: COMP15 and 20, or consent. COMP115 is also recommended as co-requisite, but not required.	

105588	Master's Degree Continuation - Part Time
Subject: CHBE	Catalog Nbr: 0401
Part-time.Please see departmental website for specific details.	

105631	Numerical Analysis
Subject: COMP	Catalog Nbr: 0126
(Cross-listed as MATH 126.) Analysis of algorithms involving computation with real numbers. Interpolation, methods for solving linear and nonlinear systems of equations, numerical integration, methods for ordinary differential equations. Recommendations: MATH 51 and programming ability in a language such as C, C++, Fortran, Pascal, or Matlab.	

105652	Numerical Linear Algebra
Subject: COMP	Catalog Nbr: 0128
(Cross-listed as MATH 128.) The two basic computational problems of linear algebra: solution of linear systems and computation of eigenvalues and eigenvectors. Recommendations: MATH 70 or 72 and COMP 11.	

105667	Master's Degree Continuation - Full Time
Subject: CHBE	Catalog Nbr: 0402
Full-time.Please see departmental website for specific details.	

Course Bulletin

105668	Artificial Intelligence			
Subject:	Catalog Nbr:			
COMP	0131			
2019 SPRG		Primary	Fabrizio Santini	Fabrizio.Santini@tufts.edu

History, theory, and computational methods of artificial intelligence. Basic concepts include representation of knowledge and computational methods for reasoning. One or two application areas will be studied, to be selected from expert systems, robotics, computer vision, natural language understanding, and planning. Recommendations: COMP 15 and MATH 61-formerly MATH 22 (students not majoring in Computer Science may substitute COMP 14 for both COMP 15 and MATH 61-formerly MATH 22)

105687	Grad Teaching Assistant			
Subject:	Catalog Nbr:			
CHBE	0405			
2018 SPRG		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 SPRG		Primary	Larry Cohen	No Email on file.
2018 SPRG		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 SPRG		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 SPRG		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 SPRG		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 SPRG		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 SPRG		Primary	Derek Mess	Derek.Mess@tufts.edu
2018 SPRG		Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 SPRG		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 SPRG		Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 SPRG		Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 SPRG		Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

105711	Grad Research Assistant			
Subject:	Catalog Nbr:			
CHBE	0406			
2018 FALL		Primary	Daniel Ryder	daniel.ryder@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Jerry Meldon	No Email on file.
2018 FALL		Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
2018 FALL		Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
2018 FALL		Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
2018 FALL		Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
2018 FALL		Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu

Course Bulletin

2018 FALL	Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
2018 FALL	Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL	Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
2018 FALL	Primary	James Van Deventer	James.Van_Deventer@tufts.edu
2018 FALL	Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

105750	**Doctoral Continuation - PT**
Subject: CHBE	Catalog Nbr: 0501
Part-time.Please see departmental website for specific details.	

105772	**Introduction To Machine Learning And Data Mining**			
Subject: COMP	Catalog Nbr: 0135			
2017 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu	
2019 SPRG	Primary	Liping Liu	Liping.Liu@tufts.edu	
An overview of methods whereby computers can learn from data or experience and make decisions accordingly. Topics include supervised learning,unsupervised learning, reinforcement learning, and knowledge extraction from large databases with applications to science,engineering, and medicine. Recommendations: COMP 15 and MATH 61 (formerly MATH 22) or permission of instructor (COMP 160 is highly recommended).				

105795	**Statistical Pattern Recognition**			
Subject: COMP	Catalog Nbr: 0136			
2017 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu	
Statistical foundations and algorithms for machine learning with a focus on Bayesian modeling. Topics include: classification and regression problems, regularization, model selection, kernel methods, support vector machines, Gaussian processes, graphical models. Recommendations: MATH 70 (formerly MATH 46), EE 104 or MATH 162, COMP 40 or COMP 80, or permission of instructor.				

105817	**Doctoral Degree Continuation - Full Time**
Subject: CHBE	Catalog Nbr: 0502
Full-time. Please see departmental website for specific details.	

Course Bulletin

105833	Advanced Computer Architecture

Subject:	Catalog Nbr:			
COMP	0140			
	2019 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu

Elements of modern computer architectures, including instruction pipelining, memory hierarchy, instruction-level parallelism, threading, and multi-core processors. Architectural issues related to software optimization. Architectural design decisions and how they affect operating systems and compilers. Quantitative analysis and evaluation of modern computing systems, including selection of appropriate benchmarks to reveal and compare the performance of alternative design choices in system design. Recommendations: COMP 40.

105871	Special Topics

Subject:	Catalog Nbr:			
COMP	0150			
	2017 FALL	Primary	Megan Monroe	Megan.Monroe@tufts.edu
	2017 FALL	Primary	Fabrizio Santini	Fabrizio.Santini@tufts.edu
	2017 FALL	Primary	Liping Liu	Liping.Liu@tufts.edu
	2017 FALL	Primary	Michel Machado	No Email on file.
	2018 FALL	Primary	Gregory Crane	gregory.crane@tufts.edu
	2018 FALL	Primary	Megan Monaghan	Megan.Monaghan@tufts.edu
	2018 FALL	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
	2018 FALL	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
	2018 FALL	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu
	2018 FALL	Primary	Khaled ElMahgoub	Khaled.ElMahgoub@tufts.edu
	2018 FALL	Primary	Jeffrey Foster	Jeffrey.Foster@tufts.edu
	2018 FALL	Primary	Michael Hughes	Michael.Hughes@tufts.edu
	2018 SUMR	Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
	2019 SPRG	Primary	Soha Hassoun	soha.hassoun@tufts.edu
	2019 SPRG	Primary	Ming Chow	ming.chow@tufts.edu
	2019 SPRG	Primary	Ronald Lasser	Ron.Lasser@tufts.edu
	2019 SPRG	Primary	Gavin Finn	Gavin.Finn@tufts.edu
	2019 SPRG	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
	2019 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
	2019 SPRG	Primary	Anthony Bucci	Anthony.Bucci@tufts.edu
	2019 SPRG	Primary	Susan Landau	Susan.Landau@tufts.edu

Content and prerequisites to be announced. Over the past three years, special topics courses have been offered in parallel computing, graph drawing, computational geometry, multimedia data compression, cryptography and security, digital network communication, spoken language systems, system and network administration, and machine learning. Please see departmental website for specific details.

105893	Algorithms

Subject:	Catalog Nbr:
COMP	0160

Course Bulletin

2017 FALL	Primary	Anselm Blumer	ablumer@cs.tufts.edu
2018 FALL	Primary	Hugo Alves Akitaya	Hugo.Alves_Akitaya@tufts.edu
2018 FALL	Primary	Karen Edwards	Karen.Edwards@tufts.edu
2018 FALL	Primary	Matias Korman	Matias.Korman@tufts.edu
2018 SUMR	Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
2019 SPRG	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2019 SPRG	Primary	Simon Steel	Simon.Steel@tufts.edu

Introduction to the study of algorithms. Strategies such as divide-and-conquer, greedy methods, and dynamic programming. Graph algorithms, sorting, searching, integer arithmetic, hashing, and NP-complete problems.
Recommendations: COMP 15 and MATH 61 (formerly MATH 22).

105952	**Computational Geometry**

Subject: COMP — Catalog Nbr: 0163

2017 FALL	Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
2018 FALL	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu

(Cross-listed as MATH 163.) Design and analysis of algorithms for geometric problems. Topics include proof of lower bounds, convex hulls, searching and point location, plane sweep and arrangements of lines, Voronoi diagrams, intersection problems, decomposition and partitioning, farthest-pairs and closest-pairs, rectilinear computational geometry.
Recommendations: COMP 160 or permission of instructor.

105973	**Cryptography**

Subject: COMP — Catalog Nbr: 0165

Introduction to private and public-key cryptography as well as pseudo-randomness. Topics include: cryptographic protocols using block ciphers. Methods for key exchange, message authentication, and digital signals. Modern cryptographic problems regarding secure voting, secret sharing, and digital cash.
Recommendations: COMP 0015 Data Structures and COMP0022/MATH 0061 (formerly MATH 22). Discrete Mathematics

105995	**Computational Biology**

Subject: COMP — Catalog Nbr: 0167

2017 FALL	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL	Primary	Lenore Cowen	lenore.cowen@tufts.edu

(Cross listed as BME 167) Computational Biology.Please see departmental website for specific details.

106079	**Computation Theory**

Subject: Catalog Nbr:

Course Bulletin

COMP	0170			
2017 FALL		Primary	Lenore Cowen	lenore.cowen@tufts.edu
2017 FALL		Primary	Simon Steel	Simon.Steel@tufts.edu
2018 SUMR		Primary	Harry Mairson	No Email on file.
2019 SPRG		Primary	Megan Monroe	Megan.Monroe@tufts.edu

(Cross-listed as MATH 170). Models of computation: Turing machines, pushdown automata, and finite automata. Grammars and formal languages, including context-free languages and regular sets. Important problems, including the halting problem and language equivalence theorems.
Recommendations: COMP 15 and MATH 61.

106100 **Human Computer Interaction**

Subject:	Catalog Nbr:			
COMP	0171			
2019 SPRG		Primary	Robert Jacob	jacob@cs.tufts.edu

Introduction to human-computer interaction, or how computers communicate with people. Methodology for designing and testing user interfaces, interaction styles (command line, menus, graphical user interfaces, virtual reality), interaction techniques (voice, gesture, eye movement), design guidelines, and user-interface management system software. Students will design a small user interface, program a prototype, and test the result for usability.
Recommendations: COMP 14 or 15.

106119 **Computer Graphics**

Subject:	Catalog Nbr:			
COMP	0175			
2019 SPRG		Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG		Primary	Erik Anderson	No Email on file.

The course provides the background to understand and build interactive graphics systems. Introduction to computer graphics from simple two-dimensional graphics through three-dimensional viewing and transforms. Interactive graphics programming, raster graphics, raster algorithms, geometrical transformations, viewing in three dimensions, modeling and hierarchical data structures, visual realism, virtual reality, interaction devices, tasks and techniques. Final project.
Recommendations: COMP 40, MATH 42 (formerly MATH 13), and MATH 70 (formerly MATH 46), or permission of instructor.

106140 **Software Engineering**

Subject:	Catalog Nbr:
COMP	0180

The special problems of creating very large programs, and methods for coping with these problems. Program design strategies, project management tools, programming environments.
Recommendations: COMP 80.

Course Bulletin

106184	Compilers

Subject:	Catalog Nbr:			
COMP	0181			
	2019 SPRG	Primary	Simon Steel	Simon.Steel@tufts.edu

Translation and implementation of programming languages. Parsing, code generation, and optimization. Compiler design projects for simple block-structured programming languages are used to illustrate the concepts and methods.
Recommendations: COMP 40, 105, and 170.

106249	Senior Design Project

Subject:	Catalog Nbr:
COMP	0190

Team analysis, planning, development, and maintenance of a software product, using software engineering principles, practices, and tools. This course fulfills the project requirement of the Bachelor of Science in Computer Science in the School of Engineering.
Recommendations: COMP 180.

106268	Directed Study

Subject:	Catalog Nbr:			
COMP	0193			
	2017 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
	2017 FALL	Primary	Benjamin Hescott	No Email on file.
	2017 FALL	Primary	Christopher Gregg	No Email on file.
	2017 SUMR	Primary	Bruce Molay	No Email on file.
	2017 SUMR	Primary	Elena Strange	Elena.Strange@tufts.edu
	2017 SUMR	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
	2018 FALL	Primary	Ethan Danahy	ethan.danahy@tufts.edu
	2018 FALL	Primary	Anselm Blumer	ablumer@cs.tufts.edu
	2018 FALL	Primary	Robert Jacob	jacob@cs.tufts.edu
	2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu
	2018 FALL	Primary	Soha Hassoun	soha.hassoun@tufts.edu
	2018 FALL	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
	2018 FALL	Primary	Ming Chow	ming.chow@tufts.edu
	2018 FALL	Primary	Lenore Cowen	lenore.cowen@tufts.edu
	2018 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu
	2018 FALL	Primary	Donna Slonim	Donna.Slonim@tufts.edu
	2018 FALL	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
	2018 FALL	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
	2018 FALL	Primary	Remco Chang	Remco.Chang@tufts.edu
	2018 FALL	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
	2018 FALL	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
	2018 FALL	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu

Course Bulletin

2018 FALL	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL	Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
2018 FALL	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL	Primary	Liping Liu	Liping.Liu@tufts.edu
2018 FALL	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided study of an approved topic. Please see departmental website for specific details.

106285 **Directed Study**

Subject: COMP — Catalog Nbr: 0194

2019 SPRG	Primary	Robert Jacob	jacob@cs.tufts.edu
2019 SPRG	Primary	Alva Couch	alva.couch@tufts.edu
2019 SPRG	Primary	Soha Hassoun	soha.hassoun@tufts.edu
2019 SPRG	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2019 SPRG	Primary	Ming Chow	ming.chow@tufts.edu
2019 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2019 SPRG	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2019 SPRG	Primary	Roni Khardon	roni@eecs.tufts.edu
2019 SPRG	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2019 SPRG	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2019 SPRG	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2019 SPRG	Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2019 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2019 SPRG	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2019 SPRG	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2019 SPRG	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2019 SPRG	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2019 SPRG	Primary	Elena Strange	Elena.Strange@tufts.edu
2019 SPRG	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2019 SPRG	Primary	Megan Monroe	Megan.Monroe@tufts.edu
2019 SPRG	Primary	Liping Liu	Liping.Liu@tufts.edu
2019 SPRG	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided study of an approved topic. Please see departmental website for specific details.

106309 **Honors Thesis-computer Science A**

Subject: COMP — Catalog Nbr: 0197

2017 FALL	Primary	Benjamin Hescott	No Email on file.
2018 FALL	Primary	Anselm Blumer	ablumer@cs.tufts.edu
2018 FALL	Primary	Robert Jacob	jacob@cs.tufts.edu
2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu
2018 FALL	Primary	Soha Hassoun	soha.hassoun@tufts.edu

Course Bulletin

2018 FALL	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
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2018 FALL	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu
2018 FALL	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2018 FALL	Primary	Remco Chang	Remco.Chang@tufts.edu
2018 FALL	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2018 FALL	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2018 FALL	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2018 FALL	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL	Primary	Elena Strange	Elena.Strange@tufts.edu
2018 FALL	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2018 FALL	Primary	Liping Liu	Liping.Liu@tufts.edu
2018 FALL	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Honors Thesis Computer Science.Please see departmental website for specific details.

106327	**Internship Computer Science**

Subject: COMP — Catalog Nbr: 0199

2017 SUMR	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 SUMR	Primary	Roni Khardon	roni@eecs.tufts.edu
2018 SUMR	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 SUMR	Primary	Liping Liu	Liping.Liu@tufts.edu
2019 SPRG	Primary	Ming Chow	ming.chow@tufts.edu

Internship Computer Science. Please see departmental website for specific details.

106526	**Computational Learning Theory**

Subject: COMP — Catalog Nbr: 0236

Probabilistic and adversarial models of machine learning. Development and analysis of machine learning principles and algorithms, their computational complexity, data complexity and convergence properties. Computational and cryptographic limitations on algorithms for machine learning.
Recommendations: COMP 160, EE 104 or MATH 162, or permission of instructor.

107336	**Advanced Special Topics**

Subject: COMP — Catalog Nbr: 0250

2017 FALL	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2019 SPRG	Primary	Susan Landau	Susan.Landau@tufts.edu

Course Bulletin

Content and prerequisites to be announced. Please see departmental website for specific details.

107376	**Advanced Algorithms**
Subject: COMP	Catalog Nbr: 0260
2019 SPRG	Primary Lenore Cowen lenore.cowen@tufts.edu
Design and analysis of sequential, parallel, probabilistic, and approximation algorithms. Graph algorithms, sorting, searching, geometric algorithms, mathematical programming, lower bounds, and intractable problems. Recommendations: COMP 160	

107398	**Advanced Computational Geometry**
Subject: COMP	Catalog Nbr: 0263
(Cross-listed as MATH 263.) Design and analysis of sequential, parallel, probabilistic, and approximation algorithms for geometry problems. Geometric data structures, complexity, searching, computation, and applications. Selected advanced topics. Recommendations: COMP 163 or permission of instructor.	

107416	**Parallel Computation**
Subject: COMP	Catalog Nbr: 0265
Existing and proposed architectures for parallel computation. Fundamental synchronization and communication protocols. Algorithm development for distributed memory multicomputers. Recommendations: COMP 15 and 160.	

107435	**Theory Of Computation**
Subject: COMP	Catalog Nbr: 0270
Computability, undecidability, computational complexity. Recommendations: COMP 170.	

107460	**User-interface Software**
Subject: COMP	Catalog Nbr: 0272
Emerging new non-WIMP (window icon menu pointer) user interface styles, such as virtual reality, lightweight, non-command, tangible, natural, continuous, and parallel interfaces. Techniques, languages, abstractions, and tools for building current and future user-computer interfaces. Project in designing, prototyping, and building a non-WIMP user interface, with class discussions and critiques.	

Course Bulletin

Recommendations: COMP 15, plus a course related to human-computer interaction.

107474	Advanced Computer Graphics
Subject: COMP	Catalog Nbr: 0275

Advanced Topics in Computer Graphics. Emphasis will change from year to year and may include physics-based modeling (including particle systems, animation kinematics, deformation, fluid modeling), advanced rendering techniques, shape representation and modeling, and computer animation.
Recommendations: COMP 175 and a good working knowledge of the C programming language.

107496	Data Visualization
Subject: COMP	Catalog Nbr: 0277

Selected advanced topics on the visualization of abstract structures, user-interface design, scientific visualization, visual languages, and graph drawing. The course includes the study and design of applications to software visualization, digital libraries, and multimedia. The class format is seminar style with presentation of research papers. Final projects will use advanced visualization tools.
Recommendations: COMP 160 or permission of instructor.

107687	Programming Project
Subject: COMP	Catalog Nbr: 0290

Independent development of a complete computer program for an approved task, including design, implementation, and documentation.Please see departmental website for specific details.

107951	Introduction To Civil & Environmental Engineering
Subject: CEE	Catalog Nbr: 0001
2018 SPRG	Primary Christopher Swan chris.swan@tufts.edu

Fundamental principles of civil and environmental engineering and their application to engineered and natural systems. Engineering materials. Environmental, geotechnical, structural, and water resource systems. With Laboratory.
Recommendations: MATH 34 (formerly MATH 12), EN 2, ES 5; Co-requisite: ES 9.

107993	Introduction To Hydraulic Engineering
Subject: CEE	Catalog Nbr: 0012
2018 SPRG	Primary Robert Viesca Robert.Viesca@tufts.edu

The application of principles of fluid mechanics to problems of engineering design and practice. The equations

Course Bulletin

of continuity, momentum, and energy are applied to problems in river engineering, dam design, hydromachinery, floodplain delineation, water-distribution systems, culverts, turbines, and other hydraulic structures. With laboratory.
Recommendations: ES 8.

108013	Structural Analysis

Subject:	Catalog Nbr:			
CEE	0022			
2018 FALL		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu

A first course in the application of mechanics to the analysis of structures, with the major emphasis on structural forms important to civil engineering. Deflections calculations of beams and frames using differential equations and moment-area theorems. Deflection of trusses and frames using virtual work. Indeterminate structural analysis using flexibility and stiffness methods. Moving loads calculations using influence lines. Introduction to computer analysis of structures. With laboratory.
Recommendations: ES 9.

108055	Steel Design

Subject:	Catalog Nbr:			
CEE	0024			
2018 SPRG		Primary	Po-Shang Chen	No Email on file.

Design of steel structural members. Determination of stresses and strains in structural members, the proportioning of members, and the design of connections for beams, girders, trusses, and frames. Work in structural representation.
Recommendations: CEE 22.

108075	Reinforced Concrete Design

Subject:	Catalog Nbr:			
CEE	0025			
2018 FALL		Primary	Brian Brenner	brian.brenner@tufts.edu

Analysis and design of reinforced concrete members. Working stress and ultimate strength theories are applied to beams, girders, slabs, columns, walls, and footings. Use of these elements in various structures is studied.
Recommendations: CEE 22.

108096	Environmental Chemistry

Subject:	Catalog Nbr:			
CEE	0034			
2017 FALL		Primary	Neelakshi Hudda	Neelakshi.Hudda@tufts.edu
2018 FALL		Primary	John Durant	john.durant@tufts.edu

Basic principles of environmental chemistry related to environmental engineering. Thermodynamics,

Course Bulletin

equilibrium, kinetics, mass balance, chemical partitioning, and reactions for predicting behavior of pollutants in air, water, and soil. Techniques for measuring dissolved oxygen, biochemical oxygen demand, nutrients, sewage indicator bacteria, airborne particles and hydrocarbons, and other pollutants. Applications to environmental processes. With laboratory.
Recommendations: CHEM 2; ES11 or BIO13; CEE 32 or equivalent.

108121	Engineering for a Sustainable and Resilient Society

Subject:	Catalog Nbr:			
CEE	0032			
2018 FALL		Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu

Quantitative description of natural and engineered processes affecting environmental sustainability at local, regional, and global scales. Principles of ecology, material and energy flows, environmental quality, climate change, and resiliency in a civil and environmental engineering context.

Recommendations: ES 2, MATH 34, CHEM 1, and PHY 11

108135	Master's Project

Subject:	Catalog Nbr:			
COMP	0293			
2017 FALL		Primary	Benjamin Hescott	No Email on file.
2018 FALL		Primary	Anselm Blumer	ablumer@cs.tufts.edu
2018 FALL		Primary	Robert Jacob	jacob@cs.tufts.edu
2018 FALL		Primary	Alva Couch	alva.couch@tufts.edu
2018 FALL		Primary	Soha Hassoun	soha.hassoun@tufts.edu
2018 FALL		Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2018 FALL		Primary	Ming Chow	ming.chow@tufts.edu
2018 FALL		Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 FALL		Primary	Roni Khardon	roni@eecs.tufts.edu
2018 FALL		Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL		Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL		Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2018 FALL		Primary	Remco Chang	Remco.Chang@tufts.edu
2018 FALL		Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2018 FALL		Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2018 FALL		Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2018 FALL		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL		Primary	Gregory Aloupis	Gregory.Aloupis@tufts.edu
2018 FALL		Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL		Primary	Elena Strange	Elena.Strange@tufts.edu
2018 FALL		Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2018 FALL		Primary	Megan Monroe	Megan.Monroe@tufts.edu
2018 FALL		Primary	Liping Liu	Liping.Liu@tufts.edu
2018 FALL		Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Course Bulletin

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

108143	Introduction To Geotechnical Engineering

Subject: CEE Catalog Nbr: 0042

2017 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
2017 FALL	Primary	John Germaine	John.Germaine@tufts.edu

The engineering properties of soils and the behavior of soil masses subjected to loads and fluid flow. Flow of water through and stress in soil. Investigation of permeability, compressibility, and strength of soil. With laboratory.
Recommendations: ES 9.

108178	Biomedical Engineering Sophomore Design And Research I

Subject: BME Catalog Nbr: 0003

2017 FALL	Primary	Michael Lovett	Michael.Lovett@tufts.edu
2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL	Primary	Rucsanda Preda	C.Preda@tufts.edu

Team design and research projects in molecular and cell biology related to regenerative medicine. Concepts of cell culture, cell signaling, biological structure-function, physiology and biological information transfer. How to keep records of design requirements, design solutions, experimental activities, and prepare written technical reports.

108214	Master's Project

Subject: COMP Catalog Nbr: 0294

2019 SPRG	Primary	Anselm Blumer	ablumer@cs.tufts.edu
2019 SPRG	Primary	Robert Jacob	jacob@cs.tufts.edu
2019 SPRG	Primary	Alva Couch	alva.couch@tufts.edu
2019 SPRG	Primary	Soha Hassoun	soha.hassoun@tufts.edu
2019 SPRG	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2019 SPRG	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2019 SPRG	Primary	Roni Khardon	roni@eecs.tufts.edu
2019 SPRG	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2019 SPRG	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2019 SPRG	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2019 SPRG	Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2019 SPRG	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2019 SPRG	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2019 SPRG	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu

Course Bulletin

2019 SPRG	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2019 SPRG	Primary	Elena Strange	Elena.Strange@tufts.edu
2019 SPRG	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2019 SPRG	Primary	Megan Monroe	Megan.Monroe@tufts.edu
2019 SPRG	Primary	Liping Liu	Liping.Liu@tufts.edu
2019 SPRG	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

108220	**Biomedical Engineering Sophomore Design And Research II**

Subject: BME Catalog Nbr: 0004

2018 SPRG	Primary	Martin Hunter	Martin.Hunter@tufts.edu

Team design and research in basic optics, and biomedical optics. Geometrical and physical optics, fiber optics, light sources, optical detectors, and principles of spectroscopy. How to present design features and research results in the form of a technical/scientific poster.
Recommendations: BME 3.

108232	**Masters Thesis**

Subject: COMP Catalog Nbr: 0295

2017 FALL	Primary	Benjamin Hescott	No Email on file.
2018 FALL	Primary	Anselm Blumer	ablumer@cs.tufts.edu
2018 FALL	Primary	Robert Jacob	jacob@cs.tufts.edu
2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu
2018 FALL	Primary	Soha Hassoun	soha.hassoun@tufts.edu
2018 FALL	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2018 FALL	Primary	Ming Chow	ming.chow@tufts.edu
2018 FALL	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 FALL	Primary	Roni Khardon	roni@eecs.tufts.edu
2018 FALL	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2018 FALL	Primary	Remco Chang	Remco.Chang@tufts.edu
2018 FALL	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2018 FALL	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2018 FALL	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL	Primary	Elena Strange	Elena.Strange@tufts.edu
2018 FALL	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2018 FALL	Primary	Liping Liu	Liping.Liu@tufts.edu

Course Bulletin

2018 FALL	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

108235	Introduction To Hazardous Materials Management

Subject: CEE
Catalog Nbr: 0039

(Cross-listed as ENV 70.) A survey of technology, health, and policy issues in hazardous materials and hazardous waste management. Topics will be examined from a scientific and technological perspective and will include characteristics of hazardous materials; health effects; hazard, exposure, and risk assessment; regulatory framework; distribution of contaminants in the environment; and an overview of remedial technologies used to clean up hazardous waste.
Recommendations: CHEM 1 or 16, ES 11 or BIO 13, and CEE 1 or CEE 32

108250	Masters Thesis

Subject: COMP
Catalog Nbr: 0296

2019 SPRG	Primary	Robert Jacob	jacob@cs.tufts.edu
2019 SPRG	Primary	Alva Couch	alva.couch@tufts.edu
2019 SPRG	Primary	Soha Hassoun	soha.hassoun@tufts.edu
2019 SPRG	Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2019 SPRG	Primary	Ming Chow	ming.chow@tufts.edu
2019 SPRG	Primary	Lenore Cowen	lenore.cowen@tufts.edu
2019 SPRG	Primary	Roni Khardon	roni@eecs.tufts.edu
2019 SPRG	Primary	Donna Slonim	Donna.Slonim@tufts.edu
2019 SPRG	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2019 SPRG	Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2019 SPRG	Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG	Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2019 SPRG	Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2019 SPRG	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2019 SPRG	Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2019 SPRG	Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2019 SPRG	Primary	Elena Strange	Elena.Strange@tufts.edu
2019 SPRG	Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2019 SPRG	Primary	Megan Monroe	Megan.Monroe@tufts.edu
2019 SPRG	Primary	Liping Liu	Liping.Liu@tufts.edu
2019 SPRG	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

108264	Biomedical Engineering Junior Design And Research I

Course Bulletin

Subject:	Catalog Nbr:			
BME	0005			
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu

Team design and research in digital signal/image processing. Signal and noise, signal averaging, Fourier analysis, convolution, and correlation. How to present design features and research results in the form of a technical/scientific article.
Recommendations: BME 4.

108269 | **Graduate Research**

Subject:	Catalog Nbr:			
COMP	0297			
2017 FALL		Primary	Benjamin Hescott	No Email on file.
2018 FALL		Primary	Anselm Blumer	ablumer@cs.tufts.edu
2018 FALL		Primary	Robert Jacob	jacob@cs.tufts.edu
2018 FALL		Primary	Alva Couch	alva.couch@tufts.edu
2018 FALL		Primary	Soha Hassoun	soha.hassoun@tufts.edu
2018 FALL		Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2018 FALL		Primary	Ming Chow	ming.chow@tufts.edu
2018 FALL		Primary	Lenore Cowen	lenore.cowen@tufts.edu
2018 FALL		Primary	Roni Khardon	roni@eecs.tufts.edu
2018 FALL		Primary	Donna Slonim	Donna.Slonim@tufts.edu
2018 FALL		Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2018 FALL		Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2018 FALL		Primary	Remco Chang	Remco.Chang@tufts.edu
2018 FALL		Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2018 FALL		Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2018 FALL		Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2018 FALL		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2018 FALL		Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2018 FALL		Primary	Elena Strange	Elena.Strange@tufts.edu
2018 FALL		Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2018 FALL		Primary	Liping Liu	Liping.Liu@tufts.edu
2018 FALL		Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

108280 | **Civil And Environmental Engineering Design**

Subject:	Catalog Nbr:			
CEE	0081			
2018 SPRG		Primary	James Limbrunner	James.Limbrunner@tufts.edu
2018 SPRG		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
2018 SPRG		Primary	Brian Brenner	brian.brenner@tufts.edu
2018 SPRG		Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu

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Integrated design and project management methods used in conceiving, developing, and managing one-of-a-kind civil and environmental engineering projects. This capstone design experience includes pre-site investigation and site planning, detail drawings, bidding documents, quantity take-off and cost estimates, planning and scheduling, as well as contracts and procurement activities. The final group design project consists of a comprehensive written report and visual presentation using computer applications such as computer-aided design and electronic spreadsheets.
Recommendations: Senior standing.

108284	Graduate Research

Subject:	Catalog Nbr:			
COMP	0298			
2019 SPRG		Primary	Anselm Blumer	ablumer@cs.tufts.edu
2019 SPRG		Primary	Robert Jacob	jacob@cs.tufts.edu
2019 SPRG		Primary	Alva Couch	alva.couch@tufts.edu
2019 SPRG		Primary	Soha Hassoun	soha.hassoun@tufts.edu
2019 SPRG		Primary	Diane Souvaine	Diane.Souvaine@tufts.edu
2019 SPRG		Primary	Ming Chow	ming.chow@tufts.edu
2019 SPRG		Primary	Lenore Cowen	lenore.cowen@tufts.edu
2019 SPRG		Primary	Roni Khardon	roni@eecs.tufts.edu
2019 SPRG		Primary	Donna Slonim	Donna.Slonim@tufts.edu
2019 SPRG		Primary	Samuel Guyer	Samuel.Guyer@tufts.edu
2019 SPRG		Primary	Norman Ramsey	Norman.Ramsey@tufts.edu
2019 SPRG		Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG		Primary	Matthias Scheutz	Matthias.Scheutz@tufts.edu
2019 SPRG		Primary	Kathleen Fisher	Kathleen.Fisher@tufts.edu
2019 SPRG		Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu
2019 SPRG		Primary	Mark Sheldon	Mark.Sheldon@tufts.edu
2019 SPRG		Primary	Fahad Dogar	Fahad.Dogar@tufts.edu
2019 SPRG		Primary	Elena Strange	Elena.Strange@tufts.edu
2019 SPRG		Primary	Johannes De Ruiter	jp.deruiter@tufts.edu
2019 SPRG		Primary	Megan Monroe	Megan.Monroe@tufts.edu
2019 SPRG		Primary	Liping Liu	Liping.Liu@tufts.edu
2019 SPRG		Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

108304	Non Major Credit

Subject:	Catalog Nbr:
COMP	0310

108316	Biomedical Engineeering Junior Design And Research II

Course Bulletin

Subject:	Catalog Nbr:			
BME	0006			
	2018 SPRG	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu

Technical and scientific literature databases, professional preparation and delivery of technical/scientific presentations, and preparation of technical proposals based on proper technical writing.
Recommendations: BME 5.

108330	**Lower Level Elective Crd**
Subject:	Catalog Nbr:
COMP	0320

108346	**Special Topics In Civil And Environmental Engineering A**
Subject:	Catalog Nbr:
CEE	0093

Topical courses offered within civil and environmental engineering.

108350	**Upper Level Elective Crd**
Subject:	Catalog Nbr:
COMP	0330

108359	**Biomedical Engineering Senior Design I**			
Subject:	Catalog Nbr:			
BME	0007			
	2017 FALL	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
	2018 FALL	Primary	Brian Timko	Brian.Timko@tufts.edu

Critical thinking approaches in design and research. Planning, initiation, and evaluation of design and research projects, goals, and processes. Students will be required to regularly report on the status and progress of their design/research activities, and to formally and critically evaluate their projects.
Recommendations: BME 6.

108363	**Independent Study**			
Subject:	Catalog Nbr:			
CEE	0094			
	2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
	2018 SPRG	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu

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	2018 SPRG	Primary	Neelakshi Hudda	Neelakshi.Hudda@tufts.edu
	2018 SUMR	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu

Supervised, independent study of topics related to civil and environmental engineering. Departmental consent required.

108393	**Research Thesis A**

Subject:	Catalog Nbr:			
CEE	0095			
	2017 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
	2017 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu

A course that permits the student to perform supervised research in a specialized field of civil and environmental engineering.
Recommendations: Consent of instructor.

108400	**Biomedical Engineering Senior Design II**

Subject:	Catalog Nbr:			
BME	0008			
	2018 SPRG	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
	2018 SPRG	Primary	Brian Timko	Brian.Timko@tufts.edu

Continuation of the design/research activities planned, initiated, and evaluated in BME 7. Students will be required submit regular progress reports and a final written report, and make a course-end oral presentation.
Prerequisites: BME 7.

108412	**Research Thesis B**

Subject:	Catalog Nbr:			
CEE	0096			
	2018 SPRG	Primary	Steven Chapra	steven.chapra@tufts.edu
	2018 SPRG	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu

A course that permits the student to perform supervised research in a specialized field of civil and environmental engineering.
Recommendations: Consent of instructor.

108430	**Biophysics**

Subject:	Catalog Nbr:			
BME	0025			
	2018 SPRG	Primary	Peggy Cebe	peggy.cebe@tufts.edu

(Cross-listed as BIO 119, PHY 25.) Presentation at an introductory level of selected topics in physics relevant to modern medicine and biology. Development of topics to the point of application to biomedical problems.

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Topics drawn from acoustics, physics of fluids, diffusion, laser physics, and other subjects varying from year to year. Offered alternate years. (Also offered as 100-level.)
Recommendations: PHY 1, 2, or 11, 12 or permission of instructor. Corequisite: MATH 42 (formerly MATH 13).

108431	Internship In Civil And Environmental Engineering

Subject:	Catalog Nbr:			
CEE	0099			
2017 SUMR		Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
2017 SUMR		Primary	Kurt Pennell	Kurt.Pennell@tufts.edu
2018 FALL		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu

Field placement in the practice of civil engineering. The purpose is to apply the knowledge and skills developed in the classroom to a field situation of practical significance.
Recommendations: Junior or senior standing in civil and environmental engineering.

108451	Introduction To Biomedical Engineering

Subject:	Catalog Nbr:			
BME	0050			
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu

(Cross-listed as EE 50.) An introduction to the interdisciplinary nature of biomedical engineering. The biological, chemical, electrical, and mechanical principles involved in the design and operation of medical devices. Biopotentials, electrodes, transducers, biocompatibility of materials, and patient safety.
Recommendations: PHY 2 or PHY 12, or permission of instructor.

108473	Introduction To Biophotonics

Subject:	Catalog Nbr:			
BME	0051			
2018 SPRG		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG		Secondary	Martin Hunter	Martin.Hunter@tufts.edu

Basic concepts in electromagnetism and light matter interactions, including optical properties, absorption, near-infrared, light scattering and fluorescence spectroscopy, microscopy, optical coherence tomography and photodynamic therapy and their relevance to human disease diagnostic and therapeutic applications.
Recommendations: PHY 12 or permission of instructor.

108475	Finite Elements Analysis

Subject:	Catalog Nbr:			
CEE	0105			
2018 SPRG		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu

(Cross-listed with ME 0129). Finite element analysis of problems important in civil infrastructure engineering. Overview of direct stiffness method. Discretization of continuum to finite elements for approximate solution of complex engineering problems. Development of governing equations, stiffness and load matrices for

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deformation and stress analysis. Work and energy theorems. Hands-on experience with computers programs and practical applications in structural and geotechnical engineering.
Recommendations: CEE 22or ME 42, or consent of instructor

108507	Structural Dynamics And Earthquake Engineering			
Subject:	Catalog Nbr:			
CEE	0106			
2018 FALL		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu

Fundamentals of vibration theory with applications important in civil engineering. Free, forced, and transient vibration of one and two degrees of freedom systems, including damping and nonlinear behavior. Base excitation and seismic instrumentation. Duhamel's integral and time step integration. Multi-degree of freedom systems, modal analysis and seismic response spectra. Introduction to earthquake design.
Recommendations: ES 9 and CEE 22, or consent of instructor

108523	Quantitative Biomaterials Characterization Laboratory I			
Subject:	Catalog Nbr:			
BME	0056			
2017 FALL		Primary	Martin Hunter	Martin.Hunter@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu

(SPRING 2013 & BEYOND). Quantitative biomaterials characterization laboratory I. Selected topics in use of electromagnetic radiation to characterize biomaterials. Please see department website for more details.

108529	Hydrology of the Built Environment			
Subject:	Catalog Nbr:			
CEE	0111			
2017 FALL		Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2018 FALL		Primary	James Limbrunner	James.Limbrunner@tufts.edu

(Cross-listed as ENV 112.)Processes and land surface characteristics that affect stormwater flows, including land-use intensification influence on flooding, geomorphic stability, and nonpoint source pollution. Design of mitigation measures based on drainage and detention, as well as land-use planning, low impact development, best management practices, and green infrastructure.
Recommendations: MATH42, CEE12, CEE32

108544	Tufts Abroad Program			
Subject:	Catalog Nbr:			
COMP	0340			
2018 SPRG		Primary	Ute Link	Ute.Link@tufts.edu
2018 SPRG		Primary	Simon Steel	Simon.Steel@tufts.edu
2018 SPRG		Primary	Susan Sanchez-Casal	susan.sanchez_casal@tufts.edu

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108547	Quantitative Biomaterials Characterization Laboratory II
Subject: BME	Catalog Nbr: 0057
Continuation of BME 56 consisting of topics not offered in BME56 in the same academic year and an introductory session focused on critical review of current biophotonics literature. Recommendations: BME 56.	

108548	Groundwater
Subject: CEE	Catalog Nbr: 0113
2018 FALL Primary Grant Garven Grant.Garven@tufts.edu	
(Cross-listed as ENV 113 and EOS 131). The geology and hydrology of groundwater. Topics include: hydraulic properties of soils, sediments, and rocks; physics of groundwater flow; flow nets, modeling groundwater systems; geology of regional flow; aquifer exploration and water well construction methods; well hydraulics and aquifer testing; applications in the geosciences and in civil /geotechnical/environmental engineering. Recommendations: EOS 1 or EOS 2 (formerly GEO 1 or GEO 2), and MATH 32 (formerly MATH 11).	

108564	Masters Degree Continuation
Subject: COMP	Catalog Nbr: 0401
Part-time.Please see departmental website for specific details.	

108569	Field Methods In Hydrogeology
Subject: CEE	Catalog Nbr: 0114
2018 SPRG Primary Grant Garven Grant.Garven@tufts.edu	
(Cross-listed as EOS 133-formerly GEO 133). Field aspects of hydrogeology, groundwater mapping and sampling, aquifer testing, well drilling, monitoring, and instrumentation of boreholes. Lecture and basic field methods to understand how monitoring and production wells are planned and drilled, and what types of geologic, geophysical, and geochemical data can be gathered for subsurface flow systems. Anetwork of boreholes on the Tufts campus will be used as field sites to characterize subsurfaceparameters in the unsaturated and saturated zones, and study regional flow in an urban watershed. Field trips, quantitative analysis of hydrogeologic data. Recommendations: EOS 002 (formerly GEO 002) and PHY 011 or equivalent.	

108571	Introduction To Human Factors And Ergonomics
Subject: BME	Catalog Nbr: 0061

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2017 FALL	Primary	Sami Durrani	Sami.Durrani@tufts.edu
2018 FALL	Primary	Linda Borghesani	Linda.Borghesani@tufts.edu

(Cross-listed as ENP 61.) A practical introduction to human performance and to designing for human use. Studies include human factors, ergonomics, work stations, and environmental and legal concerns that impact on design. Examples of good and bad designs illustrate course principles.

108584	Masters Degree Continuation
Subject: COMP	Catalog Nbr: 0402

Full-time.Please see departmental website for specific details.

108591	Molecular Biotechnology
Subject: BME	Catalog Nbr: 0062

2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG	Primary	Niall Lennon	No Email on file.
2018 SUMR	Primary	Dana Cairns	Dana.Cairns@tufts.edu
2018 SUMR	Primary	Nina Dinjaski	Nina.Dinjaski@tufts.edu

(Cross-listed as CHBE 62 and BIO 62.) Overview of key aspects of molecular biology and engineering aspects of biotechnology. Lecture topics include molecular biology, recombinant DNA techniques, immunology, cell biology, protein purification, fermentation, cell culture, combinatorial methods, bioethics, and bioinformatics. Includes a semester-long technical project. (May also be taken at 100 level.)
Recommendations: CHEM 1, BIO 13, or permission of instructor.

108593	The Art Of Building
Subject: CEE	Catalog Nbr: 0120

Late 19th and early 20th century problems in creating a built environment consistent with modern life. Work of key designers and writers. Connections between structural form and architectural theory form the basis for critiques of modern structure and architecture.
Recommendations: Consent of instructor.

108606	Grad Teaching Assistant
Subject: COMP	Catalog Nbr: 0405

108622	Solid Mechanics
Subject:	Catalog Nbr:

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CEE	0122			
2018 FALL		Primary	Mark Kachanov	mark.kachanov@tufts.edu

(Cross-listed as ME 122). Strain tensor, stress tensor, elastic stress analysis, isotropic and anisotropic materials, torsion problem, inelastic behavior of materials, elements of plasticity and creep.
Recommendations: ES 9 Strength of Materials or equivalent.

108627	**Grad Research Assistant**
Subject:	Catalog Nbr:
COMP	0406

108640	**Advanced Structural Systems Analysis**			
Subject:	Catalog Nbr:			
CEE	0123			
2017 FALL		Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
2018 FALL		Primary	Eric Hines	Eric.Hines@tufts.edu

The application of mechanics to the analysis of indeterminate structural forms important to civil and aeronautical engineering, with emphasis on modern structural types. The analysis of fundamental structural forms, including curved beams, arches, rings, thin-walled cell-type structures, and members with variable inertia, for stress and deflection by the classical methods. Influence lines for indeterminate structures. Introduction to matrix analysis and vibration of structures.
Recommendations: CEE 22.

108650	**Internship**			
Subject:	Catalog Nbr:			
BME	0087			
2017 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu

Supervised internships at suitable locations in industry and government. Internships are offered on basis of availability. Term paper required. Credit not given retroactively. Prior arrangements necessary.

108651	**Doctoral Degree Continuation**
Subject:	Catalog Nbr:
COMP	0501

Part-time.Please see departmental website for specific details.

108662	**Advanced Steel Design**
Subject:	Catalog Nbr:
CEE	0124

An advanced course in steel design using the Load Resistance Factor Design (LRFD). Component design,

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connections, composite and built-up sections are covered. Design problems involve braced and rigid structures subjected to gravity, wind, and seismic loads. Recommendations: CEE 24 and consent of instructor

108667	Doctoral Degree Continuation			
Subject:	Catalog Nbr:			
COMP	0502			
Full-time.Please see departmental website for specific details.				

108673	Internship			
Subject:	Catalog Nbr:			
BME	0088			
2018 FALL	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu	
2018 SUMR	Primary	Sergio Fantini	sergio.fantini@tufts.edu	
Internships at suitable locations in industry and government. Internships are offered on basis of availability. Term paper required. Credit not given retroactively. Prior arrangements necessary.				

108679	Advanced Reinforced Concrete			
Subject:	Catalog Nbr:			
CEE	0125			
2018 SPRG	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu	
Further study of concrete design with emphasis on columns with biaxial bending, flat slab theory and design, torsion, and the analysis and design of prestressed concrete structural members. Recommendations: CEE 25				

108692	Honors Thesis A			
Subject:	Catalog Nbr:			
BME	0089			
2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu	
Supervised research on a topic that has been approved as a suitable subject for an honors thesis. The work is performed over the fall and spring semesters of the senior year. Please see departmental website for specific details. Recommendations: Senior standing or permission of instructor.				

108699	Structural Stability
Subject:	Catalog Nbr:
CEE	0126
Elastic buckling of columns, including the effects of initial crookedness and eccentricity. Large deflections of the Euler column. Tangent modulus and double modulus theory. Beam columns and the stability of	

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frameworks and trusses. Torsional buckling of columns and lateral buckling of beams. Plate buckling with applications to flange buckling and web crippling of plate girders.
Recommendations: ES 9 and CEE 22, or consent of instructor

108712	Honors Thesis B

Subject:	Catalog Nbr:			
BME	0090			
2018 SPRG		Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 SPRG		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 SPRG		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 SPRG		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 SPRG		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 SPRG		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 SPRG		Primary	Brian Timko	Brian.Timko@tufts.edu

Supervised research on a topic that has been approved as a suitable subject for an honors thesis. The work is performed over the fall and spring semesters of the senior year. Please see departmental website for specific details.
Recommendations: Senior standing or permission of instructor.

108721	Nonlinear Analysis of Materials and Structures

Subject:	Catalog Nbr:			
CEE	0128			
2018 FALL		Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu

(Cross-listed as ME 128.) Nonlinear solid mechanics, nonlinear constitutive models and variational principles as essential prerequisites for nonlinear finite element formulations.
Recommendations: ES 9.

108734	Special Topics

Subject:	Catalog Nbr:			
BME	0093			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu
2018 FALL		Secondary	Lauren Black III	Lauren.Black@tufts.edu

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Guided study of an approved topic in biomedical engineering.

108745	**Bridge Design And Rehabilitation**
Subject: CEE	Catalog Nbr: 0129
A practical introduction to bridge engineering, exploring the design, behavior, maintenance and rehabilitation of bridges. Bridge systems, loadings, superstructures, substructures, details, and inspections will be discussed. The theory behind development of certain provisions in AASHTO code will be reviewed, with the purpose of developing an understanding of the code and its related commentary, and the objective of preparing students to use the criteria not as a "black box." Approximate analysis methods will be discussed. Design of elements including steel and pre-stressed concrete beams, abutments, piers, joints, and bearings using AASHTO code (LRFD) will be covered. Recommendations: CEE 24 and CEE 25, or consent of instructor.	

108762	**Special Topics**			
Subject: BME	Catalog Nbr: 0094			
	2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu
	2018 SPRG	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
	2018 SPRG	Primary	Sergio Fantini	sergio.fantini@tufts.edu
	2018 SPRG	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
	2018 SPRG	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
	2018 SPRG	Primary	Lauren Black III	Lauren.Black@tufts.edu
	2018 SPRG	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
	2018 SPRG	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
	2018 SPRG	Primary	Brian Timko	Brian.Timko@tufts.edu
Guided study of an approved topic in biomedical engineering.				

108768	**River Hydraulics and Stream Restoration**			
Subject: CEE	Catalog Nbr: 0112			
	2017 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
Design of rivers and stream channels including lined aqueducts, stilling basins, water surface elevation control, and sediment stability. Influence of engineered works on natural processes such as sediment transport, wildlife migration, and flood attenuation. Stream restoration methods including nature-like riverbed and riverbank design, and aquatic organism passage design. Recommendations: MATH 51 and CEE 12				

108812	**Environmental Engineering Processes**
Subject: CEE	Catalog Nbr: 0036

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	2018 SPRG	Primary	Linda Abriola	Linda.Abriola@tufts.edu
Fundamental environmental engineering processes with applications in all environmental media. Particle interaction and settling, filtration, disinfection, diffusion and dispersion, sorption, mass transfer, biotic and abiotic reactions, and kinetics. Extensions to engineering design. With laboratory. Recommendations: CEE34 and CEE52				

108840	Wastewater Plant Design			
	Subject: CEE	Catalog Nbr: 0133		
	2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
Design of facilities for municipal drinking water and wastewater treatment. Synthesis of unit processes and operations into integrated treatment plant. Emphasis on conventional treatment processes. Additional topics include liquid and solids streams, hydraulics, chemical feed and control systems, costs, and performance requirements. Design projects and field trips. Recommendations: CEE 32 or consent of instructor				

108855	Design Of Medical Instrumentation			
	Subject: BME	Catalog Nbr: 0100		
	2018 SPRG	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
(Cross-listed as EE 100.) An introduction to the design principles of medical instrumentation and simple biomedical signal analysis. Topics include analysis of the instrument and subject as a linear system, characteristics of various biological signals, design of transducers, modern implementation of A/D conversion, analog and digital filters, instrumentation amplifiers, patient isolation, and battery powered equipment. Recommendations: ES 3 and/or experience with basic electronics including operational amplifiers				

108886	Air Pollution Control			
	Subject: CEE	Catalog Nbr: 0136		
	2017 FALL	Primary	Stephen Zemba	No Email on file.
(Cross-listed as CHBE136.) A study of health and environmental effects from air pollution, dispersion modeling, air pollution laws and regulations, fate and transport of air pollution, and design of pollution control equipment and processes. Recommendations: (ES 8 & CEE 32) or CHBE 22				

108908	Public Health			
	Subject: CEE	Catalog Nbr: 0057		
	2018 FALL	Primary	David Gute	david.gute@tufts.edu
An introduction to the public health approach is provided. The epidemiological model of the disease process is				

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used to study a variety of infectious and noninfectious diseases. The wide variety of nonmedical approaches to disease control is emphasized. The public health aspects of vital statistics, evaluation, and administrative decision making are introduced and applied to current problems in public health.
Recommendations: Consent of instructor.

108931	Hazardous Waste Treatment Technologies
Subject:	Catalog Nbr:
CEE	0138

(Cross-listed as CHBE138.) Hazardous waste treatment options based on physical, chemical, biological, and thermal processing technologies. Brief review of definitions and appropriate hazardous waste legislation. Introduction to pollution prevention. Traditional end-of-pipe treatment technologies. Applications to include solvent recovery, chemical fixation, land disposal, biodegradation, and special wastes. Incineration and associated environmental discharges constitute a major portion of course. Emerging technologies and evaluation of technical/economic process viability.
Recommendations: Senior standing or consent of instructor.

108951	Bioremediation: Natural And Enhanced
Subject:	Catalog Nbr:
CEE	0139

(Cross-listed as ENV 139). Biodegradation of organic contaminants is evaluated in natural settings and in treatment processes. Aerobic and anaerobic pathways, their prediction and control are examined. Water, soil, and vapor phase transformations are evaluated. Subject areas include kinetics, equilbria, sorption, gas transfer, and transformation products. Process design for treatment plants and in-situ applications applied to case studies.
Recommendations: CEE 132.

108982	Geomechanics
Subject:	Catalog Nbr:
CEE	0245
2018 SPRG	Primary Robert Viesca Robert.Viesca@tufts.edu

Introduction to the mechanics of solids focused on earth materials as porous, deformable media. Strain, stress, and equations of motion. Elasticity and seismic wave propagation. Failure, inelastic deformation, and plasticity. Role of pore fluid in deformation and failure. Consolidation. Fluid flow and Darcy's law; seepage forces and design considerations. Recommendations: ES-9, CEE-42

109003	Site Remediation
Subject:	Catalog Nbr:
CEE	0143
2018 FALL	Primary Paul Dombrowski Paul.Dombrowski@tufts.edu

Conventional and innovative remediation technologies are examined under the remedial

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investigation/feasibility study (RI/FS) process. Knowledge of fundamental processes governing remedy implementation is integrated with an understanding of site characterization and applicable regulations to enable design of site-specific treatment systems for clean-up of the contaminated subsurface environment.
Recommendations: CEE 12 and CEE 32, or consent of instructor

109024	Computer Methods In Geotechnical Engineering
Subject: CEE	Catalog Nbr: 0145

Computer methods for processing subsurface information and for analyzing geotechnical/geoenvironmental engineering problems. Applications to be selected from settlement, deformation, bearing capacity, slope stability, pile driving, seepage, and soil amplification analyses. Finite element and finite difference applications.
Recommendations: CEE 42

109049	Foundation Engineering
Subject: CEE	Catalog Nbr: 0146
2018 FALL	Primary Lucy Jen Lucy.Jen@tufts.edu

Foundation engineering design, with emphasis on bearing capacity and settlement for shallow (footings) and deep (pile) foundations. Design of footings, rafts, piles, and piers subjected to axial and lateral loads; building code requirements for design; and evaluation and selection of foundation types and alternatives. Case studies.
Recommendations: CEE 42.

109068	Geotechnical Earthquake Engineering
Subject: CEE	Catalog Nbr: 0247

Review of seismicity, fault-rupture mechanisms, vibration and wave propagation theory. Deterministic and probabilistic seismic hazard analysis including ground motion prediction equations. Dynamic behavior of soils, including soil amplification concepts, liquefaction, and ground response analysis. Application of soil dynamics in terms of design codes and design ground motions. Recommendations: CEE 42 and ES56.

109086	Earth Support Systems
Subject: CEE	Catalog Nbr: 0149
2018 SPRG	Primary Lucy Jen Lucy.Jen@tufts.edu

Examination of earth pressure theories and design problems related to earth-retaining structures and tunnels. Analysis and design of braced and unbraced excavations; code requirements; strut-waler systems; tie backs; ground movement control; reinforced earth and slurry wall methods. Slope stability analysis related to excavations and retaining structures.

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Recommendations: CEE 42.

109111	Principles Epidemiology			
Subject:	Catalog Nbr:			
CEE	0154			
2018 FALL	Primary	Mark Woodin	mark.woodin@tufts.edu	
(Cross-listed as NUTR 204 and CH 154.) Methods that quantify disease processes in human populations. Topics include study design, sources of inaccuracy in experimental and observational studies, the methodology of data collection, and an introduction to the statistical evaluation of epidemiological data. Cannot receive credit for both CEE 154 and CEE 54				

109134	Occupational And Environmental Health			
Subject:	Catalog Nbr:			
CEE	0158			
2018 SPRG	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu	
(Cross-listed as ENV 158.) An examination of current topics in the area of occupational and environmental health, with particular emphasis on the types of materials that produce human health effects. Both clinical and epidemiologic data will be used to assess the public health importance of environmental pollutants and to evaluate the effectiveness of control strategies Recommendations: Senior standing or consent of instructor.				

109167	Project Study In Human Systems A			
Subject:	Catalog Nbr:			
BME	0120			
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu	
(Cross-listed as ENP 120 and PSY 120.) A senior-level project design (capstone course), led by faculty from engineering and psychology as well as outside lecturers. Students participate in team fashion in human factors design problems set by industry sponsors. Professional-level work is required, including report preparation and presentations. Timely lectures supplement the projects. Recommendations: BME/ENP 161, 162, PSY 31, 32, 130. This is a yearlong course. Students will receive 3 credits at the completion of the second semester.				

109187	Epidemiological Methods			
Subject:	Catalog Nbr:			
CEE	0155			
2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu	
(Continuation of CEE154.) Topics include the principles of data analysis, including hypothesis testing and estimation, options in study design, internal validity, screening programs, registries, and genetics. Both theoretical and practical aspects of each topic will be discussed.				

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Recommendations: CEE 154 or CEE 54

109213	Environmental Toxicology			
Subject:	Catalog Nbr:			
CEE	0157			
2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu	

(Cross-listed as ENV 167.) This course is designed to present the basic scientific principles of toxicology and the relationship of toxicology to health-based risk assessment and hazardous materials management. The toxic effects of hazardous substances on specific organ systems are described, as well as the mechanisms of action of some frequently encountered environmental contaminants. Specialized topics related to the field of toxicology are also discussed, including animal to human extrapolation of data, mutagenicity/carcinogenicity, and teratogenesis.
Recommendations: Senior standing or consent of instructor.

109218	Quantitative Physiology I			
Subject:	Catalog Nbr:			
BME	0121			
2017 FALL	Primary	Brian Timko	Brian.Timko@tufts.edu	
2018 FALL	Primary	Lauren Black III	Lauren.Black@tufts.edu	

(Cross-listed as EE 121). Coursework designed for students interested in advanced work in biomedical engineering. A quantitative approach to cell physiology, nerve/muscle interaction, the cardiovascular system, and the respiratory system, through the study of vital biological signals and their measurement. Anatomy and physiology of each organ system. Current engineering efforts in instrumentation and basic science to further study each system's physiology.
Recommendations: BME/EE/ES 50, BIO 1 or BIO 13 or ES 11, or permission of instructor.

109266	Quantitative Physiology II			
Subject:	Catalog Nbr:			
BME	0122			
2018 SPRG	Primary	Lauren Black III	Lauren.Black@tufts.edu	

(Cross-listed as EE 122). A laboratory course designed for students interested in advanced work in biomedical engineering. The course will involve labs covering nerve physiology, skeletal muscle physiology, and cardiopulmonary physiology, through the study of vital biological signals and their measurement. The course will be structured in modules, with labs in each module focused on 1) measurement and acquisition of the physiological data of interest and 2) computational modeling of acquired physiological data.
Recommendations: BME/EE/ES 121 or BIO 115, BME/EE/ES 50, BIO 13 or ES 11, or Permission of instructor.

109277	Health Effects And Risk Assessment
Subject:	Catalog Nbr:
CEE	0153

Course Bulletin

	2018 SPRG	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu

A study of chronic and acute human health effects of exposure to hazardous materials. Principles of toxicology and pharmacokinetics of toxic substances. Standards for environmental quality, risk assessment methodologies, and risk communication strategies.
Recommendations: CHEM 1 or 16, senior standing and consent of instructor

109287	**Biophysics**

Subject:	Catalog Nbr:			
BME	0125			
	2018 SPRG	Primary	Peggy Cebe	peggy.cebe@tufts.edu

(Cross-listed as BIO 119, PHY 25 .) Presentation at an introductory level of selected topics in physics relevant to modern medicine and biology. Development of topics to the point of application to biomedical problems. Topics drawn from acoustics, physics of fluids, diffusion, laser physics, and other subjects varying from year to year. Offered alternate years. (Also offered as lower-level.)
Recommendations: PHY 1, 2, or 11, 12 or permission of instructor. Corequisite: MATH 42 (formerly MATH 13).

109305	**Principles Of Medical Imaging**

Subject:	Catalog Nbr:			
BME	0131			
	2018 SPRG	Primary	Sergio Fantini	sergio.fantini@tufts.edu

(Cross-listed as EE 131 and BIO 131.) This interdisciplinary course presents the principles of medical imaging techniques such as diagnostic ultrasound, radiography, X-ray computed tomography (CT), and magnetic resonance imaging (MRI). For each imaging modality, topics include the physical principles, key aspects of instrumentation design, mathematical methods, and the anatomical/physiological information content of the images. Representative medical images will be discussed and interpreted. This course cannot be taken for basic science requirement for engineering students.
Recommendations: MATH 32 (formerly MATH 11), PHY 2 or 12, or permission of instructor.

109326	**Analytical Tools For Biomedical Engineering**

Subject:	Catalog Nbr:			
BME	0141			
	2018 FALL	Primary	Sergio Fantini	sergio.fantini@tufts.edu

Statistical methods of data analysis with emphasis upon biomedical applications. Fourier analysis, probability, Bayes' theorem, interpretation of diagnostic tests (sensitivity, specificity, predictive values), random variables, covariance and correlation, normal distribution, samples, statistical tests, linear systems, spectral analysis, correlation, coherence, phase analysis, independent component analysis, principal component analysis. Students are required to review, critique, and prepare written and oral reports of selected research articles published in the literature.
Recommendations: MATH 42 (formerly MATH 13), or permission of instructor.

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109329	Legal Issues Of Engineering
Subject:	Catalog Nbr:
CEE	0185

This course examines the legal principles applicable to engineering design, construction, and manufacturing. Topics covered include introduction to the legal system, sources of law, contract law principles, professional liability risks, risk management practices, contract administration, differing site conditions claims, professional registration, and ethical issues.
Recommendations: Junior standing or consent of instructor

109349	Geographical Information Systems
Subject:	Catalog Nbr:
CEE	0187

2017 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu

Spatial analysis with Geographic Information Systems (GIS), including their use for engineering applications. GIS data structure and management, techniques for spatial analysis. Applications including seismic hazard, water resources, and environmental health. Laboratory exercises in GIS.
Recommendations: ES 56.

109370	Building Information Modeling
Subject:	Catalog Nbr:
CEE	0188

Storage and organization of technical building information using Building Information Modeling (BIM). Use of geometric visualization, rendering, animation, walkthrough, and construction sequencing to gain efficiencies in 3D design review and construction management. Applications in constructability and coordination of civil structures. Laboratory experiences using industry standard software. Recommended: ES 18.

109378	Biomechanics
Subject:	Catalog Nbr:
BME	0149

Graduate-level seminar course designed for students who are interested in getting a broad overview of different research methods and analytical techniques in human factors/ergonomics research. Topics to be covered are related to the acquiring, recording, and analyzing of empirical data. Theory underlying these methods in human factors/ergonomics research is also studied.

109421	Special Topics
Subject:	Catalog Nbr:
CEE	0193

2017 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
2017 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2017 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu

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	2018 FALL	Primary	Elena Naumova	elena.naumova@tufts.edu
	2018 FALL	Primary	Shan Jiang	Shan.Jiang@tufts.edu
	2018 SUMR	Primary	David Gute	david.gute@tufts.edu

Topical courses offered within civil and environmental engineering.

109444	Microprocessor Architecture And Applications W/lab

Subject:	Catalog Nbr:			
EE	0014			
	2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu

Introduction to the microprocessor with a comparative analysis of some popular forms; memory devices, interface devices, and other support circuitry; machine language and assembly language programming. Microprocessor use in dedicated applications. The course includes a laboratory devoted to software and hardware design. Fall.
Recommendations: ES 4, some programming experience.

109449	Land Use Planning II

Subject:	Catalog Nbr:
CEE	0201

(Cross-listed as UEP 201 and ENV 201.) An overview of land use planning methods, growth dynamics, and land development controls. Comparison of different approaches to land use planning and decision making. Impact of recent environmental legislation on land use. Techniques of mapping, site analysis, subdivision regulation, development controls, and fiscal incentives.
Recommendations: Consent of instructor.

109476	Environmental Statistics

Subject:	Catalog Nbr:			
CEE	0202			
	2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu

(Cross-listed as ENV 202). Methods for analyzing environmental data, which is often censored, skewed, and correlated in space and time. Topics include exploratory data analysis, nonparametric methods, hypothesis testing, multivariate statistics, frequency analysis, uncertainty analysis, experimental design, and model building.
Recommendations: ES 56 or equivalent

109495	Environmental Law

Subject:	Catalog Nbr:
CEE	0207

(Cross-listed as UEP 207 and ENV 207.) Analysis of environmental law and natural resource management at the federal, Tribal, state and local levels of government. The course is designed for those planing careers in environmental science, land use planning and environmental management and should be of value to others

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interested in learning about the structure of the nation's primary pollution statues and mechanisms for managing and protecting natural resources.

109516	Electromagnetic Fields And Waves W/lab

Subject: EE | Catalog Nbr: 0018

2018 SPRG | Primary | Thomas Vandervelde | tvanderv@ece.tufts.edu

Coordinate systems and transformations, base vectors, scalar and vector point functions, gradient, divergence, curl, Laplacian, divergence theorem, Stokes theorem, source-point and field-point notation, electrostatic and magnetostatic fields and laws, scalar and vector potential functions, continuity equation, Maxwell's equations in differential and integral form, boundary conditions, wave equation, time-harmonic fields, plane waves, electromagnetic radiation, dipole antenna, Poynting theorem, distributed circuits and transmission lines. Associated laboratory work.
Recommendations: ES 3, PHYS 12, MATH 51 (formerly MATH 38).

109523	Chemical Principles In Environmental & Water Resources Engineering

Subject: CEE | Catalog Nbr: 0212

2017 FALL | Primary | Wayne Chudyk | wayne.chudyk@tufts.edu

Basic principles of water chemistry related to environmental and water resources engineering. Thermodynamics, chemical equilibrium, acid-base reactions, alkalinity, complexation, precipitation, dissolution, sorption, and reduction-oxidation reactions. Quantitative problem solving. Fall.
Recommendations: CHEM 1 or equivalent.

109537	Introduction To Human Factors And Ergonomics

Subject: BME | Catalog Nbr: 0160

Same as BME 61, with additional requirements for graduate students. A practical introduction to human performance and to designing for human use. Studies include human factors, ergonomics, work stations, and environmental and legal concerns that impact on design. Examples of good and bad designs illustrate course principles. Includes a semester-long technical project and paper. (Also offered as lower-level.)

109542	Transport Principles In Environmental & Water Resources Engineering

Subject: CEE | Catalog Nbr: 0213

2018 FALL | Primary | C. Andrew Ramsburg | Andrew.Ramsburg@tufts.edu

An examination of transport phenomena in the natural or engineered environment. Topics include: momentum transport, energy transport, mass transport, interphase mass transfer, and environmental applications of ideal and non-ideal reactor models. Students will enhance their ability to apply a first principles approach for analysis of complex environmental systems. Fall.

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Recommendations: MATH 51 (formerly MATH 38) and ES 8, or equivalents

109559	**Human Factor Product Design**			
Subject:	Catalog Nbr:			
BME	0161			
2018 SPRG	Primary	James Intriligator	James.Intriligator@tufts.edu	
(Cross-listed as ENP 161.) Material relevant in consumer product design, biomedical engineering, architectural design, and machine design. Topics include design methodologies, user feedback techniques, performance measurements, sensory evaluation techniques, creative design, and prototyping. Extensive individual and group project design work. Emphasis on designing and creativity. Recommendations: EN 1, 2, ENP 61, PSY 31, 32, 53, and junior standing, or permission of instructor.				

109562	**Environmental And Water Resource Systems**			
Subject:	Catalog Nbr:			
CEE	0214			
2018 SPRG	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu	
Mathematical models of water resource and environmental systems are presented in combination with optimization procedures, decision theory, and environmental applied statistics to generate an integrated approach to the planning, design, and management of complex water resources systems. Water resources systems applications are formulated as decision problems where an optimal solution is sought, yet cost, safety, environment, and technology appear as competing constraints. Applications include regional water quality management; siting treatment plants; reservoir system operations; and design, irrigation, flood control, and watershed planning.				

109563	**Electronics I W/lab**			
Subject:	Catalog Nbr:			
EE	0021			
2018 SPRG	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu	
Characteristics of the operational amplifier; amplifiers and active filters using the operational amplifier; analysis and design of filters using phasors; characteristics of junction diodes, analysis and design of diode circuits; field-effect transistors, MOSFET device operation, small-signal models and the low-frequency analysis of transistor amplifiers; Elementary MOS amplifier configurations. Associated laboratory work. Students may not take both EE 21 and either EE 11 or EE 13 for credit. Recommendations: ES 3.				

109571	**Electronics II W/lab**			
Subject:	Catalog Nbr:			
EE	0022			
2017 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu	
2018 FALL	Primary	Kemal Kulovic	Kemal.Kulovic@tufts.edu	

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Integrated circuit realizations of MOS transistor circuits, current mirrors, active loads; Bipolar Junction Transistors, (BJT), device operation, small signal model and analysis, elementary BJT amplifier configuration; differential amplifiers, multi-stage amplifiers; frequency response of amplifiers; feedback and stability in analog circuits, nyquist stability criteria, frequency compensation; RC oscillators, LC oscillators, and waveform generators; output structures; power amplifiers; AM/FM circuits. Associated laboratory work. Students may not take both EE 22 and EE 12 for credit.
Recommendations: EE 21.

109580	Molecular Biotechnology			
Subject:	Catalog Nbr:			
BME	0162			
2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu	
2018 SPRG	Primary	Niall Lennon	No Email on file.	
2018 SUMR	Primary	Dana Cairns	Dana.Cairns@tufts.edu	
2018 SUMR	Primary	Nina Dinjaski	Nina.Dinjaski@tufts.edu	

(Cross-listed as BIO 162 and CHBE 162.) Overview of key aspects of molecular biology and engineering aspects of biotechnology. Lecture topics include molecular biology, recombinant DNA techniques, immunology, cell biology, protein purification, fermentation, cell culture, combinatorial methods, bioethics, and bioinformatics. Includes a semester-long technical project and oral presentation. (Also offered as lower-level.)

109581	Advanced Solid Mechanics
Subject:	Catalog Nbr:
CEE	0221

(Cross-listed as ME 221). Mechanics of deformable bodies based on equilibrium, geometry of strain, and properties of materials. Theory of elasticity, plasticity, viscoelasticity and creep.

109588	Linear Systems			
Subject:	Catalog Nbr:			
EE	0023			
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu	

Vector spaces, orthogonality, the continuous and discrete bi-lateral and uni-lateral Fourier transform, the bi-lateral and uni-lateral Laplace transform, convolution, and correlation; Introduction to discrete Fourier transform and Fast Fourier transform via MatLab; the Z transform.; matrices, eigenvectors, and eigenvalues; numerical methods for linear systems through stability and causality for control systems for analog applications and up-sampling an down-sampling for discrete systems. Students may not take both EE 23 and EE 102 for credit.
Recommendations: EE 21 and MATH 51 (formerly MATH 38).

109635	Recombinant DNA Techniques
Subject:	Catalog Nbr:

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BME	0163			
2017 SUMR		Primary	David Kaplan	david.kaplan@tufts.edu
2018 SUMR		Primary	Wenwen Huang	Wenwen.Huang@tufts.edu
2018 SUMR		Primary	Zaira Martin Moldes	Zaira.Martin_Moldes@tufts.edu

(Cross-listed as BIO 163 and CHBE 163.) This lecture and laboratory course is designed to familiarize the student with methods employed to produce recombinant products. The lectures cover fundamental aspects of the recombinant DNA methodologies used in the laboratory as well as some commercial applications of the techniques. The laboratory provides hands-on experience with the key skills used in genetic engineering including DNA isolation, restriction enzyme mapping, cloning and selection, protein expression, gel electrophoresis, polymerase chain reaction, DNA sequencing, and related techniques.
Recommendations: CHEM 1, BIO 13, or permission of instructor.

109650	**Advanced Structural Dynamics**
Subject:	Catalog Nbr:
CEE	0225

The design of structures and structural elements to resist dynamic loads. Applications of classical, numerical, and shock spectrum methods to problems in engineering seismology, blast resistance, shock and vibration isolation, and impact, including linear and nonlinear effects.
Recommendations: CEE 105 and 106.

109681	**Advanced Structural Design**
Subject:	Catalog Nbr:
CEE	0228

Please see departmental website for detailed course description.
Recommendations: Consent of instructor

109688	**Principles Of Controlled Release And Drug Delivery**			
Subject:	Catalog Nbr:			
BME	0165			
2018 FALL		Primary	Anthony Barry	Anthony.Barry@tufts.edu

Fundamentals of drug product development and formulation with particular emphasis on novel and developing technologies for controlled release and drug delivery for biopharmaceuticals. Course includes coverage of formulation principles and discussion of the interplay between physiology, pathophysiology and dosage form development, pharmacokinetics, and novel materials used in controlled release.
Recommendations: CHEM 1 or 16, BIO 13 or ES 11, ES 2, and MATH 34 (formerly MATH 12), or permission.

109702	**Digital Logic Systems W/lab**			
Subject:	Catalog Nbr:			
EE	0026			
2018 SPRG		Primary	Chorng Chang	chorng.chang@tufts.edu

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Integrated circuit logic families and their characteristics. Review of combinatorial and sequential design using SSI devices. Arithmetic circuits, shift registers, and counters. Random access and read only memories. Design of memory systems. Waveshaping devices and display devices. Programmable logic arrays and their applications. Asynchronous and synchronous system design using MSI and LSI devices. Finite state machines and the specification of system controllers. Systematic approaches to controller realization. Associated laboratory work. Spring.
Recommendations: ES 4 and EE 14, or permission.

109704	Reactive Transport In Porous Media
Subject: CEE	Catalog Nbr: 0230

The fundamental processes governing component transported in porous media. Volume averaging, dispersion, reactive transport, non-linear and non-equilibrium sorption, anomalous transport, mass transfer, multiphase flow and transport. Theoretical foundation on which to base critical assessments of component transport in complex porous media. Spring (alternating years).
Recommendations: CEE 213 or consent of instructor.

109717	Junior Design Project
Subject: EE	Catalog Nbr: 0031

2018 SPRG Primary Ronald Lasser Ron.Lasser@tufts.edu

Junior level team project with ECE faculty direction and guidance. Introduction of the engineering method: concept, planning and analysis, design, test. Integration of theoretical concepts from circuit theory, digital and analog electronics, signal processing, engineering economics, and engineering design practices to deliver a working prototype. Use of microcontroller and peripherals, analog-to-digital converters, digital signal-processors, memory and computer aided design tools. Students are expected to provide schedules, schematics and specifications; build prototypes; present their projects orally; and deliver a working system.
Pre-reqs: EE or Comp-Eng Majors. EE 14, EE 21,and EE 23 or permission of instructor

109730	Biology of Water & Health
Subject: CEE	Catalog Nbr: 0251

2018 FALL Primary David Gute david.gute@tufts.edu

109743	Computer Interface Design
Subject: BME	Catalog Nbr: 0166

2018 SPRG Primary Jonathan Tilliss Jonathan.Tilliss@tufts.edu

(Cross-listed as ENP 166.) This hands-on course challenges students to design computer-based products and

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systems that are easy to learn and use. Lectures cover the user interface-design process, basic design principles, and design evaluation methods. In-class exercises and projects reinforce the students' understanding of the lecture material and provide practical design experience. Students use computer-based prototyping tools to model and demonstrate their design solutions. Frequent guest lectures by user-interface design specialists from industry.
Recommendations: EN 1, 2, and junior standing, or permission of instructor.

109751	Laboratory And In-situ Measurement Of Soil Property

Subject: CEE | Catalog Nbr: 0244 | 2017 FALL | Primary | John Germaine | John.Germaine@tufts.edu

In-depth study of various laboratory and in-situ tests used to measure the shear strength, compressibility, and permeability of soils. Laboratory work includes index, consolidation, and triaxial tests. Field tests discussed include SPT, cone, vane, pressuremeter, and dilatometer. Discussion of methods used to process laboratory and field data. Report writing and hands-on laboratory testing.
Recommendations: CEE 42.

109757	Introduction To Biomedical Engineering

Subject: EE | Catalog Nbr: 0050

(Cross-listed as BME 50.) An introduction to the interdisciplinary nature of biomedical engineering. The biological, chemical, electrical, and mechanical principles involved in the design and operation of medical devices. Biopotentials, electrodes, transducers, biocompatibility of materials, and patient safety. Fall.
Recommendations: PHY 2 or PHY 12, or permission of instructor.

109773	Biotechnology Processing Projects Lab

Subject: BME | Catalog Nbr: 0168 | 2018 SUMR | Primary | Hyunmin Yi | Hyunmin.Yi@tufts.edu

(Cross-listed as CHBE 168 and BIO 168.) Laboratory experience with techniques in biotechnology processing: fermentation of recombinant E. coli cells, hybridoma cell culture, purification of protein and antibodies and related analytical procedures. Laboratories accompanied by lectures and relevant readings to cover the underlying principles.

109782	Corporate Management Of Environmental Issues

Subject: CEE | Catalog Nbr: 0265 | 2018 FALL | Primary | Ann Rappaport | ann.rappaport@tufts.edu

(Cross-listed as UEP 265 and ENV 265.) Explores companies' responses to pressure from stockholders, regulatory agencies, community and nongovernmental organizations to exercise greater responsibility toward

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the environment. Topics include strategy, staffing and organization, decision making, codes of conduct, resources, program development, product responsibility, pollution prevention, trade associations, and foreign operations.

109786	**Seminar**
Subject: EE	Catalog Nbr: 0092
An undergraduate course devoted to the study of the special problems in electrical engineering. Please see departmental website for specific details.	

109798	**Seminar In Biotechnology**
Subject: BME	Catalog Nbr: 0169
(Cross-listed as CHBE169 and BIO 169.) Seminar course. Journal articles on current biotechnology-related research are reviewed and presented. Leading researchers in the field present seminars and students assess future research directions based on in-depth review of articles and presentations.Please see departmental website for specific details:http://ase.tufts.edu/biology/	

109799	**Special Topics**			
Subject: EE	Catalog Nbr: 0093			
	2017 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 SPRG	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
Content and prerequisites to be announced. Please see departmental website for specific details.				

109812	**Directed Study**			
Subject: EE	Catalog Nbr: 0094			
	2018 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 SPRG	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
Guided independent study of an approved topic. Please see departmental website for specific details.				

109825	**Tissue Engineering Research Laboratory**			
Subject: BME	Catalog Nbr: 0175			
	2017 FALL	Primary	Bruce Panilaitis	bruce.panilaitis@tufts.edu
	2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu
	2018 FALL	Primary	Chiara Ghezzi	Chiara.Ghezzi@tufts.edu
To gain hands-on experience in the field of tissue engineering by preparing and characterizing scaffold				

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biomaterials, expansion and handling human adult stem cell, preparation and use of bioreactors and assembling a functional system to grow a tissue. In addition, safety, ethical, and general laboratory protocol issues are covered.

109827	Subsurface Fluid Dynamics

Subject:	Catalog Nbr:			
CEE	0287			
	2018 FALL	Primary	Grant Garven	Grant.Garven@tufts.edu

(Cross-listed as EOS 287). Advanced theory in groundwater hydrology. Topics include: hydrodynamics of groundwater flow; Darcy's Law in porous sediments and fractured rocks; fluid potential; flow nets and hodographs; vorticity of inhomogeneous fluids; physics of the unsaturated zone; two-phase flow in petroleum reservoirs and carbon sequestration; flow in deforming media; aqueous mass transport in reactive formations; fluid and heat transport in geothermal reservoirs.
Recommendations: MATH 51 (formerly MATH 38) and ES 8, or equivalents

109844	Special Projects

Subject:	Catalog Nbr:
EE	0095

Undergraduate research under supervision of a member of the department. Please see departmental website for specific details.

109848	Introduction Biomedical Devices

Subject:	Catalog Nbr:
BME	0180

An introduction to the principles and applications of biomedical microdevices, with emphasis on miniaturization and the integration of diverse, leading-edge technologies to produce devices and systems for medical diagnosis and therapy. Basic principles of optics, electronics, mechanics, and microfluidics are explored as they apply to the development of new bioMEMS, fiberoptic, and electronic devices for sensing, data acquisition, and analysis. Discussions are to include micro-devices for hearing, endoscopy, imaging, and various clinical and diagnostic applications.

109857	Master's Seminar

Subject:	Catalog Nbr:			
CEE	0291			
	2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
	2018 SPRG	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
	2018 SPRG	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu

Presentation of individual reports on basic topics to a seminar group for discussion and criticism. Please see departmental website for specific details.

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109875	Drug Product Formulation			
Subject:	Catalog Nbr:			
BME	0185			
2018 SPRG		Primary	Bernardo Perez-Ramirez	No Email on file.
(Cross-listed as CHBE 185). Drug Product Formulation.				

109878	Special Projects			
Subject:	Catalog Nbr:			
EE	0096			
Undergraduate research under supervision of a member of the department. Please see departmental website for specific details.				

109879	Graduate Seminar			
Subject:	Catalog Nbr:			
CEE	0292			
2018 FALL		Primary	John Germaine	John.Germaine@tufts.edu
2018 SPRG		Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
2018 SPRG		Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
Presentation of individual reports on basic topics to a seminar group for discussion and criticism. Please see departmental website for specific details. Recommendations: Consent of instructor				

109909	Senior Design Project			
Subject:	Catalog Nbr:			
EE	0097			
2018 FALL		Primary	Ronald Lasser	Ron.Lasser@tufts.edu
A comprehensive design project undertaken during the senior year, individually or as a team, under the guidance of a faculty supervisor. The work is spread over two terms.Please see departmental website for specific details. Pre Requisites: EE 31 or equivalent or permission of instructor.				

109926	Special Topics			
Subject:	Catalog Nbr:			
CEE	0293			
2018 FALL		Primary	Richard Hooper	Richard.Hooper@tufts.edu
2018 FALL		Primary	Amy Pickering	Amy.Pickering@tufts.edu
2018 SPRG		Primary	Christopher Swan	chris.swan@tufts.edu
2018 SPRG		Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2018 SPRG		Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu

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	2018 SPRG	Primary	Grant Garven	Grant.Garven@tufts.edu
	2018 SPRG	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
Topical courses offered within civil and environmental engineering.				

109965	**Senior Design Project**			
Subject:	Catalog Nbr:			
EE	0098			
	2018 SPRG	Primary	Ronald Lasser	Ron.Lasser@tufts.edu
A comprehensive design project undertaken during the senior year, individually or as a team, under the guidance of a faculty supervisor. The work is spread over two terms.Please see departmental website for specific details. Recommendations: Senior standing and permission of instructor and EE 97.				

109970	**Master's Thesis**			
Subject:	Catalog Nbr:			
CEE	0295			
	2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
	2018 FALL	Primary	David Gute	david.gute@tufts.edu
	2018 FALL	Primary	John Durant	john.durant@tufts.edu
	2018 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
	2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
	2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
	2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
	2018 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
	2018 FALL	Primary	Brian Brenner	brian.brenner@tufts.edu
	2018 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu
	2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
	2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
	2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
	2018 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
	2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
	2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
	2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
	2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
	2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
	2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
	2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
	2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
	2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu
	2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu
	2018 SPRG	Primary	Linda Abriola	Linda.Abriola@tufts.edu
	2018 SPRG	Primary	Kurt Pennell	Kurt.Pennell@tufts.edu

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	2018 SPRG	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu

Guided research on a topic that has been approved as a suitable subject for a master's thesis. Required: Consent of instructor.

109987	**Master's Thesis II**			
Subject:	Catalog Nbr:			
CEE	0296			
	2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
	2018 FALL	Primary	David Gute	david.gute@tufts.edu
	2018 FALL	Primary	John Durant	john.durant@tufts.edu
	2018 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
	2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
	2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
	2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
	2018 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
	2018 FALL	Primary	Brian Brenner	brian.brenner@tufts.edu
	2018 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu
	2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
	2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
	2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
	2018 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
	2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
	2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
	2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
	2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
	2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
	2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
	2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
	2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
	2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu
	2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu
	2018 SPRG	Primary	Linda Abriola	Linda.Abriola@tufts.edu
	2018 SPRG	Primary	Kurt Pennell	Kurt.Pennell@tufts.edu
	2018 SPRG	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu

Guided research on a topic that has been approved as a suitable subject for a master's thesis. Required: CEE 295 and consent of instructor.

110024	**Doctoral Thesis II**			
Subject:	Catalog Nbr:			
CEE	0298			
	2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu

Course Bulletin

	2018 FALL	Primary	David Gute	david.gute@tufts.edu
	2018 FALL	Primary	John Durant	john.durant@tufts.edu
	2018 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
	2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
	2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
	2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
	2018 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
	2018 FALL	Primary	Brian Brenner	brian.brenner@tufts.edu
	2018 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu
	2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
	2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
	2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
	2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
	2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
	2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
	2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
	2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
	2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
	2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
	2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
	2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu
	2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu
	2018 SPRG	Primary	Elena Naumova	elena.naumova@tufts.edu
	2018 SPRG	Primary	Linda Abriola	Linda.Abriola@tufts.edu
	2018 SPRG	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
	2018 SPRG	Primary	Kurt Pennell	Kurt.Pennell@tufts.edu
	2018 SPRG	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu
Guided research on a topic suitable for a doctoral dissertation. Required: CEE 297 and consent of instructor.				

110039	**Undergraduate Internship In Electrical Engineering**			
Subject: EE	Catalog Nbr: 0099			
	2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
	2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
	2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
	2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
	2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
	2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
	2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
	2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
	2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
	2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
	2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu

Course Bulletin

	2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
	2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
	2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu
	2018 SPRG	Primary	Alva Couch	alva.couch@tufts.edu

Supervised internships at suitable locations in industry and government. Jobs offered on basis of availability. Term paper required. Credit not given retroactively. Prior arrangements necessary.

110042	**Doctoral Thesis III**

Subject:	Catalog Nbr:			
CEE	0299			
	2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
	2018 FALL	Primary	David Gute	david.gute@tufts.edu
	2018 FALL	Primary	John Durant	john.durant@tufts.edu
	2018 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
	2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
	2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
	2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
	2018 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
	2018 FALL	Primary	Brian Brenner	brian.brenner@tufts.edu
	2018 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu
	2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
	2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
	2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
	2018 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
	2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
	2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
	2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
	2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
	2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
	2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
	2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
	2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
	2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu
	2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu
	2018 SPRG	Primary	Linda Abriola	Linda.Abriola@tufts.edu
	2018 SPRG	Primary	Kurt Pennell	Kurt.Pennell@tufts.edu
	2018 SPRG	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Required: CEE 298 and consent of instructor.

110067	**Non Major Credit**

Subject:	Catalog Nbr:
CEE	0310

Course Bulletin

110073	Design Of Medical Instrumentation			
Subject:	Catalog Nbr:			
EE	0100			
2018 SPRG	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu	
(Cross-listed as BME 100.) An introduction to the design principles of microprocessor-based medical instrumentation and simple biomedical signal analysis. Topics include the origin of bioelectric potentials, characteristics of various biological signals, transducers, A/D converters, analog and digital filters, instrumentation amplifiers, patient isolation, battery powered equipment, and microprocessor design. Each student will be required to complete a paper design of a biomedical instrument. Spring. Recommendations: ES 3.				

110097	Lower Level Elective Crd			
Subject:	Catalog Nbr:			
CEE	0320			

110117	Special Topics			
Subject:	Catalog Nbr:			
BME	0193			
2017 FALL	Primary	Janet Krevolin	Janet.Krevolin@tufts.edu	
2017 FALL	Primary	Jean-Michel Molenaar	Jean-Michel.Molenaar@tufts.edu	
2017 FALL	Primary	Hoda Koushyar	Hoda.Koushyar@tufts.edu	
2018 FALL	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu	
2018 FALL	Primary	Skander Limem	Skander.Limem@tufts.edu	
Guided study of an approved topic.				

110120	Upper Level Crd			
Subject:	Catalog Nbr:			
CEE	0330			

110137	Special Topics			
Subject:	Catalog Nbr:			
BME	0194			
2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu	

Course Bulletin

2018 SPRG	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 SPRG	Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 SPRG	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 SPRG	Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 SPRG	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 SPRG	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 SPRG	Primary	Brian Timko	Brian.Timko@tufts.edu
2018 SPRG	Primary	Steven Jacques	Steven.Jacques@tufts.edu
2018 SPRG	Primary	Anh Hoang	Anh.Hoang592095@tufts.edu

Guided study of an approved topic. Please see departmental website for details.

110141	**Master's Degree Continuation-pt**
Subject:	Catalog Nbr:
CEE	0401

Part-time.Please see departmental website for specific details.

110161	**Optics And Wave Motion**
Subject:	Catalog Nbr:
BME	0215

2018 FALL	Primary	Gary Goldstein	gary.goldstein@tufts.edu

(Cross-listed as PHY 31). Propagation of electromagnetic waves; geometrical optics; polarization; optical properties of metals, insulators, and semiconductors; Fraunhofer and Fresnel diffraction; interference; Fourier optics. Lectures and laboratories.
Recommendations: PHY 2 or 2N or 12 or 12N. Corequisite: MATH 42 (formerly MATH 13)

110187	**Master's Degree Continuation-ft**
Subject:	Catalog Nbr:
CEE	0402

Full-time.Please see departmental website for specific details.

110203	**Principles Of Biomedical Engineering**
Subject:	Catalog Nbr:
BME	0250

2018 FALL	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu

(Cross-listed as EE 250). The role of biomedical engineering in the diagnosis and treatment of various pathologies such as cardiovascular disease, cancer, diabetes, and neurological disorders. For each disease model, biomedical engineering principles are used to examine the function of the organ, mechanisms of the disease, diagnostic tools, and treatment approaches. Covered biomedical engineering areas include biomaterials, implantable devices, bioimaging techniques, gene therapy, and biosensors.

Course Bulletin

Recommendations: ES 121 or equivalent, or permission of instructor.

110221	Graduate Teaching Assistant

Subject:	Catalog Nbr:			
CEE	0405			
2018 FALL	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
2018 FALL	Primary	David Gute	david.gute@tufts.edu
2018 FALL	Primary	John Durant	john.durant@tufts.edu
2018 FALL	Primary	James Limbrunner	James.Limbrunner@tufts.edu
2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu
2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
2018 FALL	Primary	Steven Chapra	steven.chapra@tufts.edu
2018 FALL	Primary	Brian Brenner	brian.brenner@tufts.edu
2018 FALL	Primary	Laurie Baise	laurie.baise@tufts.edu
2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2018 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu

Please see departmental website for specific details.

110231	Graduate Introduction To Biophotonics

Subject:	Catalog Nbr:			
BME	0251			
2018 SPRG	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG	Secondary	Martin Hunter	Martin.Hunter@tufts.edu

A graduate-level version of BME 51. Additional homework problems and a term paper are required for graduate level credit.
Recommendations: PHY 31, or BME 215, or permission of instructor. Graduate students only.

110242	Graduate Research Assistant

Subject:	Catalog Nbr:

Course Bulletin

CEE	0406			
2018 FALL		Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
2018 FALL		Primary	David Gute	david.gute@tufts.edu
2018 FALL		Primary	John Durant	john.durant@tufts.edu
2018 FALL		Primary	James Limbrunner	James.Limbrunner@tufts.edu
2018 FALL		Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
2018 FALL		Primary	Christopher Swan	chris.swan@tufts.edu
2018 FALL		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
2018 FALL		Primary	Steven Chapra	steven.chapra@tufts.edu
2018 FALL		Primary	Brian Brenner	brian.brenner@tufts.edu
2018 FALL		Primary	Laurie Baise	laurie.baise@tufts.edu
2018 FALL		Primary	Eric Hines	Eric.Hines@tufts.edu
2018 FALL		Primary	Linda Abriola	Linda.Abriola@tufts.edu
2018 FALL		Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
2018 FALL		Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2018 FALL		Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
2018 FALL		Primary	Richard Hooper	Richard.Hooper@tufts.edu
2018 FALL		Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
2018 FALL		Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
2018 FALL		Primary	Robert Viesca	Robert.Viesca@tufts.edu
2018 FALL		Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
2018 FALL		Primary	John Germaine	John.Germaine@tufts.edu
2018 FALL		Primary	Amy Pickering	Amy.Pickering@tufts.edu
2018 FALL		Primary	Helen Suh	Helen.Suh@tufts.edu
2018 FALL		Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu

Please see departmental website for specific details.

110281	**Graduate Quantitative Biomaterials Characterization Laboratory I**			
Subject:	Catalog Nbr:			
BME	0256			
2017 FALL		Primary	Martin Hunter	Martin.Hunter@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu

(SPRING 2013 & BEYOND). Graduate quantitative biomaterials characterization laboratory I. A graduate version of BME 56 including BME56 topics and weekly journal club meetings focused on critical reviews of current biophotonics articles.

110292	**Doctoral Degree Continuation-pt**
Subject:	Catalog Nbr:
CEE	0501

Part-time.Please see departmental website for specific details.

Course Bulletin

110334	Introduction To Vlsi Design			
Subject:	Catalog Nbr:			
EE	0103			
2017 FALL	Primary	Valencia Koomson		Valencia.Koomson@tufts.edu
An introduction to CMOS VLSI design. Topics include the structure of the MOS transistor, theory of operation, fabrication methods, CMOS circuit design, subsystem design, the PLA and finite state machines, introduction to memory design, system timing techniques. Students will design a circuit of modest complexity. Recommendations: Senior standing or permission of instructor.				

110340	Graduate Quantitative Biomaterials Characterization Laboratory II
Subject:	Catalog Nbr:
BME	0257
A graduate version of BME 57 including BME57 topics and weekly journal club meetings focused on critical reviews of current biophotonics articles. Recommendations: BME 56, or BME 256. Graduate students only.	

110348	Doctoral Degree Continuation-ft
Subject:	Catalog Nbr:
CEE	0502
Full-time.Please see departmental website for specific details.	

110360	Graduate Seminar			
Subject:	Catalog Nbr:			
BME	0291			
2018 FALL	Primary	Brian Timko		Brian.Timko@tufts.edu
Biomedical engineering seminar series and presentation of individual reports to a seminar group for discussion.				

110369	Probabilistic Systems Analysis			
Subject:	Catalog Nbr:			
EE	0104			
2017 FALL	Primary	Brian Aull		Brian.Aull@tufts.edu
2018 FALL	Primary	Eric Miller		Eric.Miller@tufts.edu
Advanced analysis in probabilistic systems with strong emphasis on theoretical methods. Development of analytical tools for the modeling and analysis of random phenomena with application to problems across a range of engineering and applied science disciplines. Probability theory, sample and event spaces, discrete and continuous random variables, conditional probability, expectations and conditional expectations, and derived distributions. Sums of random variables, moment generating functions, central limit theorem, laws of large numbers. Statistical analysis methods including hypothesis testing, confidence intervals and nonparametric methods. Undergraduates may not take both EE 0024 and EE 0104 for degree credit.				

Course Bulletin

Prerequisite: Math 0042 or equivalent. Recommendation: Senior or graduate standing or consent of instructor.

110409	**Graduate Seminar**			
Subject:	Catalog Nbr:			
BME	0292			
2018 SPRG		Primary	Brian Timko	Brian.Timko@tufts.edu
Biomedical engineering seminar series and presentation of individual reports to a seminar group for discussion.				

110437	**Special Topics**			
Subject:	Catalog Nbr:			
BME	0293			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu
Guided individual study of an approved topic.				

110444	**Feedback-control Systems**			
Subject:	Catalog Nbr:			
EE	0105			
2017 FALL		Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL		Primary	Brian Aull	Brian.Aull@tufts.edu
Modern control and fundamentals of state-feedback including matrix differential equations, controllability, state transformations, canonical forms, and control matrix design. Classical control and output-feedback with topics including transfer functions, s-plane analysis, stability criteria, PID controllers, root locus, controller design using op-amps, and compensation networks. Prerequisite: EE23 and Math 70; OR graduate standing				

110453	**Special Topics**
Subject:	Catalog Nbr:
BME	0294
Guided individual study of an approved topic.	

Course Bulletin

110472	Master's Thesis			
Subject:	Catalog Nbr:			
BME	0295			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu
2018 FALL		Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu
Guided research on an approved topic suitable for a master's thesis.				

110493	Advanced Feedback-control Systems
Subject:	Catalog Nbr:
EE	0106
A continuation of EE 105. Topics include an introduction to digital control systems, difference equations, the Z-transform, implementation of the discrete filter, th W-transform, stability of sample-data systems, an introduction to state-space concepts and the control of multivariable systems. Spring. Recommendations: EE 105.	

110513	Master's Thesis			
Subject:	Catalog Nbr:			
BME	0296			
2018 SPRG		Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 SPRG		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 SPRG		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 SPRG		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 SPRG		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 SPRG		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 SPRG		Primary	Brian Timko	Brian.Timko@tufts.edu
Guided research on an approved topic suitable for a master's thesis.				

110537	Doctoral Thesis
Subject:	Catalog Nbr:
BME	0297

Course Bulletin

2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL	Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL	Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL	Primary	Brian Timko	Brian.Timko@tufts.edu
2018 FALL	Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu

Guided research on a topic suitable for a doctoral dissertation.

110573	**Doctoral Thesis**

Subject: BME — Catalog Nbr: 0298

2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 SPRG	Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 SPRG	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 SPRG	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 SPRG	Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 SPRG	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 SPRG	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 SPRG	Primary	Brian Timko	Brian.Timko@tufts.edu

Guided research on a topic suitable for a doctoral dissertation.

110627	**Master Of Engineering Project**

Subject: BME — Catalog Nbr: 0299

2018 FALL	Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL	Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL	Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL	Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL	Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL	Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL	Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL	Primary	Brian Timko	Brian.Timko@tufts.edu
2018 FALL	Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu

Execution of a major project under the guidance of a faculty adviser. Each project must address a substantive engineering analysis or design problem. Students are required to submit a written report and make an oral

Course Bulletin

presentation of their project work. Students are expected to enroll in this course in the last term of their degree program. Enrollment is limited to and required for matriculated students in the master of engineering program.
Recommendations: Enrollment is limited to and required for matriculated students in the master of engineering program.

110652	Communications Systems
Subject: EE	Catalog Nbr: 0107
2018 FALL	Primary Mai Vu Mai.Vu@tufts.edu
Fundamentals of analog and digital communication systems. Analog and digital modulations, including AM, FM, pulse code modulation, PAM, PSK, QAM techniques. Effects of noise and transmission medium on communication performance via the signal-to-noise ratio, bit error rate and inter-symbol interference. Concept of channel capacity. Associated laboratory work and design project. Prerequisites: EE23, EE24	

110660	Non Major Credit
Subject: BME	Catalog Nbr: 0310

110688	Wireless Communications
Subject: EE	Catalog Nbr: 0108
2018 SPRG	Primary Mai Vu Mai.Vu@tufts.edu
Wireless propagation characteristics, path loss, shadowing and fading; statistical channel models; wireless channel capacity; fading and diversity techniques, multiple antenna and MIMO techniques, multicarrier and OFDMA techniques; multiuser systems, cellular and ad hoc wireless networks. Prerequisites: EE107 or equivalent, EE104 or equivalent	

110710	Lower Level Elective Crd
Subject: BME	Catalog Nbr: 0320

110747	Upper Level Elective Crd
Subject: BME	Catalog Nbr: 0330

Course Bulletin

110815	Master's Continuation			
Subject:	Catalog Nbr:			
BME	0401			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu
2018 FALL		Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu
Master's Continuation - Part Time				

110867	Master's Continuation
Subject:	Catalog Nbr:
BME	0402
Full-time.	

110902	Grad Teaching Assistant			
Subject:	Catalog Nbr:			
BME	0405			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu

110929	Grad Research Assistant
Subject:	Catalog Nbr:
BME	0406

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110955	Doctoral Continuation - Part Time

Subject:	Catalog Nbr:
BME	0501

Doctoral Continuation - Part Time

110988	Doctoral Continuation - Full Time

Subject:	Catalog Nbr:			
BME	0502			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Mark Cronin-Golomb	mark.cronin-golomb@tufts.edu
2018 FALL		Primary	Sergio Fantini	sergio.fantini@tufts.edu
2018 FALL		Primary	Irene Georgakoudi	Irene.Georgakoudi@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Lauren Black III	Lauren.Black@tufts.edu
2018 FALL		Primary	Qiaobing Xu	Qiaobing.Xu@tufts.edu
2018 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2018 FALL		Primary	Brian Timko	Brian.Timko@tufts.edu
2018 FALL		Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu

Full-time doctoral continuation.

111244	Semiconductor Devices

Subject:	Catalog Nbr:			
EE	0113			
2018 SPRG		Primary	Brian Aull	Brian.Aull@tufts.edu

Introduction to semiconductor physics; quantum mechanics, equilibrium distribution; charge transport; P-N junction theory; diodes; bipolar junction transistors; field-effect devices; heterojunction devices; novel semiconductor devices such as carbon nanotubes.
Recommendations: EE 21 and MATH 51 (formerly MATH 38).

111296	Entrepreneurship And Business Planning

Subject:	Catalog Nbr:			
ELS	0101			
2017 FALL		Primary	Mark Ranalli	No Email on file.
2018 FALL		Primary	Tina Weber	Tina.Weber@tufts.edu
2018 FALL		Primary	Joshua Wiesman	Joshua.Wiesman@tufts.edu
2018 FALL		Primary	Jonathan Mixter	jay.mixter@tufts.edu
2018 SPRG		Primary	Lana Caron	Lana.Caron@tufts.edu

This course focuses on investigating, understanding, and implementing the process of founding a start-up firm. Elements of searching out new venture opportunities, matching skills with a new venture, financing,

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competitive strategy, intellectual property, and operating a new venture will be explored. The focus of the course will be the development and presentation of a business plan created by teams of students with various academic backgrounds.

111335	Entrepreneurial Finance

Subject:	Catalog Nbr:			
ELS	0103			
2018 FALL	Primary	Alicia Amaral	Alicia.Amaral@tufts.edu
2018 FALL	Primary	Frank Apeseche	Frank.Apeseche@tufts.edu

This course focuses on understanding how to construct the data and find appropriate financing for a startup venture. Various forms of financing are introduced: vendor financing, factoring, etc. Through a medley of tests, case studies, and team exercises, students exercise basic financial skills such financial statement formulation, NPV analysis and scenario analysis. The course focuses as much attention on how to reject a bad idea as support a good one.
Recommended: at least one core ELS class or accounting elective

111371	Entrepreneurial Marketing

Subject:	Catalog Nbr:			
ELS	0105			
2018 FALL	Primary	John Derby	Jack.Derby@tufts.edu
2018 FALL	Primary	Gavin Finn	Gavin.Finn@tufts.edu

This course focuses on institutional and product marketing methods used by start-up to medium-sized companies. After an overview of basic marketing principles, the course will cover the spectrum from day-to-day marketing activities of the entrepreneurial business to positioning and strategy. Students will learn to analyze, formulate, and implement marketing strategies, explore concepts for understanding customer behavior and creating entrepreneurial marketing strategy, and learn the fundamentals of market research, pricing, and reaching and selling to customers.

111394	Entrepreneurial Leadership

Subject:	Catalog Nbr:			
ELS	0107			
2018 FALL	Primary	Pamela Stepp	Pamela.Stepp@tufts.edu
2018 FALL	Primary	Elizabeth McCarthy	Elizabeth.McCarthy@tufts.edu

This course is designed to help students develop the knowledge, confidence, skills, and self-image necessary to pursue entrepreneurial ventures in such domains as business, government, and public service. It provides a foundation in the fundamentals of entrepreneurial leadership, as well as a source of inspiration and energy in the art and science of taking visions and bringing them to reality.

111412	Introduction Microwaves

Subject:	Catalog Nbr:

Course Bulletin

EE	0117			
2018 FALL		Primary	Mohammed Afsar	mohammed.afsar@tufts.edu

Transmission and reflection of guided waves. The Smith chart and matching. Scattering parameters and flow graphs. Biological effects. Laboratory measurement of power, frequency, attenuation, Q-factor, and time-domain reflectometry. Fall.
Recommendations: EE 18, or 13 and permission of instructor.

111425	**Innovative Social Enterprises**			
Subject:	Catalog Nbr:			
ELS	0141			
2018 SPRG		Primary	Julianne Zimmerman	Julianne.Zimmerman@tufts.edu

(Cross-listed as AMER 141 & TCS 141) Social entrepreneurs bring innovative, practical solutions to social problems. Entrepreneurs are opportunity oriented, resourceful, value-creating change agents. Social entrepreneurs are similar, but they focus on public problems. Students will consider the role of social enteprises in improving society, and learn to develop a business plan to create enduring social impact: Identify social impact model, plan needed activities and resources, conduct market research and create a marketing plan, build a team, prepare a financial model, and create a plan to attract the support the mission requires.
Recommendations: Sophomore standing.

111441	**Special Topics**			
Subject:	Catalog Nbr:			
ELS	0193			
2017 FALL		Primary	Mark Ranalli	No Email on file.
2018 SPRG		Primary	Scott Warren	No Email on file.
2018 SPRG		Primary	Josef Volman	Josef.Volman@tufts.edu

Special Topics.Please see departmental website for specific details.
Recommended: at least one core ELS class or accounting elective

111448	**Microwave Semiconductor Devices And Circuits**			
Subject:	Catalog Nbr:			
EE	0118			
2017 FALL		Primary	Mohammed Afsar	mohammed.afsar@tufts.edu

Varistor and varactor diodes, PIN diodes, microwave transistors, negative resistance devices. Gallium arsenide properties and technology. Receiving mixers, transmitting modulators, amplifiers, oscillators, switches, limiters, duplexers, phase shifters, and harmonic generators. Laboratory characterization of devices and circuits, including noise measurements. Spring.
Recommendations: EE 117 or permission of instructor.

111461	**Special Topics**
Subject:	Catalog Nbr:

Course Bulletin

ELS	0194			
2017 FALL		Primary	Steven Koltai	Steven.Koltai@tufts.edu
2018 FALL		Primary	John Derby	Jack.Derby@tufts.edu
2018 FALL		Primary	Nancy Lippe	Nancy.Lippe@tufts.edu
2018 FALL		Primary	Tina Weber	Tina.Weber@tufts.edu
2018 SPRG		Primary	Partha Ghosh	Partha.Ghosh@tufts.edu
2018 SPRG		Primary	Gavin Finn	Gavin.Finn@tufts.edu
2018 SPRG		Primary	Christopher Manos	Christopher.Manos@tufts.edu
2018 SPRG		Primary	Mark Ranalli	No Email on file.

Special Topics. Please see departmental website for specific details.

111478	**Entrepreneurial Fieldstudy**			
Subject:	Catalog Nbr:			
ELS	0199			
2018 SPRG		Primary	Mark Ranalli	No Email on file.

This course enables students to apply the learning and skills acquired by other courses on entrepreneurship. Students have the option of starting a new business based on an actual business plan or consulting in an actual start-up operation. Students who select the new business option will be expected to submit a project-scope paper that outlines the elements of the launch that could be accomplished within the term limits.

111499	**Non Major Credit**
Subject:	Catalog Nbr:
ELS	0310

111514	**Lower Level Elective Crd**
Subject:	Catalog Nbr:
ELS	0320

111531	**Upper Level Elective Crd**
Subject:	Catalog Nbr:
ELS	0330

111575	**Engineering Management**
Subject:	Catalog Nbr:
EM	0051

Course Bulletin

2018 FALL	Primary	Monica Pheifer	Monica.Pheifer@tufts.edu
2018 FALL	Primary	Jennifer Braggin	Jennifer.Braggin@tufts.edu

Organization of companies and engineering groups. Financial fluency, including time value of money, return on investment, income and cash flow statements, and balance sheets. Management of people and organizations. Project and program management techniques and tools. Management of research, development, and design. Operations management, including manufacturing operations and supply chains.

111589	Technical & Managerial Communication

Subject: EM | Catalog Nbr: 0052

2018 FALL	Primary	Amy Hirschfeld	amy.hirschfeld@tufts.edu

Written and oral communications in the business setting. Written communications including technical reports and papers, memoranda, and electronic communications. Design and delivery of effective presentations. Informal communication styles and techniques. Communication across cultures.

111606	Engineering Leadership

Subject: EM | Catalog Nbr: 0054

2018 FALL	Primary	Annette Sawyer	Annette.Sawyer@tufts.edu

Development of knowledge, skills, and mindset essential for leading programs and teams in a business organization. Topics include understanding personalities of self and others, emotional intelligence, creating high performance teams, influencing without authority, managing conflict, fostering creativity, creating shared visions, and organizational change. Communicating to inspire. Cultural differences in leadership style. Ethical considerations.

111626	Management Of Innovation

Subject: EM | Catalog Nbr: 0153

2018 FALL	Primary	Samuel Liggero	Samuel.Liggero@tufts.edu
2018 SPRG	Primary	Eli Cushner	Eli.Cushner@tufts.edu

Knowledge and skill development for students who aspire to lead and manage innovation initiatives in technology based companies. Technology strategy and its role in the overall business strategy of commercial firms. Role of innovation in entrepreneurial ventures and established firms. Skills to present new product development proposals to senior management and/or prospective investors.

111642	Quantitative Methods for Data-Driven Design

Subject: EM | Catalog Nbr: 0210

2017 FALL	Primary	Mary Viola	Mary.Viola@tufts.edu
2017 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

Course Bulletin

Application-oriented engineering tools and techniques, including data analysis, simulations and modeling, statistical process control, and experimental design.

111662	Developing Winning Projects

Subject:	Catalog Nbr:			
EM	0220			
	2017 FALL	Primary	Mary Viola	Mary.Viola@tufts.edu
	2017 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

In depth treatment of both business and technical aspects of new product development, including voice of the customer, concept generation and evaluation, marketing, supply chain, intellectual property and usability.

111692	Computer Animation For Technical Communications

Subject:	Catalog Nbr:
EE	0120

Create 2-D and 3-D animations to present and analyze complex scientific topics. Examples include NASA visualizations of atmospheric data and aerospace design mathematics of 3-D space, rotation, and displacement. Rendering algorithms including Phong, Garoud, and Ray Tracing. Hands-on experience in animation and graphic development, including manipulation of scanned images, storyboarding, video production, and CD-ROM technology. Computer-based lectures augmented with major animation and CD-ROM projects. Fall.
Recommendations: COMP 11.

111726	Project & Operations Management

Subject:	Catalog Nbr:			
EM	0230			
	2017 FALL	Primary	Mary Viola	Mary.Viola@tufts.edu
	2017 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

Series of modules providing best practices in project management, operations management, supply chain, and an introduction to finance and accounting.

111783	Physiology For Engineers I

Subject:	Catalog Nbr:			
EE	0121			
	2017 FALL	Primary	Brian Timko	Brian.Timko@tufts.edu
	2018 FALL	Primary	Lauren Black III	Lauren.Black@tufts.edu

(Cross-listed as BME 121). Coursework designed for students interested in advanced work in biomedical engineering. A quantitative approach to cell physiology, nerve/muscle interaction, the cardiovascular system, and the respiratory system, through the study of vital biological signals and their measurement. Anatomy and physiology of each organ system. Current engineering efforts in instrumentation and basic science to further study each system's physiology.

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Recommendations: BME/EE/ES 50, BIO 1 or BIO 13 or ES 11, or permission of instructor.

111798	**Global Strategic Management**			
Subject:	Catalog Nbr:			
EM	0240			
2018 SPRG	Primary	Mary Viola	Mary.Viola@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	
Introduction to a strategy development for high technology businesses. Explores the basis of competition, core competencies, functional (technology, marketing, supply chain) strategies, best practices in innovation, and multinational growth.				

111823	**Humanistic Perspectives on Leadership**			
Subject:	Catalog Nbr:			
EM	0250			
2018 SPRG	Primary	Mary Viola	Mary.Viola@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	
Introduction to responsible leadership through the lens of classical literary works. Increases students' understanding of cultural, social and ethical contexts of leadership in complex and uncertain environments.				

111837	**Leading Teams and Organizations**			
Subject:	Catalog Nbr:			
EM	0260			
2018 SPRG	Primary	Mary Viola	Mary.Viola@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	
Development of the interpersonal skills necessary for leadership. Involves 360 degree assessment tools. Topics include creating high performance teams,, giving feedback, influencing without authority, managing conflict, fostering creativity, communicating to inspire and working across cultures.				

111855	**Industry Consulting Project – Team Practicum**			
Subject:	Catalog Nbr:			
EM	0270			
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	
2018 SUMR	Primary	Mary Viola	Mary.Viola@tufts.edu	
2018 SUMR	Primary	Kevin Oye	Kevin.Oye@tufts.edu	
Team consulting project, conducted at a local business during summer intersession to provide students with opportunity to apply classroom learning.				

111898	**Quantitative Physiology II**
Subject:	Catalog Nbr:

Course Bulletin

EE	0122

(Cross-listed as EE 122). A laboratory course designed for students interested in advanced work in biomedical engineering. The course will involve labs covering nerve physiology, skeletal muscle physiology, and cardiopulmonary physiology, through the study of vital biological signals and their measurement. The course will be structured in modules, with labs in each module focused on 1) measurement and acquisition of the physiological data of interest and 2) computational modeling of acquired physiological data. Recommendations: BME/EE/ES 121 or BIO 115, BME/EE/ES 50, BIO 13 or ES 11, or Permission of instructor.

111911	**Capstone Leadership Project**

Subject:	Catalog Nbr:			
EM	0280			
2018 FALL		Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu
2018 SPRG		Primary	Mary Viola	Mary.Viola@tufts.edu

Student led 'real-life' engineering project to demonstrate business acumen and leadership skills. Project must be complex and involve risk with a 6-9 month duration, often done with the student's current employer.

111932	**Non Major Credit**

Subject:	Catalog Nbr:
EM	0310

111951	**Lower Level Elective Crd**

Subject:	Catalog Nbr:
EM	0320

111969	**Upper Level Elective Crd**

Subject:	Catalog Nbr:
EM	0330

111990	**Masters Continuation - Part Time**

Subject:	Catalog Nbr:			
EM	0401			
2017 FALL		Primary	Mary Viola	Mary.Viola@tufts.edu

Part-time.Please see departmental website for specific details.

112032	**Digital Signal Processing**

Course Bulletin

Subject:	Catalog Nbr:			
EE	0125			
	2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu

Discrete signals and systems, digital simulation of analog systems. Z transforms, recursion equations, finite-order systems. Fourier transforms, line spectra and Fourier series, discrete Fourier series and Fast Fourier Transforms (FFT). Sampling and interpolation, mean-square approximations. Nonrecursive and recursive filters. Selected topics on algorithms, design and applications of digital signal processing. Fall.

112034	**Masters Degree Continuation**			
Subject:	Catalog Nbr:			
EM	0402			
	2018 FALL	Primary	Mary Viola	Mary.Viola@tufts.edu

Full-time.Please see departmental website for specific details.

112076	**Computer Engineering W/lab**			
Subject:	Catalog Nbr:			
EE	0126			
	2017 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 FALL	Primary	Joel Grodstein	Joel.Grodstein@tufts.edu

(Cross-listed w/ COMP146) Topics covered include computer abstractions, performance measurements, instruction set architectures, designing processor datapath and control, pipelining, memory hierarchy, I/O, multiprocessors. The associated lab consists of designing, implementing, and validating a simplified MIOS processor using Verilog, a hardware description language. Fall.
Recommendations: EE 14.

112117	**Information Theory**			
Subject:	Catalog Nbr:			
EE	0127			
	2018 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu

Information theory as a systematic framework to address fundamental laws and limits of data compression and digital communication. Source coding/data compression; information measures on discrete memory-less sources; practical schemes and algorithms for lossless data compression such as Huffman coding, arithmetic coding, Lempel-Ziv Coding; channel coding for reliable communication and rate distortion for lossy source compression. Advanced topics such as information theoretic cryptography. Recommendations: EE 104 or permission of instructor.

112309	**Operating Systems**			
Subject:	Catalog Nbr:			
EE	0128			
	2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu

Course Bulletin

(Cross-listed as COMP 111). Fundamental issues in operating system design. Concurrent processes: synchronization, sharing, deadlock, scheduling. Relevant hardware properties of uniprocessor and multiprocessor computer systems.
Recommendations: COMP 15 and either COMP 40 OR EE 14.

112329	Introduction To Computing In Engineering

Subject: ES | Catalog Nbr: 0002

2018 SPRG | Primary | Brian Tracey | brian.tracey@tufts.edu

An introduction to engineering problem-solving with the aid of computational software. Scientific computing concepts will be introduced including number representation, arrays, structured programming techniques, and good coding practices. Basic numerical and data analysis methods will be introduced including numerical differentiation and integration, matrix operations, descriptive statistics, curve fitting, and optimization. Examples drawn from a variety of engineering disciplines will give students extensive practice in coding solutions and applying them to data.

112452	Computer Communication Networks

Subject: EE | Catalog Nbr: 0129

2018 FALL | Primary | Chorng Chang | chorng.chang@tufts.edu

Data communications concepts. Communications networking techniques: switching and broadcast networks, access protocols, local networks. Design issues, overview of current products. Computer communications architecture: hardware/software issues, protocols and architecture, layered approach and hierarchical approach. Prerequisite: senior or graduate electrical engineering degree candidate, or consent.
Recommendations: Senior or graduate electrical engineering degree candidate, or permission of instructor.

112629	Principles Of Medical Imaging

Subject: EE | Catalog Nbr: 0131

2018 SPRG | Primary | Sergio Fantini | sergio.fantini@tufts.edu

(Cross-listed as BIO 131 and BME 131.) This interdisciplinary course presents the principles of medical imaging techniques such as diagnostic ultrasound, radiography, X-ray computed tomography (CT), and magnetic resonance imaging (MRI). For each imaging modality, topics include the physical principles, key aspects of instrumentation design, mathematical methods, and the anatomical/physiological information content of the images. Representative medical images will be discussed and interpreted. This course cannot be taken for basic science requirement for engineering students.
Recommendations: MATH 32 (formerly MATH 11), PHY 2 or 12, or permission of instructor.

112651	Digital Image Processing

Subject: | Catalog Nbr:

Course Bulletin

EE	0133			

Fundamentals and some practical applications of digital image processing. Topics include image formation, sampling, and quantization; distortions due to lens aberrations, image motion and detector noise; image enhancement and restoration by spatial filtering and maximum entropy; image coding for bandwidth compression by DPCM, transform coding, and entropy coding; and image understanding.
Recommendations: EE 23 or permission of instructor.

112656	Introduction To Electrical Systems W/ Lab			
Subject:	Catalog Nbr:			
ES	0003			
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu	
2018 FALL	Primary	Ronald Lasser	Ron.Lasser@tufts.edu	

Definitions of circuit elements, fundamental laws, selected network theorems, controlled sources, introduction to the oscilloscope, energy and power, natural response and complete response of first order circuits, steady state sinusoidal behavior, algebra of complex numbers, phasors, impedance, average and reactive power, introduction to analog and digital systems, frequency response and filters, measurements and instrumentation, introduction to computer applications for circuit analysis and design. Associated laboratory project work.
Recommendations: Must be preceded or accompanied by MATH 34 (formerly MATH 12).

112675	Advanced Electromagnetics			
Subject:	Catalog Nbr:			
EE	0135			
2018 SPRG	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu	

Stationary electric and magnetic fields. Differential and integral forms of Maxwell's equations. Time-harmonic fields and potential functions. Electromagnetics of circuits. Transmission line transients and coupling. Plane wave propagation. Guided wave propagation. Electromagnetic radiation. Electromagnetic properties of materials. Practical applications. Fall.
Recommendations: EE 18 or equivalent.

112721	Antennas For Radar, Avionics, And Communications			
Subject:	Catalog Nbr:			
EE	0136			
2017 FALL	Primary	Khaled ElMahgoub	Khaled.ElMahgoub@tufts.edu	

Definition of fields, radiation patterns, sources, linearity, and superposition. Antennae parameters: gain, effective aperture, beamwidth, sidelobes, impedance, polarization, and bandwidth. Radiation: electric dipole, multiple sources. Transmission lines and waveguides. Radiation from discontinuities, slots, and horns. Techniques of antenna measurements. Theory of antenna arrays. Spring.
Recommendations: Senior or graduate standing in electrical engineering or physics.

Course Bulletin

112747	Radar Engineering
Subject: EE	Catalog Nbr: 0137
2018 SPRG	Primary Khaled ElMahgoub Khaled.ElMahgoub@tufts.edu
Physical principles and basic equations. Pulsed, continuous-wave, and pulsed-Doppler radars. Antenna systems; transmitters; detection theory. Waveform considerations, including pulse compression. Principles of synthetic aperture radar. Miscellaneous topics: propagation, clutter, and airborne radar. Fall. Recommendations: EE 18 or equivalent.	

112767	Introduction To Digital Logic Circuits W/ Lab
Subject: ES	Catalog Nbr: 0004
2018 SPRG	Primary Karen Panetta Karen.Panetta@tufts.edu
Number systems and their conversions. Boolean algebra and Karnaugh map minimizations of Boolean expressions. Logic gates. Analysis and design of combinational logic circuits. Characteristics of various flip-flops. Analysis and design of sequential logic circuits. Design of counter and shift register circuits. Various binary codes and code conversion circuits. Binary arithmetic and arithmetic circuits. Introduction to iterative design. Associated laboratory work. Spring. Recommendations: ES 3.	

112912	Advanced Digital Signal Processing
Subject: EE	Catalog Nbr: 0145
Discrete time signals in time and frequency domains. Advanced topics in digital processing of continuous-time signals. Digital filter structures, design, implementation, finite wordlength effects. Multirate signal processing. Applications. Associated laboratory work. Recommendations: EE 125 or permission of instructor.	

112960	Analog And Mixed Signal Mos Integrated Circuit Design
Subject: EE	Catalog Nbr: 0147
Practical and theoretical aspects of analog and mixed-signal MOS IC design. Basic building blocks including current sources, gain stages, and two-stage opamps. Opamp circuit feedback and noise modeling. Switched capacitor (SC) circuits from Z-transform, sample hold circuit, SC filters, and SC gain circuit. Noise and nonlinear effects in SC circuits. Component matching, layout of analog building blocks. Fundamentals of data converters.	

112982	Silicon Radio Frequency Ic Design
Subject: EE	Catalog Nbr: 0148
2018 SPRG	Primary Mohammed Afsar mohammed.afsar@tufts.edu

Course Bulletin

An overview of Silicon Germanium BICMOS semiconductor process (SiGe) and technology. Bipolar and CMOS transistor models, resistor, capacitor and inductor models, process variation of devices, corner, statistical simulation techniques for the process, voltage and temperature variation, and device matching. Voltage gain, power gain and their conversions. Class A and B amplifiers, output power compression, and inter-modulation and IP3 from two tone analyses. Noise classification of bipolar transistor, noise figure definition and analysis. S-parameters and smith-charts. Applications including low-noise, cascade, differential, and various-gain amplifiers, as well as practical bias circuits for current and voltage reference (band-gap voltage). Associated laboratories utilizing Electronic Design Automation (EDA) tools.\
Recommendations: EE 11 and 12.

113042	**Introduction To Mechanics- Statics And Dynamics**

Subject: ES | Catalog Nbr: 0005

2018 FALL	Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu

Introduction to analysis and problem solving in statics and dynamics. Equilibrium of particles and rigid bodies in two and three dimensions. Vector and matrix analysis. Force-moment balance equations. Applications include trusses, frames, machines, beams, and friction problems. Kinematics and kinetics of particles and rigid bodies. Newton's equation, impulse-momentum, work and energy, Centroids and moments of inertia.
Recommendations: MATH 32 (formerly MATH 11) and PHY 11

113161	**Thermodynamics**

Subject: ES | Catalog Nbr: 0007

2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 SPRG	Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 SPRG	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu

A course stressing the concepts and the laws of classical thermodynamics. Thermodynamics functions, first law, second law, properties of pure substances, availability and irreversibility. Emphasis is placed on applying the thermodynamic mode of reasoning.

113270	**Fluid Mechanics**

Subject: ES | Catalog Nbr: 0008

2017 FALL	Primary	Robert Peattie	Robert.Peattie@tufts.edu
2017 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu

An introduction to fluids at rest and in motion. Fluid properties. Pressure and velocity variations in flows. Mass, momentum, and energy conservation in a flowing fluid. Bernoulli's equation and inviscid flows. An

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introduction to viscous flows. Dimensional analysis. Drag and lift of moving objects. Fall.

113357	Computer-aided Design Of Microwave Circuits
Subject:	Catalog Nbr:
EE	0160

Microwave network representation, scattering matrix, constant gain circles, stability and gain concepts, microwave amplifier design. Modeling of circuit elements: coaxial lines, striplines, microstriplines, coplanar lines, coupled lines, lumped elements. Sensitivities and measurement techniques. Constant noise circles and low-noise broad-band amplifier design. Microwave circuit analysis and gradient techniques, multiband and multimode optimization of filters, phase shifters, and switches. Extensive laboratory and project work using state-of-the-art CAD software.
Recommendations: EE 117

113425	Microwave Integrated Circuits
Subject:	Catalog Nbr:
EE	0161

Review of CAD techniques for microwave circuits. Substrate, conductor, dielectric, and resistive film materials for integrated circuits. Mask layout, mask layout tools, and mask fabrication. Hybrid microwave integrated circuits, monolithic integrated circuits, foundry requirements, hybrid versus monolithic circuits, performance and testing. Extensive laboratory work.
Recommendations: EE 160.

113468	Applied Mechanics (strength Of Materials)
Subject:	Catalog Nbr:
ES	0009

2018 SPRG Primary Luis Dorfmann Luis.Dorfmann@tufts.edu

Analysis of stress and strain. Behavior of isotropic materials, theories of failure. Behavior of members subjected to axial, torsional, and flexural loadings, combined stress, Mohr's circle, compression members and columns.
Recommendations: ES 5.

113601	Introduction To Materials Science
Subject:	Catalog Nbr:
ES	0010

2018 SPRG Primary Hyunmin Yi Hyunmin.Yi@tufts.edu

Structure of materials; chemical composition; phase transformations; properties of metals, ceramics, polymers, biopolymers, and related materials. Material selection in chemical and biological engineering applications.
Recommendations: MATH 34 (formerly MATH 12), CHEM 1 or 16.

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113663	Fundamentals Of Biological Systems			
Subject:	Catalog Nbr:			
ES	0011			
2017 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2017 FALL		Primary	Arsia Jamali	Arsia.Jamali@tufts.edu
2018 FALL		Primary	Madeleine Oudin	Madeleine.Oudin@tufts.edu

Fundamentals of biology in the context of engineering disciplines. Chemical and physical mechanisms underlying biological functions in complex environments. Case studies of relevance in various engineering disciplines, with a focus on cells and information transfer. May not be counted toward the Biology major. One may not receive credit for both ES 11 and BIO 13. Potential premedical students are advised to take BIO 13 instead of this course.
Recommendations: MATH 34 (formerly MATH 12), PHY 11, and CHEM 1.

113762	Electrical Engineering Seminar			
Subject:	Catalog Nbr:			
EE	0191			
2017 FALL		Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL		Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL		Primary	Mai Vu	Mai.Vu@tufts.edu

A course devoted to the study of special problems in electrical engineering. Please see departmental website for specific details.

113778	Electrical Engineering Seminar			
Subject:	Catalog Nbr:			
EE	0192			
2018 SPRG		Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu

A course devoted to the study of special problems in electrical engineering. Please see departmental website for specific details.

113810	Special Topics			
Subject:	Catalog Nbr:			
EE	0193			
2017 FALL		Primary	Karen Panetta	Karen.Panetta@tufts.edu
2017 FALL		Primary	Ronald Lasser	Ron.Lasser@tufts.edu
2017 FALL		Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL		Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL		Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL		Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
2018 FALL		Primary	Joel Grodstein	Joel.Grodstein@tufts.edu
2018 FALL		Primary	Khaled ElMahgoub	Khaled.ElMahgoub@tufts.edu

Course Bulletin

2018 FALL	Primary	Steven Bell	Steven.Bell@tufts.edu
2018 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu

Content and prerequisites to be announced. Please see departmental website for specific details.

113825	**Directed Study**		
Subject:	Catalog Nbr:		
EE	0194		
2018 SPRG	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 SPRG	Primary	Ming Chow	ming.chow@tufts.edu
2018 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 SPRG	Primary	Ronald Lasser	Ron.Lasser@tufts.edu
2018 SPRG	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 SPRG	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 SPRG	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 SPRG	Primary	Joel Grodstein	Joel.Grodstein@tufts.edu
2018 SPRG	Primary	Kemal Kulovic	Kemal.Kulovic@tufts.edu

Guided independent study of an approved topic at an intermediate level.

113886	**Honors Thesis**		
Subject:	Catalog Nbr:		
EE	0197		
2018 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu

Honors Thesis.Please see departmental website for specific details.

113925	**Internship**		
Subject:	Catalog Nbr:		
EE	0199		
2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

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	2018 SPRG	Primary	Alva Couch	alva.couch@tufts.edu
Supervised internships at suitable locations in industry and government. Jobs offered on basis of availability. Term paper required. Credit not given retroactively. Prior arrangements necessary. Please see departmental website for specific details.				

113948	**Digital Systems Design For Testability**
Subject: EE	Catalog Nbr: 0202
Fault modeling and simulation using VHDL. Test generation algorithms for combinational and sequential circuits. Testability techniques including ad hoc methods, scan design, and built-in self-test. Logic synthesis and testability, testability analysis and random pattern testability. Linear feedback shift registers, error-detecting codes, and self-checking codes. Requires a major design project and applications for industrial partners. Spring. Recommendations: EE 26.	

113998	**Environment And Technology**
Subject: ES	Catalog Nbr: 0025
2018 FALL	Primary Anne Marie Desmarais annemarie.desmarais@tufts.edu
(Cross-listed as ENV 25.) The impact and interaction of technology and the environment will be evaluated using historical examples. Environmental problems and their solutions will be evaluated from an engineering viewpoint. This course is a core requirement of the Environmental Studies program. Recommendations: CHEM 1 or 16 and sophomore standing	

114014	**Advanced Topics In Computer Architecture**
Subject: EE	Catalog Nbr: 0156
Modern computer architecture, starting from basic 5-stage pipelines and progressing to out-of-order superscalar processors, multicore processors, and heterogeneous processors. Techniques to maximize single-thread performance within the constraints of memory technology, power consumption, and the inherent instruction-level parallelism of applications. Current and future challenges faced by computer architects and computer-system designers. Discussion of research papers. Recommendations: EE 126 or COMP 46	

114097	**Detection And Estimation Theory**
Subject: EE	Catalog Nbr: 0229
A systematic development of optimal detection and estimation theory, including Bayesian, Maximum Likelihood (MLE), Maximum Aposteriori (MAP), and minimum mean squared error (MMSE) techniques. The	

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Karhunen-Loeue expansion for non-white noise is studied. Applications to digital and analog communications, and radar problems are included. Nonparametric approaches, spectral estimation, and spread spectrum systems are examined.
Recommendations: EE 108 or equivalent.

114115	Advanced Analog & Mixed Signal Ic Design

Subject: EE | Catalog Nbr: 0247

2018 SPRG | Primary | Sameer Sonkusale | sameer@ece.tufts.edu

Advanced topics in analog VLSI design, switched capacitor filters, continuous time filters, principles of nyquist rate analog to digital converters and digital to analog converters, oversampled delta sigma analog to digital converter design. Design and implementation of phase locked loops, frequency synthesizer and related building blocks for communication systems. Novel concepts in analog and mixed signal circuit design from current literature.
Recommendations: EE 147.

114138	Devices & Circuits For Optical Communications

Subject: EE | Catalog Nbr: 0249

Underlying principles and integrated circuit design techniques for optical communication systems (fiber-based and free-space). Optoelectronic device operation, receiver circuit fundamentals, noise analysis, transimpedance amplifiers, lasers and modulators, driver circuits, and clock/data recovery circuit blocks. Opto-electronic integration methods,modulation schemes, system-level simulation, and applications to problems in broadband communication and frequency-domain optical imaging are also presented. Projects employing VLSI CAD software.
Recommendations: EE 103 or consent of instructor. Corequisite: EE 147.

114161	Biomedical Engineering

Subject: EE | Catalog Nbr: 0250

2018 FALL | Primary | Qiaobing Xu | Qiaobing.Xu@tufts.edu

An introduction to the interdisciplinary nature of biomedical engineering. The biological, chemical, electrical, and mechanical principles involved in the design and operation of medical devices. Biopotentials, electrodes, transducers, biocompatibility of materials, and patient safety.

114174	Public Health Engineering

Subject: CEE | Catalog Nbr: 0052

2018 SPRG | Primary | Daniele Lantagne | Daniele.Lantagne@tufts.edu

(Cross-listed as ENV 27 and CH 52). An introduction to public health engineering. Elements of waterborne

Course Bulletin

disease control, hazardous materials management, occupational health and safety, and environmental interventions. Applications to environmental engineering and environmental engineering science.

114205	Plasma Engineering
Subject: EE	Catalog Nbr: 0251

Engineering applications and physics of gaseous plasmas. Plasma applications include integrated circuit fabrication; plasma displays; ion thrusters; plasma science coverage of Boltzmann equation; energy distribution functions; ion and electron transport; electromagnetic interaction with plasma; plasma sheath; collision statistics; mass and energy balance; analytical and numerical modeling.
Recommendations: EE 117 or equivalent, EE 104 or equivalent.

114290	Introduction To Chemical And Biological Engineering (chbe)
Subject: EN	Catalog Nbr: 0069

Fundamentals and applications of Chemical and Biological Engineering. Relevance of fundamental sciences (math, physics, chemistry, and biology), and basic chemical engineering concepts, including thermodynamics, transport phenomena, reaction kinetics, reactor and separation system design, in solving industrial problems. Introduction to chemical process synthesis, design, optimization, control, and economic analysis. Discussion of the many career paths choices for graduates in chemical and biological engineering. Guest speakers from a broad spectrum of industries employing Chemical Engineers, field trips to local companies, and a semester-long group project to research, describe, and design a process for the production of a common consumer chemical product.

114449	Master's Project
Subject: EE	Catalog Nbr: 0293

2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

Course Bulletin

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

114505	Non Major Credit
Subject:	Catalog Nbr:
EN	0310

114523	Lower Level Elective Crd
Subject:	Catalog Nbr:
EN	0320

114541	Upper Level Elective Crd
Subject:	Catalog Nbr:
EN	0330

114553	Master's Project
Subject:	Catalog Nbr:
EE	0294

2018 SPRG	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 SPRG	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 SPRG	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 SPRG	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 SPRG	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 SPRG	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 SPRG	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 SPRG	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 SPRG	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 SPRG	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 SPRG	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 SPRG	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 SPRG	Primary	Mai Vu	Mai.Vu@tufts.edu

Guided individual study of an approved topic suitable for a master's design project. Please see departmental website for specific details.

Course Bulletin

114616	Numerical Methods			
Subject:	Catalog Nbr:			
ES	0055			
2018 FALL		Primary	Steven Chapra	steven.chapra@tufts.edu

Introduction to using computers to solve engineering-oriented mathematical problems. Topics include mathematical modeling, round-off and truncation error, root location, linear algebraic equations, optimization, regression, interpolation, numerical differentiation and integration, ordinary and partial differential equations. Applications using software and programming languages.
Recommendations: ES 2 and MATH 51 (formerly MATH 38)

114618	Master's Thesis			
Subject:	Catalog Nbr:			
EE	0295			
2018 FALL		Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL		Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL		Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL		Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL		Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL		Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL		Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL		Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL		Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL		Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL		Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL		Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL		Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL		Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL		Primary	Mai Vu	Mai.Vu@tufts.edu

Guided research on a topic that has been approved as a suitable subject for a master's thesis. Please see departmental website for specific details.

114655	Probability And Statistics			
Subject:	Catalog Nbr:			
ES	0056			
2018 FALL		Primary	Helen Suh	Helen.Suh@tufts.edu
2018 SUMR		Primary	Wayne Chudyk	wayne.chudyk@tufts.edu

Application of the concepts of probability and statistics to problem solving in engineering systems. Topics include data reduction techniques, probability, probability distribution functions, error propagation, sampling distributions, estimation, hypothesis testing, simple comparative experiments, and linear regression. Examples are drawn from a variety of disciplines, including the environment, materials, manufacturing, computing, and process design.
Recommendations: MATH 42 (formerly MATH 13)

Course Bulletin

114664	Master's Thesis			
Subject:	Catalog Nbr:			
EE	0296			
2018 SPRG		Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 SPRG		Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 SPRG		Primary	Chorng Chang	chorng.chang@tufts.edu
2018 SPRG		Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 SPRG		Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 SPRG		Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 SPRG		Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 SPRG		Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 SPRG		Primary	Eric Miller	Eric.Miller@tufts.edu
2018 SPRG		Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 SPRG		Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 SPRG		Primary	Usman Khan	Usman.Khan@tufts.edu
2018 SPRG		Primary	Brian Tracey	brian.tracey@tufts.edu
2018 SPRG		Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 SPRG		Primary	Mai Vu	Mai.Vu@tufts.edu
Guided research on a topic that has been approved as a suitable subject for a master's thesis. Please see departmental website for specific details.				

114719	Doctoral Thesis			
Subject:	Catalog Nbr:			
EE	0297			
2018 FALL		Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL		Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL		Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL		Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL		Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL		Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL		Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL		Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL		Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL		Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL		Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL		Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL		Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL		Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL		Primary	Mai Vu	Mai.Vu@tufts.edu
Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.				

Course Bulletin

114755	Appropriate Technology In Sustainable Engineering
Subject: ES	Catalog Nbr: 0060
Selection of culturally appropriate technology and attainment of economic sustainability. Topics include community needs assessment, green manufacturing, societal issues, and sustainable implementation strategies. Emphasis on interdisciplinary approach at the intersection of community resource allocation, engineering technology, and government policy.	

114809	Doctoral Thesis			
Subject: EE	Catalog Nbr: 0298			
	2018 SPRG	Primary	Karen Panetta	Karen.Panetta@tufts.edu
	2018 SPRG	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
	2018 SPRG	Primary	Chorng Chang	chorng.chang@tufts.edu
	2018 SPRG	Primary	Douglas Preis	DPreis@eecs.tufts.edu
	2018 SPRG	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 SPRG	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
	2018 SPRG	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
	2018 SPRG	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
	2018 SPRG	Primary	Eric Miller	Eric.Miller@tufts.edu
	2018 SPRG	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
	2018 SPRG	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
	2018 SPRG	Primary	Usman Khan	Usman.Khan@tufts.edu
	2018 SPRG	Primary	Brian Tracey	brian.tracey@tufts.edu
	2018 SPRG	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
	2018 SPRG	Primary	Mai Vu	Mai.Vu@tufts.edu
Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.				

114828	Non Major Credit
Subject: EE	Catalog Nbr: 0310

114862	Lower Level Elective Crd
Subject: EE	Catalog Nbr: 0320

114869	Musical Instrument Design And Manufacture

Course Bulletin

Subject:	Catalog Nbr:			
ES	0073			
2018 FALL		Primary	Matthew Mueller	Matthew.Mueller@tufts.edu

(Cross-listed as ME 73) Review of the underlying engineering and the basic fabrication of musical instruments, including an introduction to musical acoustics, computer-based simulation tools, laboratory measurement, and manufacturing. The bulk of the class is dedicated to designing, simulating, building, and testing of an instrument.

114874	**Upper Level Elective Crd**
Subject:	Catalog Nbr:
EE	0330

114891	**Masters Degree Continuation**		
Subject:	Catalog Nbr:		
EE	0401		
2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

Part-time.Please see departmental website for specific details.

114927	**Masters Degree Continuation**		
Subject:	Catalog Nbr:		
EE	0402		
2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu

Course Bulletin

2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

Full-time.Please see departmental website for specific details.

114966	**Grad Teaching Assistant**

Subject:	Catalog Nbr:
EE	0405

2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu

114981	**Grad Research Assistant**

Subject:	Catalog Nbr:
EE	0406

2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu

114989	**Special Topics In Engineering**

Subject:	Catalog Nbr:
ES	0093

Guided study of chosen topics in Engineering and Engineering Science. Please see the School of Engineering Website for further details.
Recommendations: Permission of instructor.

114999	**Doctoral Degree Continuation**

Subject:	Catalog Nbr:
EE	0501

2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu

Course Bulletin

2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

Part-time.Please see departmental website for specific details.

115032	**Doctoral Degree Continuation**

Subject: EE — Catalog Nbr: 0502

2018 FALL	Primary	Karen Panetta	Karen.Panetta@tufts.edu
2018 FALL	Primary	Mohammed Afsar	mohammed.afsar@tufts.edu
2018 FALL	Primary	Chorng Chang	chorng.chang@tufts.edu
2018 FALL	Primary	Douglas Preis	DPreis@eecs.tufts.edu
2018 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
2018 FALL	Primary	Sameer Sonkusale	sameer@ece.tufts.edu
2018 FALL	Primary	Valencia Koomson	Valencia.Koomson@tufts.edu
2018 FALL	Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu
2018 FALL	Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL	Primary	Aleksandar Stankovic	alex.stankovic@tufts.edu
2018 FALL	Primary	Usman Khan	Usman.Khan@tufts.edu
2018 FALL	Primary	Brian Tracey	brian.tracey@tufts.edu
2018 FALL	Primary	Shuchin Aeron	Shuchin.Aeron@tufts.edu
2018 FALL	Primary	Mai Vu	Mai.Vu@tufts.edu

Full-time. Please see departmental website for specific details.

115273	**Electronic Musical Instrument Design**

Subject: ES — Catalog Nbr: 0095

2018 SPRG	Primary	Paul Lehrman	paul.lehrman@tufts.edu

(Cross-listed as MUS 63). Non-standard electronic musical instruments or "controllers," incorporating sensors that respond to touch, position, movement, finger pressure, wind pressure, and other human factors, and their translation to Musical Instrument Digital Interface (MIDI) data. Designing and building original systems using common materials and object-oriented music-specific programming languages and software-based synthesis. Students will complete several creative projects using music hardware and software. Recommendations: Experience in one or more of the following--electronic music, electronic prototyping, mechanical engineering, computer programming.

Course Bulletin

115411	Numerical Methods
Subject: ES	Catalog Nbr: 0101
2017 FALL	Primary Jason Rife Jason.Rife@tufts.edu
Numerical methods are studied and applied to the solution of problems in applied science and engineering. Interpolation, approximation, numerical linear algebra, including system solution and eigenvalue problems, solution of nonlinear equations, numerical differentiation and integration, ordinary differential equation algorithms, and finite-difference solution of partial differential equations. Applications using calculative software. Recommendations: MATH 51 (formerly MATH 38) and the ability to implement computer solutions.	

115714	Engineering Systems: Stochastic Models
Subject: ES	Catalog Nbr: 0152
An introduction to network models in the study/design of engineering, economic, environmental, and social systems with an emphasis on systems exhibiting probabilistic behavior. Topics include network models, Markov chains, queuing theory, reliability analysis, and genetic algorithms (GAs). Practical treatment is stressed; applications and projects are chosen from several areas, including civil and environmental engineering. Recommendations: Junior Standing or consent of instructor	

115942	Engineering Psychology
Subject: ENP	Catalog Nbr: 0053
2017 FALL	Primary Nathan Ward Nathan.Ward@tufts.edu
2018 FALL	Primary Matthew Cain Matthew.Cain@tufts.edu
(Cross-listed as PSY 53). Survey of the applied areas of psychology that have proven useful in the design of equipment for human use and in the design of human-machine systems. Emphasis on how humans process information and how psychological science can further inform each stage of information processing.	

115987	Non Major Credit
Subject: ES	Catalog Nbr: 0310

115999	Lower Level Elective Crd
Subject: ES	Catalog Nbr: 0320

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116016	Upper Level Elective Crd
Subject:	Catalog Nbr:
ES	0330

116022	Introduction To Human Factors And Ergonomics			
Subject:	Catalog Nbr:			
ENP	0061			
2017 FALL		Primary	Sami Durrani	Sami.Durrani@tufts.edu
2018 FALL		Primary	Linda Borghesani	Linda.Borghesani@tufts.edu
2018 SPRG		Primary	Timothy McEwen	Timothy.McEwen@tufts.edu

(Cross-listed as BME 61.) A practical introduction to human performance and to designing for human use. Studies include human factors, ergonomics, work stations, and environmental and legal concerns that impact on design. Examples of good and bad designs illustrate course principles.

116048	Internship In Engineering Psychology			
Subject:	Catalog Nbr:			
ENP	0099			
2017 SUMR		Primary	Brian Gravel	brian.gravel@tufts.edu
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu
2018 SUMR		Primary	Edward Kutsoati	edward.kutsoati@tufts.edu
2018 SUMR		Primary	Nathan Ward	Nathan.Ward@tufts.edu

A mentored preprofessional experience in engineering psychology at an off-site organization. The internship must conform to all the requirements of the School of Engineering internship programs. The engineering psychology program will grant course credit for internships if the following conditions are met: 1) The student has junior or senior standing and has declared a major in engineering psychology. 2) The student has submitted a written internship proposal that has been approved prior to the semester in which the internship will be performed. No internships with course credit will be approved once the semester of the internship has started. 3) A faculty mentor in engineering psychology holds supervisory and technical control of any work that receives credit. 4) The student submits a written report that is to be evaluated by the faculty adviser and the outside institutional supervisor. Work of a proprietary nature cannot be used as a basis for the granting of course credit.
Recommendations: Junior or Senior standing or permission of instructor.

116058	Tufts Program Abroad
Subject:	Catalog Nbr:
ES	0340

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116068	Assistive Technology			
Subject:	Catalog Nbr:			
ENP	0105			
2018 FALL		Primary	Jennifer Buxton	Jennifer.Buxton@tufts.edu

(Cross-listed as OTS 105). Examination of problems in designing and providing assistive devices to individuals with disabilities, to assist mobility, communication, positioning, and environmental control and daily living. Processes discussed include needs assessment, search for available devices, resources available, and creative problem solving. Students work with materials commonly used to create individualized devices, in cross-disciplinary teams on a design for a specific user or group. Problems of funding and delivery of devices also explored. For students in occupational therapy and engineering, and for educators, speech/language pathologists, and rehabilitation personnel.

116129	Project Study In Human Systems A			
Subject:	Catalog Nbr:			
ENP	0120			
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu

(Cross-listed as BME 120 and PSY 120.) A senior-level project design (capstone course), led by faculty from engineering and psychology as well as outside lecturers. Students participate in team fashion in human-factors design problems set by industry sponsors. Professional-level work is required, including report preparation and presentations. Timely lectures supplement the projects. Spring.
Recommendations: ENP 161, 162, PSY 31, 32, 130.

This is a yearlong course. Students will receive 3 credits at the completion of the second semester.

116201	Seminar In Engineering Psychology			
Subject:	Catalog Nbr:			
ENP	0149			
2017 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu
2017 SUMR		Primary	Timothy McEwen	Timothy.McEwen@tufts.edu
2017 SUMR		Primary	Sami Durrani	Sami.Durrani@tufts.edu
2018 FALL		Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 SPRG		Primary	Michael Wiklund	michael.wiklund@tufts.edu
2018 SPRG		Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 SPRG		Primary	Nathan Ward	Nathan.Ward@tufts.edu
2018 SPRG		Primary	Jennaca Davies	Jennaca.Davies@tufts.edu
2018 SPRG		Primary	Mary Stearns	Mary.Stearns@tufts.edu
2018 SPRG		Primary	Eric Bogner	Eric.Bogner@tufts.edu
2018 SPRG		Primary	John Pollard	John.Pollard@tufts.edu

Graduate-level seminar course designed for students who are interested in getting a broad overview of different research methods and analytical techniques in human factors/ergonomics research. Topics to be covered are related to the acquiring, recording, and analyzing of empirical data. Theory underlying these methods in human factors/ergonomics research also studied. Three term assignments. Fall.

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116409	Human Factor Product Design			
Subject:	Catalog Nbr:			
ENP	0161			
2018 FALL		Primary	Sami Durrani	Sami.Durrani@tufts.edu
2018 SPRG		Primary	James Intriligator	James.Intriligator@tufts.edu

(Cross-listed as BME 161.) Material relevant in consumer product design, biomedical engineering, architectural design, and machine design. Topics include design methodologies, user feedback techniques, performance measurements, sensory evaluation techniques, creative design, and prototyping. Extensive individual and group project design work. Emphasis on designing and creativity.
Recommendations: EN 1, 2, ENP 61, PSY 31, 32, 53, and junior standing, or permission of instructor.

116464	Human-machine System Design			
Subject:	Catalog Nbr:			
ENP	0162			
2017 FALL		Primary	Timothy McEwen	Timothy.McEwen@tufts.edu
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu

Techniques for man-machine system designs in which cognitive and dynamic aspects are of major importance. Applications to computer-interface design, auto/semiautomated systems, biomedical systems, and others. Topics include information processing, decision making, reaction times, and signal detection theory. Individual and group projects, laboratory demonstrations.

Recommendations: ENP 64 and senior standing, or graduate standing.

116481	Analytical Methods In Human Factors Engineering			
Subject:	Catalog Nbr:			
ENP	0163			
2017 FALL		Primary	Daniel Hannon	Dan.Hannon@tufts.edu

Quantitative and qualitative analysis methods applied in human factors engineering. Longitudinal data analysis, root cause analysis, inter-rater reliability analysis, utility analysis, usability analysis, heuristic review, and applications of machine learning to human factors.

Recommendations: ENP 162 or graduate standing.

116557	Computer Interface Design			
Subject:	Catalog Nbr:			
ENP	0166			
2018 SPRG		Primary	Jonathan Tilliss	Jonathan.Tilliss@tufts.edu

(Cross-listed as BME 166.) This hands-on course challenges students to design computer-based products and systems that are easy to learn and use. Lectures cover the user interface-design process, basic design principles, and design evaluation methods. In-class exercises and projects reinforce the students'

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understanding of the lecture material and provide practical design experience. Students use computer-based prototyping tools to model and demonstrate their design solutions. Frequent guest lectures by user-interface design specialists from industry.
Recommendations: EN 1, 2, and junior standing, or permission of instructor.

116608	Special Topics			
Subject:	Catalog Nbr:			
ENP	0193			
2017 FALL	Primary	Michael Wiklund	michael.wiklund@tufts.edu	
2017 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu	
2017 FALL	Primary	Jennifer Buxton	Jennifer.Buxton@tufts.edu	
2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu	
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu	
Guided individual study of an approved topic. Please see departmental website for specific details.				

116631	Special Topics			
Subject:	Catalog Nbr:			
ENP	0194			
2018 SPRG	Primary	Michael Wiklund	michael.wiklund@tufts.edu	
2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu	
2018 SPRG	Primary	Daniel Hannon	Dan.Hannon@tufts.edu	
2018 SPRG	Primary	James Intriligator	James.Intriligator@tufts.edu	
Guided individual study of an approved topic. Please see departmental website for specific details.				

116649	Human Factors In Medical Systems
Subject:	Catalog Nbr:
ENP	0210
Advanced topics in medical error analysis, user-centered medical technology design, product development and testing, FDA requirements, patenting, simulation, displays and controls, computerization, system implementation and maintenance, and product usability and accessibility. Recommendations: ENP 163	

116670	Interface Design In Complex Systems
Subject:	Catalog Nbr:
ENP	0215
Computer-based interfaces, complex human-machine systems (e.g., power plant control room and emergency response dispatch centers), ecological approach, work environment analysis, information representation. Recommendations: ENP 161 or equivalent.	

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116694	Special Topics			
Subject:	Catalog Nbr:			
ENP	0293			
2018 FALL	Primary	David Aurelio	David.Aurelio@tufts.edu	
Guided individual study on an approved topic. Please see departmental website for specific details.				

116710	Special Topics
Subject:	Catalog Nbr:
ENP	0294
Guided individual study on an approved topic. Please see departmental website for specific details.	

116724	Thesis		
Subject:	Catalog Nbr:		
ENP	0295		
2018 FALL	Primary	Michael Wiklund	michael.wiklund@tufts.edu
2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
Guided research on a topic that has been approved as a suitable subject for a master's thesis.Please see departmental website for specific details.			

116734	Thesis		
Subject:	Catalog Nbr:		
ENP	0296		
2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 SPRG	Primary	James Intriligator	James.Intriligator@tufts.edu
Guided research on a topic that has been approved as a suitable subject for a master's thesis.Please see departmental website for specific details.			

116762	Graduate Research
Subject:	Catalog Nbr:
ENP	0298
Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.	

116782	Non Major Credit
Subject:	Catalog Nbr:
ENP	0310

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116801	Lower Level Elective Crd
Subject:	Catalog Nbr:
ENP	0320

116819	Upper Level Elective Crd
Subject:	Catalog Nbr:
ENP	0330

121277	Special Topics In Engineering			
Subject:	Catalog Nbr:			
ME	0149			
	2017 FALL	Primary	Pratap Misra	Pratap.Misra@tufts.edu
	2017 FALL	Primary	Tadeu Carneiro	Tadeu.Carneiro@tufts.edu
	2017 FALL	Primary	Hoda Koushyar	Hoda.Koushyar@tufts.edu
	2017 FALL	Primary	Bradley Duncan	No Email on file.
	2018 FALL	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
	2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
	2018 SPRG	Primary	Gary Leisk	Gary.LEISK@tufts.edu
	2018 SPRG	Primary	James Vlahakis	James.Vlahakis@tufts.edu
	2018 SPRG	Primary	Robert Peattie	Robert.Peattie@tufts.edu
	2018 SPRG	Primary	Matthew Kelly	Matthew.Kelly@tufts.edu
	2018 SPRG	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
	2018 SPRG	Primary	Kelsey Hochgraf	Kelsey.Hochgraf@tufts.edu
Study of selected engineering problems in the analysis and design of physical systems.Please see departmental website for specific details: http://engineering.tufts.edu/me/about/courses/index.htm				

121501	Applied Mathematics For Engineers			
Subject:	Catalog Nbr:			
ME	0150			
	2017 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
	2018 FALL	Primary	Robert Peattie	Robert.Peattie@tufts.edu
Review of ordinary differential equations and oscillatory phenomena. Fourier series and applications. Orthogonal functions, Bessel functions. Partial differential equations and their applications to fluid mechanics, heat transfer, vibration and wave propagation. In no case may both ME 150 and MATH 151 be taken for credit. Recommendations: MATH 51 (formerly MATH 38) or equivalent.				

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121513	Biomechanics
Subject:	Catalog Nbr:
ME	0152

Mechanical properties of muscle and bone, activation of muscles, kinematics and dynamics of joints, forces and energy in movement, movement data recording and analysis. Classroom presentations and research projects.
Recommendations: ES 9 Applied Mechanics (Strength of Materials) or equivalent.

121726	Wind Engineering
Subject:	Catalog Nbr:
ME	0167

Structure interaction with atmospheric boundary layers. Characterization of wind data, wind variation with height, and variation with local topography. Boundary layer turbulence and connection to meteorological events. Wind forces on basic shapes, mean loading, and wind tunnel techniques. Dynamic effects including vortex oscillations, response of rigid and flexible structures and suppression. Building geometries and special cases such as masts, towers, bridges, and special structures. Wind turbine aerodynamics and wind turbine design.
Recommendations: ES 8 - Fluid Mechanics.

121812	Seminar In Fluid Mechanics And Heat Transfer
Subject:	Catalog Nbr:
ME	0168

Presentation to a seminar group of selected topics on recent developments in fluid mechanics and heat transfer. Student, faculty, or an outside guest carries out the presentation, which is followed by discussion. Individual guided study is required for students taking this course for credit.
Recommendations: ME 65 or 165.

122006	Digital Control Of Dynamic Systems			
Subject:	Catalog Nbr:			
ME	0180			
2017 FALL		Primary	William Messner	William.Messner@tufts.edu
2018 FALL		Primary	Pratap Misra	Pratap.Misra@tufts.edu

Fundamental concepts and modern techniques for the modeling and control of dynamic systems with multiple inputs and outputs . Formal modeling methods and linear closed-loop control principles. State-space techniques for continuous and discrete time controller design.. Analysis of system properties and performance. Related mathematical methods, computational software tools, and controller hardware.
Recommendations: ME 80 or consent.

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122016	Advanced Dynamics			
Subject:	Catalog Nbr:			
ME	0181			
2018 SPRG	Primary	Jason Rife	Jason.Rife@tufts.edu	
Kinematics and dynamics of rigid bodies in three dimensions. Lagrange's equations for the derivation of system equations of motion. Numerical solution of nonlinear ordinary differential equations. Computer tools. Recommendations: ME 80, ME 180 or consent.				

122068	Robotics			
Subject:	Catalog Nbr:			
ME	0184			
2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu	
Broad review of theoretical and applied aspects of robotic manipulators and mobile robots. Statics, kinematics, dynamics, actuation, sensing, sensor fusion, trajectory planning and control with hands-on applications. Pre-requisites: ME 0084 or graduate standing or permission of instructor.				

122154	Special Topics		
Subject:	Catalog Nbr:		
ME	0193		
2018 SPRG	Primary	James Moore	No Email on file.
2018 SPRG	Primary	Mark Moeller	No Email on file.
2018 SUMR	Primary	Jason Rife	Jason.Rife@tufts.edu
2018 SUMR	Primary	Marc Hodes	Marc.Hodes@tufts.edu
Guided study of an approved topic. Please see departmental website for specific details.			

122168	Special Topics
Subject:	Catalog Nbr:
ME	0194
Guided study of an approved topic. Please see departmental website for specific details.	

122414	Special Tps:study Abroad
Subject:	Catalog Nbr:
ME	0197

122554	Advanced Structural Dynamics
Subject:	Catalog Nbr:
ME	0225
Study of free and forced vibration of continuous structures such as plates and shells. Laplace transform and	

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Fourier series, Rayleigh-Ritz and Galerkin methods. The use of discrete techniques such as finite-difference and finite-element methods to solve practical problems in structural dynamics.

122720	Flow-real Viscous Fluids
Subject: ME	Catalog Nbr: 0265
Stress tensor in viscous fluids, incompressible boundary-layer equations, Blasius equation, Karman-Polhausen method, semiempirical and statistical theories of turbulence.	

122775	Advanced Engineering Controls
Subject: ME	Catalog Nbr: 0280
A case-study exploration of modern control design techniques for multidisciplinary engineering and manufacturing applications. State-space methods are implemented in linear systems for multivariable controller and observer design, as well as in nonlinear system analysis by describing functions and sliding mode control. Linear quadratic techniques in optimal and robust control of time-varying systems, as well as adaptive control algorithms with system identification are also introduced. Emphasis is placed on use of the computer as a real-time controller in laboratory projects related to the students' own research. Recommendations: ME 180 or permission of instructor.	

122817	Graduate Seminar			
Subject: ME	Catalog Nbr: 0291			
	2017 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
	2017 FALL	Primary	Robert White	R.White@tufts.edu
	2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
	2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
Presentation of individual reports on basic topics to a seminar group for discussion and criticism. Please see departmental website for specific details.				

122869	Graduate Seminar			
Subject: ME	Catalog Nbr: 0292			
	2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu
	2018 SPRG	Primary	Robert White	R.White@tufts.edu
	2018 SPRG	Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
Presentation of individual reports on basic topics to a seminar group for discussion and criticism. Please see departmental website for specific details.				

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122898	Special Topics			
Subject:	Catalog Nbr:			
ME	0293			
2018 SPRG		Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
Guided individual study of an approved topic. Please see departmental website for specific details.				

122913	Special Topics			
Subject:	Catalog Nbr:			
ME	0294			
Guided individual study of an approved topic. Please see departmental website for specific details.				

122944	Master's Thesis			
Subject:	Catalog Nbr:			
ME	0295			
2017 FALL		Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
2018 FALL		Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 FALL		Primary	Mark Kachanov	mark.kachanov@tufts.edu
2018 FALL		Primary	Anil Saigal	anil.saigal@tufts.edu
2018 FALL		Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL		Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 FALL		Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 FALL		Primary	Gary Leisk	Gary.LEISK@tufts.edu
2018 FALL		Primary	Robert White	R.White@tufts.edu
2018 FALL		Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
2018 FALL		Primary	Jason Rife	Jason.Rife@tufts.edu
2018 FALL		Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL		Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
2018 FALL		Primary	William Messner	William.Messner@tufts.edu
2018 FALL		Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
2018 FALL		Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
2018 FALL		Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
2018 FALL		Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
2018 FALL		Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu
2018 FALL		Primary	Deborah Sunter	Deborah.Sunter@tufts.edu
Guided research on an approved topic suitable for a master's thesis. Please see departmental website for specific details.				

122996	Master's Thesis
Subject:	Catalog Nbr:
ME	0296

Course Bulletin

	2018 SPRG	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
	2018 SPRG	Primary	Michael Wiklund	michael.wiklund@tufts.edu
	2018 SPRG	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
	2018 SPRG	Primary	Mark Kachanov	mark.kachanov@tufts.edu
	2018 SPRG	Primary	Anil Saigal	anil.saigal@tufts.edu
	2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu
	2018 SPRG	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
	2018 SPRG	Primary	Douglas Matson	Douglas.Matson@tufts.edu
	2018 SPRG	Primary	Gary Leisk	Gary.LEISK@tufts.edu
	2018 SPRG	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
	2018 SPRG	Primary	Jason Rife	Jason.Rife@tufts.edu
	2018 SPRG	Primary	Marc Hodes	Marc.Hodes@tufts.edu
	2018 SPRG	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
	2018 SPRG	Primary	Pratap Misra	Pratap.Misra@tufts.edu
	2018 SPRG	Primary	William Messner	William.Messner@tufts.edu
	2018 SPRG	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
	2018 SPRG	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
	2018 SPRG	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
	2018 SPRG	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
	2018 SPRG	Primary	James Intriligator	James.Intriligator@tufts.edu
	2018 SUMR	Primary	Robert White	R.White@tufts.edu

Guided research on an approved topic suitable for a master's thesis. Please see departmental website for specific details.

123035	**Doctoral Thesis**			
Subject: ME	Catalog Nbr: 0297			
	2017 FALL	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
	2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
	2018 FALL	Primary	Mark Kachanov	mark.kachanov@tufts.edu
	2018 FALL	Primary	Anil Saigal	anil.saigal@tufts.edu
	2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
	2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
	2018 FALL	Primary	Douglas Matson	Douglas.Matson@tufts.edu
	2018 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu
	2018 FALL	Primary	Robert White	R.White@tufts.edu
	2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
	2018 FALL	Primary	Jason Rife	Jason.Rife@tufts.edu
	2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
	2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
	2018 FALL	Primary	William Messner	William.Messner@tufts.edu
	2018 FALL	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
	2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu

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2018 FALL	Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
2018 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
2018 FALL	Primary	Deborah Sunter	Deborah.Sunter@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

123064	**Graduate Research**

Subject:	Catalog Nbr:			
ME	0298			
2018 SPRG		Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
2018 SPRG		Primary	Michael Wiklund	michael.wiklund@tufts.edu
2018 SPRG		Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 SPRG		Primary	Mark Kachanov	mark.kachanov@tufts.edu
2018 SPRG		Primary	Anil Saigal	anil.saigal@tufts.edu
2018 SPRG		Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG		Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 SPRG		Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 SPRG		Primary	Gary Leisk	Gary.LEISK@tufts.edu
2018 SPRG		Primary	Robert White	R.White@tufts.edu
2018 SPRG		Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
2018 SPRG		Primary	Jason Rife	Jason.Rife@tufts.edu
2018 SPRG		Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 SPRG		Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
2018 SPRG		Primary	Pratap Misra	Pratap.Misra@tufts.edu
2018 SPRG		Primary	William Messner	William.Messner@tufts.edu
2018 SPRG		Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
2018 SPRG		Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
2018 SPRG		Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
2018 SPRG		Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
2018 SPRG		Primary	James Intriligator	James.Intriligator@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Please see departmental website for specific details.

123213	**Master Of Engineering Project**

Subject:	Catalog Nbr:			
ME	0299			
2018 FALL		Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 FALL		Primary	Mark Kachanov	mark.kachanov@tufts.edu
2018 FALL		Primary	Anil Saigal	anil.saigal@tufts.edu
2018 FALL		Primary	Chris Rogers	chris.rogers@tufts.edu

Course Bulletin

2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 FALL	Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu
2018 FALL	Primary	Robert White	R.White@tufts.edu
2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
2018 FALL	Primary	Jason Rife	Jason.Rife@tufts.edu
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
2018 FALL	Primary	William Messner	William.Messner@tufts.edu
2018 FALL	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
2018 FALL	Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
2018 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
2018 FALL	Primary	Deborah Sunter	Deborah.Sunter@tufts.edu
2018 SPRG	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
2018 SPRG	Primary	Michael Wiklund	michael.wiklund@tufts.edu
2018 SPRG	Primary	Pratap Misra	Pratap.Misra@tufts.edu
2018 SPRG	Primary	Hoda Koushyar	Hoda.Koushyar@tufts.edu

Execution of a major project under the guidance of a faculty adviser. Each project must address a substantive engineering analysis or design problem. Students are required to submit a written report and make an oral presentation of their project work. Students are expected to enroll in this course in the last term of their degree program. Enrollment is limited to and required for matriculated students in the master of engineering program.

123233	**Non Major Credit**
Subject:	Catalog Nbr:
ME	0310

123260	**Lower Level Elective Crd**
Subject:	Catalog Nbr:
ME	0320

123283	**Upper Level Elective Crd**
Subject:	Catalog Nbr:
ME	0330

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123330	Tufts Abroad Program
Subject:	Catalog Nbr:
ME	0340

123490	Master's Degree Continuation		
Subject:	Catalog Nbr:		
ME	0401		
2017 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 SPRG	Primary	Robert White	R.White@tufts.edu
Part-time. Please see departmental website for specific details.			

123543	Master's Degree Continuation		
Subject:	Catalog Nbr:		
ME	0402		
2017 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 SPRG	Primary	Robert White	R.White@tufts.edu
Full-time.Please see departmental website for specific details.			

123584	Grad Teaching Assistant		
Subject:	Catalog Nbr:		
ME	0405		
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG	Primary	Robert White	R.White@tufts.edu

123607	Grad Research Assistant		
Subject:	Catalog Nbr:		
ME	0406		
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 SPRG	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG	Primary	Robert White	R.White@tufts.edu

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123772	Doctoral Degree Continuation			
Subject:	Catalog Nbr:			
ME	0501			
2017 FALL		Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL		Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 SPRG		Primary	Robert White	R.White@tufts.edu
2018 SPRG		Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
Part-time.Please see departmental website for specific details.				

123827	Doctoral Degree Continuation			
Subject:	Catalog Nbr:			
ME	0502			
2017 FALL		Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG		Primary	Robert White	R.White@tufts.edu
2018 SPRG		Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
Full-time. Please see departmental website for specific details.				

127097	Mechanical Design And Fabrication			
Subject:	Catalog Nbr:			
ME	0001			
2018 SPRG		Primary	Gary Leisk	Gary.LEISK@tufts.edu
2018 SPRG		Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
Fabrication techniques focusing on manual and CNC machines. Engineering drawings. Fundamentals of machine design. Elastic and plastic deformation, theories of failure, impact, and fatigue of machine elements. The design of machines is approached through selected design problems that are integrated throughout the course. Recommendations: ES 5 (Statics and Dynamics)				

127281	Heat Transfer			
Subject:	Catalog Nbr:			
ME	0016			
2018 SPRG		Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
A first course in thermal analysis. Steady-state and transient conduction in solids; numerical solution of conduction problems; radiative heat transfer; forced and natural convection. Introduction to boiling and condensation heat transfer. Heat exchanger analysis. A mandatory weekly lab session designated as ME 16L (no credit) must be taken concurrently. These scheduled laboratory periods involve either experiments from ME 16 or 37, demonstrations both experimental and computational, and problem-solving recitations. Recommendations: ES 7 and 8, MATH 51 (formerly MATH 38).				

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127439	Instruments And Experiments			
Subject:	Catalog Nbr:			
ME	0018			
2018 SPRG		Primary	Chris Rogers	chris.rogers@tufts.edu
2018 SPRG		Primary	Robert White	R.White@tufts.edu

Design, execution, and analysis of experiments in different fields of mechanical engineering, such as fluid mechanics, heat transfer, dynamics, and materials. Specific topics include sensors, software-based data acquisition, instrument control, data reduction, report writing, and statistical analysis.

127673	Materials Science and Engineering			
Subject:	Catalog Nbr:			
ME	0025			
2017 FALL		Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
2018 FALL		Primary	Anil Saigal	anil.saigal@tufts.edu
2018 FALL		Primary	Tadeu Carneiro	Tadeu.Carneiro@tufts.edu

A study of the structure-property relationships of engineering materials. It covers the internal structure of both perfect and imperfect materials and the principles and techniques by which this structure can be controlled. The relationship of mechanical properties to structure is studied, and the influence of these properties on actual production processes is covered.

127791	Dynamics And Vibration			
Subject:	Catalog Nbr:			
ME	0037			
2017 FALL		Primary	Sauro Liberatore	Sauro.Liberatore@tufts.edu
2018 FALL		Primary	Mark Kachanov	mark.kachanov@tufts.edu

Kinematics and kinetics of particles and of rigid bodies in plane motion. Free and forced vibration of damped and undamped single-degree of freedom systems.
Recommendations: ES 9 and MATH 51 (formerly MATH 38).

128033	Machine Design			
Subject:	Catalog Nbr:			
ME	0042			
2017 FALL		Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
2018 FALL		Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 FALL		Primary	Gary Leisk	Gary.LEISK@tufts.edu

Design and selection of individual machine elements, including gears, bearings, springs, fasteners, brakes, motors, fluid actuators etc. Design projects that relate to these topics are assigned with emphasis placed on the application of fundamental engineering concepts as well as establishing the validity and practicality of the solution.

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Recommendations: ME 1 (Mechanical Design and Fabrication) and ES 9 (Strength of Materials)

128322	**Senior Design Project**			
Subject:	Catalog Nbr:			
ME	0043			
2017 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu	
2017 FALL	Primary	Natasha Wright	No Email on file.	
2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu	
2018 FALL	Primary	Brandon Stafford	Brandon.Stafford@tufts.edu	
Individual and group independent design projects under the supervision of a department faculty member. The design must be open-ended and make use of the elements of design, as well as use the student's knowledge of engineering science. Please see departmental website for specific details: http://ase.tufts.edu/mechanical/ Recommendations: ME 42, senior standing. Permission of instructor.				

128706	**System Dynamics & Controls**			
Subject:	Catalog Nbr:			
ME	0080			
2018 SPRG	Primary	Pratap Misra	Pratap.Misra@tufts.edu	
2018 SPRG	Primary	William Messner	William.Messner@tufts.edu	
Fundamental design concepts in modeling and control of dynamic electromechanical systems. Differential mathematical models of continuous system physics. Behavior in the time and frequency domains. Performance tuning using feedback control, proportional-integral-derivative controllers, sensors, actuators, root locus methods, and frequency response methods. Computer tools for design and measurement. Recommendations: ME 37.				

128724	**Introductory Robotics And Mechatronics**			
Subject:	Catalog Nbr:			
ME	0084			
2018 SPRG	Primary	Ethan Danahy	ethan.danahy@tufts.edu	
Introduction to controls, image processing, sensor development, filtering, and state machines through weekly robotic competitions. Basic concepts from circuit theory, artificial intelligence, microprocessor control and physical design used to solve practical problems. Recommendations: ES 3 and 5, and MATH 51 (formerly MATH 38). These courses may be taken concurrently.				

128830	**Special Topics**			
Subject:	Catalog Nbr:			
ME	0093			
2018 SPRG	Primary	Joshua Wiesman	Joshua.Wiesman@tufts.edu	
2018 SPRG	Primary	Natasha Wright	No Email on file.	

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	2018 SPRG	Primary	Brandon Stafford	Brandon.Stafford@tufts.edu
	2018 SPRG	Primary	Jivko Sinapov	Jivko.Sinapov@tufts.edu

Supervised study in some specialized field of mechanical engineering. Please see departmental website for specific details.
Recommendations: Permission of instructor and department chair.

128868	Undergraduate Research

Subject:	Catalog Nbr:			
ME	0094			
	2018 FALL	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
	2018 FALL	Primary	Michael Wiklund	michael.wiklund@tufts.edu
	2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
	2018 FALL	Primary	Mark Kachanov	mark.kachanov@tufts.edu
	2018 FALL	Primary	Anil Saigal	anil.saigal@tufts.edu
	2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
	2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
	2018 FALL	Primary	Douglas Matson	Douglas.Matson@tufts.edu
	2018 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu
	2018 FALL	Primary	Robert White	R.White@tufts.edu
	2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
	2018 FALL	Primary	Jason Rife	Jason.Rife@tufts.edu
	2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
	2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
	2018 FALL	Primary	Pratap Misra	Pratap.Misra@tufts.edu
	2018 FALL	Primary	William Messner	William.Messner@tufts.edu
	2018 FALL	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
	2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
	2018 FALL	Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
	2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
	2018 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
	2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
	2018 FALL	Primary	Deborah Sunter	Deborah.Sunter@tufts.edu
	2018 SPRG	Primary	Sauro Liberatore	Sauro.Liberatore@tufts.edu
	2018 SPRG	Primary	Hoda Koushyar	Hoda.Koushyar@tufts.edu

Independent undergraduate research in the field of mechanical engineering. Please see departmental website for specific details.
Recommendations: Permission of instructor and Department Chair.

128897	Thesis

Subject:	Catalog Nbr:			
ME	0096			
	2018 FALL	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu

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	2018 FALL	Primary	Michael Wiklund	michael.wiklund@tufts.edu
	2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
	2018 FALL	Primary	Mark Kachanov	mark.kachanov@tufts.edu
	2018 FALL	Primary	Anil Saigal	anil.saigal@tufts.edu
	2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
	2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
	2018 FALL	Primary	Douglas Matson	Douglas.Matson@tufts.edu
	2018 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu
	2018 FALL	Primary	Robert White	R.White@tufts.edu
	2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
	2018 FALL	Primary	Jason Rife	Jason.Rife@tufts.edu
	2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
	2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
	2018 FALL	Primary	Pratap Misra	Pratap.Misra@tufts.edu
	2018 FALL	Primary	William Messner	William.Messner@tufts.edu
	2018 FALL	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
	2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
	2018 FALL	Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
	2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
	2018 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
	2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
	2018 FALL	Primary	Deborah Sunter	Deborah.Sunter@tufts.edu

Supervised research in some specialized field of mechanical engineering. Please see departmental website for specific details.
Recommendations: Permission of instructor and Department Chair.

128929	**Internship In Mechanical Engineering**

Subject: ME — Catalog Nbr: 0099

2018 FALL	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu
2018 FALL	Primary	Michael Wiklund	michael.wiklund@tufts.edu
2018 FALL	Primary	Behrouz Abedian	behrouz.abedian@tufts.edu
2018 FALL	Primary	Mark Kachanov	mark.kachanov@tufts.edu
2018 FALL	Primary	Anil Saigal	anil.saigal@tufts.edu
2018 FALL	Primary	Chris Rogers	chris.rogers@tufts.edu
2018 FALL	Primary	Daniel Hannon	Dan.Hannon@tufts.edu
2018 FALL	Primary	Douglas Matson	Douglas.Matson@tufts.edu
2018 FALL	Primary	Gary Leisk	Gary.LEISK@tufts.edu
2018 FALL	Primary	Robert White	R.White@tufts.edu
2018 FALL	Primary	Kristen Wendell	Kristen.Wendell@tufts.edu
2018 FALL	Primary	Jason Rife	Jason.Rife@tufts.edu
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu
2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu
2018 FALL	Primary	Pratap Misra	Pratap.Misra@tufts.edu

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2018 FALL	Primary	William Messner	William.Messner@tufts.edu
2018 FALL	Primary	Igor Sokolov	Igor.Sokolov@tufts.edu
2018 FALL	Primary	Jeffrey Guasto	Jeffrey.Guasto@tufts.edu
2018 FALL	Primary	Jianmin Qu	Jianmin.Qu@tufts.edu
2018 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu
2018 FALL	Primary	Iryna Zenyuk	Iryna.Zenyuk@tufts.edu
2018 FALL	Primary	Sauro Liberatore	Sauro.Liberatore@tufts.edu
2018 FALL	Primary	James Intriligator	James.Intriligator@tufts.edu
2018 FALL	Primary	Deborah Sunter	Deborah.Sunter@tufts.edu

A mentored preprofessional experience in mechanical engineering at an off-site organization. The internship must conform to all the requirements of the School of Engineering Internship Program. The department will grant course credit for internships if the following conditions are met: 1) The student submits a written internship proposal that is approved by the department prior to the semester in which the internship will be performed (no internships with course credit will be approved once the semester of the internship has started), 2) a faculty mentor has supervisory control of any work that receives credit, and 3) a written report is submitted that will be evaluated by the faculty adviser and the outside institutional supervisor.
Recommendations: Junior or senior standing. Permission of Instructor.

128952	**Inventive Design**

Subject:	Catalog Nbr:			
ME	0102			
2018 FALL		Primary	Gary Leisk	Gary.LEISK@tufts.edu

The invention, design, and development of new products. The identification of product opportunities from marketing, manufacturing, and consumers' viewpoints. The organization of new product effort within a corporation. Primary assignments are design projects that are presented before a jury of professionals in the field.
Recommendations: Senior Standing.

128969	**Micro-fabrication And Design**

Subject:	Catalog Nbr:
ME	0103

An introduction to Micro-Electro-Mechanical Systems (MEMS). Topics include fabrication, design, and applications of MEMS devices. Introduction to computer-aided design techniques and tools.
Recommendations: Senior Standing.

129074	**Statistical Quality Control**

Subject:	Catalog Nbr:			
ME	0108			
2018 SPRG		Primary	Anil Saigal	anil.saigal@tufts.edu

This course deals with principle, role, management, and history of quality control in modern manufacturing and servicing organizations. Topics covered include statistical process control, probability and statistics, Pareto diagrams, statistical design of experiments, Taguchi methods, acceptance sampling, and cost of quality.

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Recommendations: Senior standing or permission of instructor.

129137	**Thermal Management Of Electronics**
Subject: ME	Catalog Nbr: 0110
Design of hardware to control temperature of electronic and photonic components. Thermal management challenges from component-to-data center scales and dependence of reliability on temperature. Fundamentals of heat transfer review. Design and analysis of key technologies: thermal interface materials, heat pipes, heat sinks, thermoelectric modules. Selected emerging technologies. Energy efficient solutions. Recommendations: ME 16 - Heat Transfer or permission of instructor.	

129155	**Thermal-fluid Transport I**			
Subject: ME	Catalog Nbr: 0111			
2017 FALL	Primary	Erica Kemmerling	Erica.Kemmerling@tufts.edu	
2018 FALL	Primary	Marc Hodes	Marc.Hodes@tufts.edu	
(Cross-listed as CHBE 111). Advanced topics in fluid mechanics. Viscous and inviscid flows. Strain rate, vorticity and streamline coordinates. Differential conservation laws for mass, momentum and energy. Dimensional analysis. Lubrication flows. Momentum and thermal laminar boundary layers. Laminar-turbulent transition. Reynolds stress and turbulence modeling. Turbulent boundary layers. Flow modeling. Recommendations: ES 8 - Fluid Mechanics or permission of instructor.				

129219	**Thermal-fluid Transport II**			
Subject: ME	Catalog Nbr: 0112			
2018 SPRG	Primary	Marc Hodes	Marc.Hodes@tufts.edu	
(Cross-listed as CHBE 112). Multi-dimensional conduction. Transient conduction including moving boundary problems. External forced and natural convection. Internal forced and natural convection. Developing flows and transition to turbulence. Condensation and boiling heat transfer. Radiation and conjugate heat transfer involving radiation. Temperature and heat flux measurements. Numerical techniques. Recommendations: ME 111 Thermal-Fluid Transport I or equivalent.				

129270	**Advanced Thermodynamics**
Subject: ME	Catalog Nbr: 0115
Classical thermodynamics; chemical thermodynamics and statistical thermodynamics. Applications to materials engineering and processes. Recommendations: MATH 51.	

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129309	Mass Transfer And Phase Transformations In Materials Processing
Subject: ME	Catalog Nbr: 0116
The course is designed for students interested in thermal, fluid, and mass transport aspects of materials processing. Topics include heat treatment, continuum diffusion, atomistics of diffusion, oxidation, evaporation, and solidification. A wide range of practical examples and applications is drawn on, and class work and readings are supplemented by in-class presentations, guest lectures, and small projects. Recommendations: ME 16 or permission of instructor.	

129432	Advanced Data Acquisition And Image Processing
Subject: ME	Catalog Nbr: 0118
An upper-level course designed for students interested in laboratory techniques relevant to mechanical engineering experimentation, including temperature, velocity, and stress measurement. Topics include image processing and advanced signal processing. After an initial review of computer interface and experiment control, the course is dedicated to how video signals are generated, acquired, and processed, including filtering techniques (Sobel, Median, Lapacian, etc.) as well as pattern recognition and identification.	

129549	Biomaterials
Subject: ME	Catalog Nbr: 0121
This course presents the following topics: elementary solid mechanics; aspects of material science applied to metals, polymers, ceramics, and biological tissues; tissue reactions to artificial materials; pathohistology; and inflammatory and immune responses. The course is completed by a survey of artificial materials and devices in clinical use, emphasizing vascular and orthopedic prostheses. A literature review and oral presentation covering a current device is assigned. Recommendations: ME 25 or permission of instructor.	

129642	Solid Mechanics			
Subject: ME	Catalog Nbr: 0122			
2018 FALL	Primary	Mark Kachanov	mark.kachanov@tufts.edu	
(Cross-listed as CEE 122). Strain tensor, stress tensor, elastic stress analysis, isotropic and anisotropic materials, torsion problem, inelastic behavior of materials, elements of plasticity and creep. Recommendations: ES 9 Strength of Materials or equivalent.				

129680	Mechanics Of Composite And Heterogeneous Materials		
Subject: ME	Catalog Nbr: 0123		
2018 SPRG	Primary	Michael Zimmerman	Michael.Zimmerman@tufts.edu

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Anisotropic materials, tensors of elastic stiffnesses and compliances, dependence of elastic properties on direction, effective properties of fiber-reinforced and laminated materials, properties of heterogeneous materials (with pores, cracks, foreign particles).
Recommendations: ME 122 or consent of the instructor.

129701	Fracture Mechanics
Subject: ME	Catalog Nbr: 0124

Fundamental physical concepts of fracture science and the basic mechanics models of fracture propagation. Cracks and stress concentration. Brittle fracture, elastic-plastic fracture, creep fracture. Damage mechanics, phenomenological criteria of strength. Applications to engineering problems.
Recommendations: ME 122 or CEE 122, or ES 9 and permission of instructor.

129749	Manufacturing Processes And Materials Technology
Subject: ME	Catalog Nbr: 0125

2018 SPRG Primary Anil Saigal anil.saigal@tufts.edu

A study of traditional and nontraditional manufacturing processes related to processing of metals, ceramics, and polymers, including computer-aided manufacturing. Topics include properties and behavior of materials, selection of materials and processes subject to surface finish, tolerance, design, and economic constraints.
Recommendations: ME 25.

129829	Computer-integrated Engineering
Subject: ME	Catalog Nbr: 0126

This is a project-oriented course that introduces students to the concept of integrated engineering consisting of design, analysis, optimization, and manufacturing. Microcomputer-based commercial software packages will be used to design and optimize a mechanical component or an assembly. Engineering constraints such as costs, material selection, and manufacturing techniques will be discussed. The students will then use a CNC Machining Center to produce their optimized design.
Recommendations: Senior standing or permission of instructor.

129898	Theory And Applications Of Polymer Materials And Processing
Subject: ME	Catalog Nbr: 0127

2018 FALL Primary Michael Zimmerman Michael.Zimmerman@tufts.edu

Design processes for developing plastic parts. Physical, rheological, environmental and electrical properties of engineering polymers. Material selection methods, mold filling simulation techniques for plastics, mechanics of polymer processing, mold design techniques, secondary assembly techniques, secondary plastic part processing. Agency considerations and economics. Applications in injection molding.

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Recommendations: ME 25 or permission of instructor.

129926	Nonlinear Analysis of Materials and Structures			
Subject:	Catalog Nbr:			
ME	0128			
2017 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu	
(Cross-listed as CEE 128.) Nonlinear solid mechanics, nonlinear constitutive models and variational principles as essential prerequisites for nonlinear finite element formulations. Recommendations: ES 9.				

129977	Finite Elements			
Subject:	Catalog Nbr:			
ME	0129			
2018 SPRG	Primary	Masoud Sanayei	masoud.sanayei@tufts.edu	
(Cross-listed with CEE 0105). Finite element analysis of problems important in civil infrastructure engineering. Overview of direct stiffness method. Discretization of continuum to finite elements for approximate solution of complex engineering problems. Development of governing equations, stiffness and load matrices for deformation and stress analysis. Work and energy theorems. Hands-on experience with computers programs and practical applications in structural and geotechnical engineering. Recommendations: CEE 22or ME 42, or consent of instructor				

130089	Advanced Vibrations
Subject:	Catalog Nbr:
ME	0137
Extension and generalization of single- and two-degree-of-freedom systems to discrete systems with many degrees of freedom, using Lagrange's equations and matrix theory. Numerical integration methods with computer applications. Introduction to continuous systems and random vibration. Recommendations: ME 37 or permission of instructor.	

130187	Acoustics			
Subject:	Catalog Nbr:			
ME	0139			
2017 FALL	Primary	Robert White	R.White@tufts.edu	
Wave propagation in fluids and solid structures; sound sources and sound radiation by vibrating structures; fluid-structure interaction; sound transmission and attenuation; laboratory and field measurements; design criteria and methods. Recommendations: ME 37.				

130256	Power Generation Systems

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Subject:	Catalog Nbr:			
ME	0145			
	2018 FALL	Primary	Luisa Chiesa	Luisa.Chiesa@tufts.edu

Design and engineering of electric power production systems. Thermal-mechanical principles of electrical energy conversion, cogeneration, and storage using fossil fuel, geothermal, hydroelectric, nuclear, ocean, solar thermal, and wind power sources. Direct generation using fuel cells and photovoltaics. Economic and environmental sustainability aspects.
Recommendations: Senior standing. ES 7 and 8, or equivalent thermal-fluids background with permission of instructor.

138656 **Honors Thesis B**

Subject:	Catalog Nbr:			
COMP	0197			
	2019 SPRG	Primary	Lenore Cowen	lenore.cowen@tufts.edu
	2019 SPRG	Primary	Samuel Guyer	Samuel.Guyer@tufts.edu

Honors Thesis Computer Science.Please see departmental website for specific details.

138675 **Tufts Programs Abroad**

Subject:	Catalog Nbr:
EE	0340

Tufts Programs Abroad

138860 **Honors Thesis Research B**

Subject:	Catalog Nbr:			
CHBE	0096			
	2018 SPRG	Primary	Daniel Ryder	daniel.ryder@tufts.edu
	2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu
	2018 SPRG	Primary	Maria Flytzani-Stephanopoulos	mflytzan@tufts.edu
	2018 SPRG	Primary	Kyongbum Lee	Kyongbum.Lee@tufts.edu
	2018 SPRG	Primary	Christos Georgakis	Christos.Georgakis@tufts.edu
	2018 SPRG	Primary	Hyunmin Yi	Hyunmin.Yi@tufts.edu
	2018 SPRG	Primary	Matthew Panzer	Matthew.Panzer@tufts.edu
	2018 SPRG	Primary	Ayse Asatekin	Ayse.Asatekin@tufts.edu
	2018 SPRG	Primary	Nikhil Nair	Nikhil.Nair@tufts.edu
	2018 SPRG	Primary	Emmanouhl Tzanakakis	Emmanuel.Tzanakakis@tufts.edu
	2018 SPRG	Primary	James Van Deventer	James.Van_Deventer@tufts.edu
	2018 SPRG	Primary	Prashant Deshlahra	Prashant.Deshlahra@tufts.edu

Supervised research in chemical and biological engineering leading to the completion of the undergraduate honors thesis. Please see the Departmental website for specific program details and qualification

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requirements.

139046	Computer Aided Design w/ Lab			
Subject:	Catalog Nbr:			
ES	0018			
2018 FALL		Primary	Ryan Marshall	Ryan.Marshall@tufts.edu

Two-and three-dimensional geometric modeling with Computer Aided Design (CAD) systems. The use of CAD technology for the design and analysis of civil structures and mechanical assemblies. Topics include traditional modeling, parametric feature-based solid part and assembly modeling, creating engineering drawings from CAD, Building Information Modeling (BIM), sculptured surface modeling, material mapping and lighting for rendering CAD models, and animation for engineering applications. Laboratory.

139047	Biological Systems Analysis			
Subject:	Catalog Nbr:			
BME	0143			
2018 FALL		Primary	Bree Aldridge	Bree.Aldridge@tufts.edu

Mathematical and computational methods of biological systems at molecular and cell levels including regression, logic, statistics, kinetics, dynamical systems, pharmacodynamics, and agent-based modeling. Biological questions coordinated with appropriate mathematical modeling approach.
Recommedations: Junior standing, CHEM 2, BIO 13, MATH 42, or permission of instructor

139048	Biomaterials and Regenerative Medicine			
Subject:	Catalog Nbr:			
BME	0153			
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Jonathan Grasman	Jonathan.Grasman@tufts.edu

(Cross-listed as CHBE 164). Fundamental concepts of biomaterials and regenerative medicine (biomaterial types, synthesis, properties, mechanisms of degradation, biological interfaces, inflammation and related issues). Specific focus on biomaterials related to regenerative medicine. Course independent of, but complementary to, BME 154.
Recommendations: Junior standing, BIO13, CHEM 1, or consent of instructor

139050	Tissue Engineering and Regenerative Medicine			
Subject:	Catalog Nbr:			
BME	0154			
2018 SPRG		Primary	David Kaplan	david.kaplan@tufts.edu
2018 SPRG		Primary	Whitney Stoppel	Whitney.Stoppel@tufts.edu

Fundamental concepts of tissue engineering and regenerative medicine (scaffolds, stem cells and bioreactors); progress with specific tissue systems; applications for tissue engineering; and current state-of-the art of tissue regeneration. Additional topics: transport phenomena and mechanical regulation of stem cell function, with

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focus on mechanisms of mechanotransduction. Course independent of, but complementary to, BME 153.
Recommendations: Junior standing, BIO 13, CHEM 51, PHYS 11, ES 9, or consent of instructor.

139051	Electronic Devices for Energy Applications

Subject: CHBE Catalog Nbr: 0175
2018 FALL Primary Matthew Panzer Matthew.Panzer@tufts.edu

Design and operating principles of a variety of thin-film devices related to electrical energy generation, storage, or conversion. An overview of optical and electronic processes in a variety of materials (metals, insulators, semiconductors), thin film deposition and characterization techniques, as well as photovoltaics (solar cells), electrochemical capacitors, batteries, field-effect transistors, colloidal quantum dot devices, and light-emitting diodes (LEDs). Recent research advances in the field of novel optoelectronic devices for energy applications.
Prerequisites: Chem 0002
Recommendations: junior standing.

139053	Research

Subject: COMP Catalog Nbr: 0191

Research on a topic in Computer Science or a related discipline, culminating in a final paper describing accomplishments, with the goal of advancing the state of the art. Topic is proposed by a faculty sponsor in Computer Science.
Recommendation: Permission of instructor.

139054	Physics of Solar Cells

Subject: EE Catalog Nbr: 0114
2018 FALL Primary Thomas Vandervelde tvanderv@ece.tufts.edu

Physics of photovoltaic cells including physics of semiconductors in photovoltaic devices, physical models of solar cell operation, characteristics and design of common types of solar cells, and approaches to increasing solar ceil efficiency.
Recommendations: MATH 42, MATH 51, EE 18, PHYS 42/43, or instructor permission

139055	Networked Estimation and Control

Subject: EE Catalog Nbr: 0130
2018 SPRG Primary Usman Khan Usman.Khan@tufts.edu

Networked estimation and control methodologies for large-scale, complex, inter-connected dynamical systems. Analysis of distributed algorithms using concepts from Markov chains and irreducible non-negative matrices. Distributed implementation of Kalman filter and related control algorithms.

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Recommendations: EE 105 and EE 125 or equivalent, or permission of instructor.

139056	Power Systems
Subject: EE	Catalog Nbr: 0170
2018 FALL	Primary Aleksandar Stankovic alex.stankovic@tufts.edu
Analysis and design of AC transmission and distribution systems, transmission lines, transformers and generators. Understanding, modeling, operating and controlling such systems; basics of voltage control and power flows in electricity networks. Graduate students are expected to complete and present an additional class project. Recommendations: EE 22 or graduate student standing	

139057	Power Electronics
Subject: EE	Catalog Nbr: 0171
2018 SPRG	Primary Aleksandar Stankovic alex.stankovic@tufts.edu
Analysis and design of energy conversion circuits that contain electronic switching devices. Emphasis on understanding and modeling, and providing engineering background to evaluate power converters. Also covers dynamics and control of this class of systems. Graduate students are expected to complete and present an additional class project. Recommendations: EE 22 or graduate student standing.	

139058	Optoelectronic Characterization
Subject: EE	Catalog Nbr: 0214
Tools and techniques used to characterize optoelectronic materials and devices. Photoluminescence, ellipsometry, scanning probe microscopy, electron microscopy, and AC/DC electrical characterization. Theoretical underpinning of and practical experience with the measurement techniques. Laboratory.	

139066	Bioinfomatics
Subject: COMP	Catalog Nbr: 0007
(Cross-listed with BIO 0040) Bioinformatics for students with little or no computer science background. Basic programming skills for data manipulation and analysis. Methods and applications of online tools for sequence alignment, molecular phylogeny, gene expression data analysis, and linking molecular variation to disease. Recommendations:Biology 41 or BME 62 or equivalent.	

139213	Human Factors in Medical Technology
Subject:	Catalog Nbr:

Course Bulletin

ENP	0110			
2018 FALL		Primary	Michael Wiklund	michael.wiklund@tufts.edu

Techniques for ensuring the safety and efficacy of medical technology ranging from over-the-counter devices to complex diagnostic and therapeutic workstations to clinical information systems. Global standards and regulations, usability engineering program planning, function and task analysis, user interface requirements, applied user interface design, user interface simulation, design verification, and design validation via usability testing. Pre-requisites: senior or graduate standing or permission of instructor.

139374	**Master's Degree Continuation**			
Subject:	Catalog Nbr:			
ENP	0401			
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu
2018 SPRG		Primary	Briana Bouchard	Briana.Bouchard@tufts.edu

Part-time. Please see departmental website for specific details.

139375	**Master's Degree Continuation**			
Subject:	Catalog Nbr:			
ENP	0402			
2018 FALL		Primary	Briana Bouchard	Briana.Bouchard@tufts.edu
2018 FALL		Primary	James Intriligator	James.Intriligator@tufts.edu

Full-time.Please see departmental website for specific details.

139447	**Special Topics in Engineering Management**			
Subject:	Catalog Nbr:			
EM	0293			
2018 FALL		Primary	Gerald Brown	Gerald.Brown@tufts.edu

Special topics in engineering management. Guided independent study of an approved topic at the graduate level.
Prerequisite: Consent of instructor

139448	**Leadership for Technical Professionals**			
Subject:	Catalog Nbr:			
EM	0261			
2017 FALL		Primary	Stacy Lennon	Stacy.Lennon@tufts.edu
2018 FALL		Primary	Ewa Winston	Ewa.Winston@tufts.edu

Development of self-awareness and skills necessary for leadership. Involves 360 degree assessment tools and extensive experiential learning. Oral communication, systems thinking, high performance teams, fostering creativity, team decision making, leading change, influence without authority. Note: for graduate students not enrolled in Gordon Institute Master of Science in Engineering Management (MSEM) program.
Pre-requisite: undergraduate degree.

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139449	Financial Management for High Technology Firms
Subject:	Catalog Nbr:
EM	0155
Concepts in accounting and finance. Review and discussion of business cases. Course project to create a financial plan for a new product or service. Pre-requisites: Available to Juniors, Seniors & Graduate students.	

139451	Business Analytics
Subject:	Catalog Nbr:
EM	0241
Developing the knowledge and skills needed to employ analytics to solve business problems in the management of high tech firms. Topics include corporate strategies in high tech firms, a framework for defining strategic problems and opportunities, and tools to transform data into insights and business solutions. Offered in a blended learning mode: 30-40% of the classroom contact hours will be on-line. Prerequisite: Undergraduate degree	

139522	Project Study In Human Systems B
Subject:	Catalog Nbr:
ENP	0120
2018 SPRG	Primary James Intriligator James.Intriligator@tufts.edu
(Cross-listed as BME 120 and PSY 120.) A senior-level project design (capstone course), led by faculty from engineering and psychology as well as outside lecturers. Students participate in team fashion in human-factors design problems set by industry sponsors. Professional-level work is required, including report preparation and presentations. Timely lectures supplement the projects. Spring.	

139523	Project Study In Human Systems B
Subject:	Catalog Nbr:
BME	0120
2018 SPRG	Primary James Intriligator James.Intriligator@tufts.edu
(Cross-listed as ENP 120 and PSY 120.) A senior-level project design (capstone course), led by faculty from engineering and psychology as well as outside lecturers. Students participate in team fashion in human factors design problems set by industry sponsors. Professional-level work is required, including report preparation and presentations. Timely lectures supplement the projects.	

140067	Microwave System Engineering
Subject:	Catalog Nbr:
EE	0119
2018 FALL	Primary Mohammed Afsar mohammed.afsar@tufts.edu

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Planning and deploying microwave systems and networks. Design and construction of system components. Design and management of microwave networks .Cellular systems Best network topologies and paths for lowest possible operations and maintenance costs. System components: oscillators, attenuators, phase shifters, modulators, mixers, filters, amplifiers, and antennas, A to D and D to A converters. Transmitter and receiver characteristics, Transceiver Design, System Gain, Satellite Communications, Radio Thermal Noise, signal to noise ratio SIN, receiver sensitivity, modulation and SIN, design principles, antenna system considerations.
Prerequisite: EE117 and EE107

140069	Project Management and Software Methodologies

Subject:	Catalog Nbr:			
EM	0231			
2018 FALL	Primary	Kishore Pochampally	Kishore.Pochampally@tufts.edu	

Development of knowledge and skills to plan and execute engineering projects. Topics include creating work break down structures, schedules, critical path determination, and risk assessment and mitigation. Methodologies also include iterative techniques (agile and scrum) often used in software development.
Prerequisite: Undergraduate degree.

140070	Innovating Breakthrough Products and Processes

Subject:	Catalog Nbr:
EM	0254

Development of knowledge and skills to identify opportunities by reframing problems and generating solutions using systematic innovation based on the principles of TRIZ. Understand technology trends and evolution and the role of technology strategy in the overall business strategy of organizations, from entrepreneurial ventures to established firms. Prerequisite: Undergraduate degree.

140071	Conflict Resolution

Subject:	Catalog Nbr:			
EM	0262			
2017 FALL	Primary	Mark Bamford	Mark.Bamford@tufts.edu	

Introduces conceptual frameworks, tools, and skills to effectively manage conflict and negotiate win/win solutions in the workplace. Course will involve lectures, cases, and role plays to simulate real on the job conflicts. Prerequisite: Undergraduate degree.

140282	Lean Six Sigma

Subject:	Catalog Nbr:			
EM	0211			
2018 FALL	Primary	Kishore Pochampally	Kishore.Pochampally@tufts.edu	

Provides principles and methods for process improvement by eliminating non-value added work and by

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reducing output variability. Tools include the define-measure-analyze-improve-control problem solving methodology, statistical process control, statistically designed experiments and risk identification and mitigation strategies.
Prerequisite: Undergraduate degree

140391	Tufts Abroad Program			
Subject:	Catalog Nbr:			
CEE	0340			
2018 SPRG	Primary	Simon Steel	Simon.Steel@tufts.edu	

140782	Probabilistic Systems Analysis			
Subject:	Catalog Nbr:			
EE	0024			
2018 SPRG	Primary	Eric Miller	Eric.Miller@tufts.edu	

Development of analytical tools for the modeling and analysis of random phenomena with application to problems across a range of engineering and applied science disciplines. Probability theory, sample and event spaces, discrete and continuous random variables, conditional probability, expectations and conditional expectations, and derived distributions. Sums of random variables, moment generating functions, central limit theorem, laws of large numbers. Statistical analysis methods including hypothesis testing, confidence intervals and nonparametric methods. Undergraduates may not take both EE 0024 and EE 0104 for degree credit.
Prerequisite: Math 0042 or equivalent

140783	Stochasic Processes, Detection, and Estimation			
Subject:	Catalog Nbr:			
EE	0140			
2017 FALL	Primary	Eric Miller	Eric.Miller@tufts.edu	

Random vectors including second order characterization; Detection including binary, M-ary, Neyman-Pearson methods; Estimation including Bayes least squares, maximum a posteriori, and maximum likelihood methods; Random processes including notions of stationarity, wide sense stationarity, and independent increments; Bernoulli process, Poisson process, Markov processes including Markov chains, Weiner processes; Wide sense stationary processes and linear systems including power spectral density, spectral factorization, noncausal and causal Weiner filters; Mean square stochastic calculus including Karhunen-Loeve decompositions.
Prerequisite: EE-0023, EE-0024 or EE-0104, Math 72 or consent of instructor.

140784	New Product Innovation			
Subject:	Catalog Nbr:			
EM	0221			
2018 FALL	Primary	Kevin Oye	Kevin.Oye@tufts.edu	

Treatment of both business and technical aspects of new product development. Topics include voice of the

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customer, concept generation and evaluation, marketing, supply chain, intellectual property and usability. Course enrollment limited to graduate students in the Master of Science in Innovation and Leadership program.

140785	Business Communications			
Subject:	Catalog Nbr:			
EM	0252			
2018 FALL	Primary	Amy Hirschfeld	amy.hirschfeld@tufts.edu	
2018 SUMR	Primary	Stephen Caplow	Stephen.Caplow@tufts.edu	

Written and oral communications in the business setting. Topics include making conscious communications decisions, principles of effective written and oral communication, and different workplace audiences. Design and delivery of effective presentations. Consideration is given to the practical, philosophical and ethical context of communication in the modern globalized business world.

140786	Innovation and Technology Strategy			
Subject:	Catalog Nbr:			
EM	0253			
2018 SPRG	Primary	Kevin Oye	Kevin.Oye@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Knowledge and skills to lead and manage innovation initiatives in technology based companies. Topics include understanding technology strategy and its role in the overall business strategy of commercial firms, the role of innovation in entrepreneurial ventures as well as in established firms, and developing skills to present new product development proposals to senior management and/or prospective investors.

140787	Financial Management in Technology Firms			
Subject:	Catalog Nbr:			
EM	0255			
2018 FALL	Primary	Frank Apeseche	Frank.Apeseche@tufts.edu	

Concepts in accounting and finance. Review and discussion of business cases. Course project to create a financial plan for a new product or service. Enrollment limited to graduate students in the Master of Science in Innovation and Leadership program.

140788	Capstone Innovation and Leadership Project			
Subject:	Catalog Nbr:			
EM	0281			
2018 SUMR	Primary	Kevin Oye	Kevin.Oye@tufts.edu	

Engineering project that demonstrate business acumen and leadership skills. Projects taken from employer for which student interns or works full time. Enrollment limited to graduate students in the Master of Science in Innovation and Leadership program.

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140789	Applications in Engineering			
Subject:	Catalog Nbr:			
EN	0001			
2017 FALL		Primary	Darryl Williams	No Email on file.
2017 FALL		Primary	Xiaocheng Jiang	Xiaocheng.Jiang@tufts.edu
2017 FALL		Primary	Brandon Stafford	Brandon.Stafford@tufts.edu
2017 FALL		Primary	Jennaca Davies	Jennaca.Davies@tufts.edu
2017 FALL		Secondary	Laurie Baise	laurie.baise@tufts.edu
2018 FALL		Primary	Ethan Danahy	ethan.danahy@tufts.edu
2018 FALL		Primary	John Durant	john.durant@tufts.edu
2018 FALL		Primary	David Kaplan	david.kaplan@tufts.edu
2018 FALL		Primary	Soha Hassoun	soha.hassoun@tufts.edu
2018 FALL		Primary	Christopher Swan	chris.swan@tufts.edu
2018 FALL		Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu
2018 FALL		Primary	Jeffrey Hopwood	Jeffrey.Hopwood@tufts.edu
2018 FALL		Primary	Thomas Vandervelde	tvanderv@ece.tufts.edu
2018 FALL		Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu
2018 FALL		Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
2018 FALL		Primary	Hoda Koushyar	Hoda.Koushyar@tufts.edu
Introduction of various concepts in engineering. Emphasis on project work, engineering ethics, and engineering design process. Discipline topic areas vary each term. Limited to first-year students.				

140795	Engineering and Science for Elementary School Educators I			
Subject:	Catalog Nbr:			
ENE	0110			
2018 FALL		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 FALL		Primary	John Heffernan	John.Heffernan@tufts.edu
Introduction to engineering for those with limited STEM background. Topics include fundamentals of engineering in society, basics of the engineering design process, introduction to programming (sense-think-act), and the integration of a selection of simple machines with engineering.				

140797	Engineering and Science for Elementary School Educators II			
Subject:	Catalog Nbr:			
ENE	0111			
2018 SUMR		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 SUMR		Primary	John Heffernan	John.Heffernan@tufts.edu
Exploring client-centered engineering design for novices. Topics will include techniques for defining design requirements and constraints, approaches to testing prototypes and interpreting results and engineering connections to science topics in circuits.				

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140798	Teaching and Learning in Engineering I			
Subject:	Catalog Nbr:			
ENE	0130			
2018 SPRG		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 SPRG		Primary	Katharine Sawrey	Katharine.Sawrey@tufts.edu
Practices for understanding of K-12 students' engineering thinking and teaching practices that support innovative K-12 engineering education curricula. Additional topics include issues of access, equity and social justice in the engineering classroom as well as instructional strategies that support students' engagement with open-ended engineering design challenges. Design an engineering lesson is required.				

140799	Teaching and Learning in Engineering II			
Subject:	Catalog Nbr:			
ENE	0131			
2018 FALL		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 FALL		Primary	Chelsea Andrews	Chelsea.Andrews@tufts.edu
Structures for responsive teaching as well as assessment of students' competencies in engineering. Additional topics include foundational knowledge of current policy and research in K-12 engineering education. Design of a curriculum unit is required.				

140800	Engineering and Science for Middle and High School Educators			
Subject:	Catalog Nbr:			
ENE	0150			
2018 FALL		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 FALL		Primary	Fayette Shaw	Fay.Shaw@tufts.edu
Understanding of the relationship between science and engineering, and techniques and knowledge that support the formative modeling of design ideas and summative testing of prototypes. Topics will include the following: techniques for analysis of design ideas (vibrations and controls), instrumentation, and computer programming				

140802	Robotics for Educators
Subject:	Catalog Nbr:
ENE	0152
Fundamental robotics knowledge in the domains of mechanical and electrical engineering as well as computer science-- include understanding actuators, microprocessors and sensors, controls, and human-robotics interfaces. Uses robotics kits and a graphical programming environment.	

140803	Engineering and Science for Middle and High School Educators II
Subject:	Catalog Nbr:

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ENE	0151			
2017 SUMR		Primary	Brian O'Connell	Brian.O_Connell@tufts.edu
2018 SUMR		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 SUMR		Primary	Jessica Swenson	Jessica.Swenson@tufts.edu

The role of product design, manufacturing and human factors elements of engineering in design process. Additional topics will include fundamental human factors techniques and theories and tools for prototyping and modeling (CAD, 3-D printing).

141009	**Information Theory**
Subject:	Catalog Nbr:
COMP	0139

(Cross-listed as EE 127). Information theory as a systematic framework to address fundamental laws and limits of data compression and digital communication. Source coding/data compression; information measures on discrete memory-less sources; practical schemes and algorithms for lossless data compression such as Huffman coding, arithmetic coding, Lempel-Ziv Coding; channel coding for reliable communication and rate distortion for lossy source compression. Advanced topics such as information theoretic cryptography. Recommendations: EE 104 or permission of instructor.

141134	**Mechanics of Materials at the Micro & Nano Scale**
Subject:	Catalog Nbr:
ME	0130

Mechanics of materials, in particular, soft materials when studied at the micro and nanoscale. Classical approaches to mechanics of materials, both static and dynamic properties. Extension of classical knowledge to the micro and nanoscale, with methods to measure the material mechanics at those scales. Practical examples of biological tissues, cells, and polymers in different environments. Recommendations: ME 37, ME42, or Senior standing.

141135	**Mechanics of Materials at the Micro & Nano Scale**
Subject:	Catalog Nbr:
ME	0230

Mechanics of materials, in particular, soft materials when studied at the micro and nanoscale. Classical approaches to mechanics of materials, both static and dynamic properties. Extension of classical knowledge to the micro and nanoscale, with methods to measure the material mechanics at those scales. Practical examples of biological tissues, cells, and polymers in different environments. Assignments identical to ME130 with additional project paper.

141384	**Music Recording and Production**			
Subject:	Catalog Nbr:			
ES	0065			
2018 FALL		Primary	Paul Lehrman	paul.lehrman@tufts.edu

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	2018 FALL	Primary	Bradford Swanson	No Email on file.
	2018 FALL	Primary	Matthew Azevedo	Matthew.Azevedo@tufts.edu

Theory and techniques for recording, editing, and producing acoustic music. Acoustics, audio perception, physics and electronics of transducers, analog and digital audio principles, stereo and multi-track recording, mixing, virtual instruments, and synchronization. Development of technical and listening skills to understand and evaluate the aesthetics of recorded sound. Additional material in analog and digital audio circuit design and signal processing. Students may not receive credit for both ES 65 and MUS 62. ES65 will satisfy a requirement for the Sound Recording and Production track of the Music Engineering minor (MUS 62 will not). Co-requisite or prerequisite: ES3. Recommended: Musical literacy, PHY 11, PHY 12.

141451 **Computer Engineering W/lab**

Subject:	Catalog Nbr:			
COMP	0146			
	2017 FALL	Primary	Mark Hempstead	Mark.Hempstead@tufts.edu
	2018 FALL	Primary	Joel Grodstein	Joel.Grodstein@tufts.edu

(Cross-listed w/ EE 126) Topics covered include computer abstractions, performance measurements, instruction set architectures, designing processor datapath and control, pipelining, memory hierarchy, I/O, multiprocessors. The associated lab consists of designing, implementing, and validating a simplified MIOS processor using Verilog, a hardware description language. Fall.
Recommendations: EE 14.

141475 **Tufts Abroad Program**

Subject:	Catalog Nbr:
EN	0340

Tufts Abroad Program

141488 **Internet-scale Distributed Systems**

Subject:	Catalog Nbr:			
COMP	0117			
	2019 SPRG	Primary	Noah Mendelsohn	Noah.Mendelsohn@tufts.edu

Principles and practices in designing large-scale distributed software systems on the Internet and beyond, including core principles of the design of the World-Wide Web. Key issues and fundamental principles are explored, e.g. global uniform naming, location independence, Metcalfe's law and network effects, function placement and the End-to-End principle, extensibility and evolution of distributed systems including Postel's law, leaky abstractions, etc. Comparison with more traditional distributed system designs, e.g. distributed objects, client/server, publish/subscribe, reliable queuing, and remote procedure calls. Prerequisite: Computer Science 40 or permission of the instructor.

141489 **Cloud Computing**

Subject:	Catalog Nbr:

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	COMP	0118			
Cloud computing fundamentals, including cloud architecture, scalability, elasticity, and metrics of cloud performance including service-level objectives (SLOs) and service-level agreements (SLAs). Cloud programming models and abstractions including Map/Reduce. Persistent storage mechanisms, including key/value stores and cold storage. Geo-distributed cloud systems. Cloud networking, including data center architecture, software defined networking, and middleboxes. Cloud security. Prerequisites: Computer Science 40					

141490	**Visualization**			
Subject:	Catalog Nbr:			
COMP	0177			
2017 FALL		Primary	Remco Chang	Remco.Chang@tufts.edu
2019 SPRG		Primary	Megan Monroe	Megan.Monroe@tufts.edu
Visualization as a tool for data analysis, recall, inference, and decision-making. Tools for visual description and presentation. Principles of effective visualization, including data-visual mapping, interaction techniques, color theory, cognitive and perceptual psychology, and human factors of visual depictions of data. Prerequisite: Computer Science 15 and 61, or permission of instructor.				

141491	**Optimal Control and State Estimation**			
Subject:	Catalog Nbr:			
ME	0282			
2018 FALL		Primary	Jason Rife	Jason.Rife@tufts.edu
State-space methods for multi-input, multi-output controller and observer design. LQR control. Bayesian estimation techniques including least-squares estimation, Kalman filters, unscented Kalman filters, and particle filters. Effects of process noise and sensor noise. Emphasis on applications through student projects. Recommendations: ME 180, EE105, or permission of instructor.				

141564	**Internship In Computer Science**			
Subject:	Catalog Nbr:			
COMP	0299			
2019 SPRG		Primary	Ming Chow	ming.chow@tufts.edu
Study of approved topics in Computer Science in concert with an internship in computing or a related field outside the University. Prerequisites: Permission of instructor				

141648	**Internship Computer Science**			
Subject:	Catalog Nbr:			
COMP	0099			
2018 FALL		Primary	Ming Chow	ming.chow@tufts.edu
2018 SUMR		Primary	Liping Liu	Liping.Liu@tufts.edu

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Study of approved topics in Computer Science in concert with an internship in computing or a related field. Prerequisites: Permission of instructor.

141729	Creative Design Process of Products
Subject: ELS	Catalog Nbr: 0162
Engineering process of product design from conception to pre-production. Basic project risk management, engineering and analysis for delivering a product on schedule. Design specifications, Occam's Razor, Abbe Errors, professional responsibilities and ethics. Includes project to practice creation, engineering, and prototyping of a novel product. Prerequisite: Sophomore Standing	

141730	Societal Aspects of Design: Integration, Innovation, and Impact
Subject: ELS	Catalog Nbr: 0109
Multi-disciplinary perspective of innovative technology-based design process for societal and community influence. Elements and principles of design from product development process, thought and emotion, ethics and responsibility. Experiments to explore failure and iteration, reflection for self-discovery and innovation. Articulation and expression via written, oral and pre-recorded audio and video presentations showing measurable impact of solutions as societal benefits.	

141815	Operations and Applied Data Science			
Subject: EM	Catalog Nbr: 0212			
	2018 SPRG	Primary	Antonius Breur	No Email on file.
	2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu
Data collection design, analysis, and interpretation to drive strategic and organizational decisions in high tech ventures. Simulations and modeling, statistical process control, and experimental design, planning, control, and improvement of manufacturing and service operations including the coordination of operations in concert with the whole organization. Course enrollment limited to graduate students in the Master of Science in Innovation and Management program.				

141816	MSIM Graduate Seminar			
Subject: EM	Catalog Nbr: 0292			
	2018 FALL	Primary	Kevin Oye	Kevin.Oye@tufts.edu
	2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu
Contemporary innovation issues and topics via presentations, workshops, and discussion. Pre-reading, post-seminar writing, or other project assignments. See department website for specific details.				

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141817	Special Topics in Innovation and Management			
Subject:	Catalog Nbr:			
EM	0294			
2018 SPRG	Primary	Kevin Oye	Kevin.Oye@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	
Special topics course within the field of innovation and management. Please see department website for specific details on focus of the course.				

141853	Special Topics for non-majors			
Subject:	Catalog Nbr:			
COMP	0005			
2018 FALL	Primary	Marie-Claire Beaulieu	Marie-Claire.Beaulieu@tufts.edu	
2018 FALL	Primary	Donna Qualters	Donna.Qualters@tufts.edu	
2018 FALL	Primary	Anthony Bucci	Anthony.Bucci@tufts.edu	
Content and prerequisites to be announced. Please see department website for specific details.				

141854	Convex Optimization
Subject:	Catalog Nbr:
EE	0109
Convex optimization theory and algorithms. Convex sets, convex functions and convex optimization problems; duality theory and optimality conditions; algorithms for solving convex problems including descent, gradient descent, Newton and interior point methods. Examples of application taken from communications, signal processing and other fields. Project. Prerequisite: Math 70 or graduate standing.	

142322	Undergraduate research
Subject:	Catalog Nbr:
BME	0091
Independent undergraduate research in the field of biomedical engineering. Term paper required. Credit not given retroactively. Prior arrangements necessary. Prerequisite: Permission of instructor.	

142323	Undergraduate research			
Subject:	Catalog Nbr:			
BME	0092			
2018 SPRG	Primary	David Kaplan	david.kaplan@tufts.edu	
2018 SPRG	Primary	Fiorenzo Omenetto	Fiorenzo.Omenetto@tufts.edu	
Independent undergraduate research in the field of biomedical engineering. Term paper required. Credit not given retroactively. Prior arrangements necessary. Prerequisite: Permission of instructor.				

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142324	Field Methods for Global Health			
Subject:	Catalog Nbr:			
CEE	0150			
2017 FALL		Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu
Hands-on approach to evaluating global health projects. Research question and study design, human subjects research ethics, survey tool development, sampling techniques (water quality/anthropometrics), data collection and analysis, and information dissemination. Emphasis on applying topics to develop a full evaluation protocol for a self-selected project.				

142325	Biostatistics			
Subject:	Catalog Nbr:			
CEE	0156			
2017 FALL		Primary	Mark Woodin	mark.woodin@tufts.edu
2018 SPRG		Primary	Amy Pickering	Amy.Pickering@tufts.edu
Statistical methods for analysis and interpretation of data generated by biomedical, environmental health, and public health studies. Descriptive statistics for continuous and categorical data, probability, hypothesis testing, correlation, analysis of variance, linear and logistic regression, multivariable regression, and non-parametric methods. Foundations of probability and statistical theory, and how to apply concepts by analyzing data. Recommendation: Math 42				

142326	Cataldo Scholar Research			
Subject:	Catalog Nbr:			
CEE	0090			
2018 FALL		Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
Supervised research through the Cataldo Scholars Program within Civil and Environmental Engineering. Department consent and Senior standing required				

142327	Doctoral Thesis I			
Subject:	Catalog Nbr:			
CEE	0297			
2018 FALL		Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
2018 FALL		Primary	Mark Woodin	mark.woodin@tufts.edu
2018 FALL		Primary	David Gute	david.gute@tufts.edu
2018 FALL		Primary	John Durant	john.durant@tufts.edu
2018 FALL		Primary	James Limbrunner	James.Limbrunner@tufts.edu
2018 FALL		Primary	Wayne Chudyk	wayne.chudyk@tufts.edu
2018 FALL		Primary	Christopher Swan	chris.swan@tufts.edu
2018 FALL		Primary	Masoud Sanayei	masoud.sanayei@tufts.edu
2018 FALL		Primary	Brian Brenner	brian.brenner@tufts.edu
2018 FALL		Primary	Laurie Baise	laurie.baise@tufts.edu

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2018 FALL	Primary	Eric Hines	Eric.Hines@tufts.edu
2018 FALL	Primary	Linda Abriola	Linda.Abriola@tufts.edu
2018 FALL	Primary	C. Andrew Ramsburg	Andrew.Ramsburg@tufts.edu
2018 FALL	Primary	Shafiqul Islam	Shafiqul.Islam@tufts.edu
2018 FALL	Primary	Luis Dorfmann	Luis.Dorfmann@tufts.edu
2018 FALL	Primary	Richard Hooper	Richard.Hooper@tufts.edu
2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu
2018 FALL	Primary	Natalie Capiro	Natalie.Capiro@tufts.edu
2018 FALL	Primary	Robert Viesca	Robert.Viesca@tufts.edu
2018 FALL	Primary	Daniel Kuchma	Dan.Kuchma@tufts.edu
2018 FALL	Primary	John Germaine	John.Germaine@tufts.edu
2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
2018 FALL	Primary	Jonathan Lamontagne	Jonathan.Lamontagne@tufts.edu
2018 SPRG	Primary	Steven Chapra	steven.chapra@tufts.edu
2018 SPRG	Primary	Kurt Pennell	Kurt.Pennell@tufts.edu
2018 SPRG	Primary	Daniele Lantagne	Daniele.Lantagne@tufts.edu

Guided research on a topic suitable for a doctoral dissertation. Required: Consent of instructor.

142328	**Independent Study**

Subject:	Catalog Nbr:			
CEE	0294			
2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
2018 SPRG	Primary	Mark Woodin	mark.woodin@tufts.edu
2018 SPRG	Primary	Amy Pickering	Amy.Pickering@tufts.edu

Supervised, independent study of topics related to civil and environmental engineering. Departmental consent required

142345	**Master's Project**

Subject:	Catalog Nbr:			
CEE	0290			
2018 FALL	Primary	Amy Pickering	Amy.Pickering@tufts.edu
2018 FALL	Primary	Helen Suh	Helen.Suh@tufts.edu
2018 SPRG	Primary	Anne Marie Desmarais	annemarie.desmarais@tufts.edu
2018 SPRG	Primary	James Limbrunner	James.Limbrunner@tufts.edu

A project under the guidance of a faculty adviser that addresses a substantial engineering problem related to the student's program of study. Students who are practicing engineers are encouraged to consider projects relevant to their own work. A written report and an oral presentation are required.

142502	**Engineering Design Process**

Subject:	Catalog Nbr:

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BME	0066			
2018 FALL		Primary	Janet Krevolin	Janet.Krevolin@tufts.edu
2018 FALL		Primary	Jean-Michel Molenaar	Jean-Michel.Molenaar@tufts.edu

Principles of design within the context of the medical device industry. Practical experience with design and product development. Converting a product from concept through design and deployment. Identifying unmet needs, inventing a new device, and implementing within the framework of medical-device design controls. Fabrication methods and version control.

142503	**Marketing and Business Communications**			
Subject:	Catalog Nbr:			
EM	0242			
2017 FALL		Primary	Kevin Oye	Kevin.Oye@tufts.edu
2017 FALL		Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu
2018 FALL		Primary	Marci Sapers	Marci.Sapers@tufts.edu

Institutional and product marketing methods used by businesses launching new ventures. Overview of basic marketing principles, from day-to-day marketing activities to positioning and strategy. Analysis, formulation, and implementation of marketing strategies; concepts for understanding customer behavior and creating marketing strategy; fundamentals of market research, pricing, and reaching and selling to customers. Generating and delivering written and oral communications with clarity and precision, for different stakeholders and audiences. Course enrollment limited to Master of Science in Innovation and Management (MSIM) students.

142504	**Leading for Impact**			
Subject:	Catalog Nbr:			
EM	0263			
2018 FALL		Primary	Stacy Lennon	Stacy.Lennon@tufts.edu

Development of self-awareness and skills necessary for leadership. 360 degree assessment tools and extensive experiential learning. Oral communication, systems thinking, high performance teams, fostering creativity, team decision making, leading change, influence without authority. Conceptual frameworks, tools, and skills to effectively manage conflict and negotiate win/win solutions in the workplace. Cases and role plays to simulate real on the job conflicts. Course enrollment limited to Master of Science in Innovation and Management (MSIM) students.

142505	**Integrating Engineering and Literacy in Elementary and Middle School**			
Subject:	Catalog Nbr:			
ENE	0120			
2018 FALL		Primary	Merredith Portsmore	merredith.portsmore@tufts.edu
2018 FALL		Primary	Elissa Milto	elissa.milto@tufts.edu

Introduction to the theory, curricula and practices of teaching integrated engineering and literacy. Topics include disciplinary engineering practices, connecting literacy to engineering, analysis of example

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implementations, and literacy practices. Required implementation of sample curricular units in educational settings.

142811	Introduction to Remote Sensing
Subject: CEE	Catalog Nbr: 0189
2018 SPRG	Primary Magaly Koch Magaly.Koch@tufts.edu

Satellite remote sensing technology and its applications to a variety of fields including urban and land use planning, natural resources monitoring and management, and environmental sciences. Physical processes in remote sensing; optical, thermal and microwave based sensors; image analysis to derive desired information, and applications for geo-environmental studies. Laboratory exercises in remote sensing.

142812	Environmental Systems Modeling
Subject: CEE	Catalog Nbr: 0215
2018 SPRG	Primary Steven Chapra steven.chapra@tufts.edu

Numerical computer modeling for environmental and water-resources simulation. Mass and energy balances, reaction kinetics, transport, and numerical solution techniques. Pollutants including pathogens, toxic substances, organic carbon/oxygen, heat, eutrophication, and pH in rivers, lakes and estuaries. Recommendations: Math 51 and CEE1, or equivalents.

142813	Scanning Probe Microscopy
Subject: ME	Catalog Nbr: 0132

Scanning probe microscopy (SPM) and atomic force microscopy (AFM). Basic principles of operation. Scanning in basic (contact, tapping, non-contact) modes. Advanced modes of operation (Electrical Force Microscopy, Chem AFM, Piezo AFM, sub-resonance tappings). Modern SPMs/AFMs. How to choose the right microscope/mode. Applications of SPM/AFM to study different types of materials, from hard materials used in the semiconductor industry, to soft materials such as polymers or biological tissues. Limitations of resolution, possible artifacts. Prerequisites: Senior or graduate standing

142814	Scanning Probe Microscopy
Subject: ME	Catalog Nbr: 0232

Scanning probe microscopy (SPM) and atomic force microscopy (AFM). Basic principles of operation. Scanning in basic (contact, tapping, non-contact) modes. Advanced modes of operation (Electrical Force Microscopy, Chem AFM, Piezo AFM, sub-resonance tappings). Modern SPMs/AFMs. How to choose the right microscope/mode. Applications of SPM/AFM to study different types of materials, from hard materials used in the semiconductor industry, to soft materials such as polymers or biological tissues. Limitations of resolution, possible artifacts. A project related to graduate research is required.

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142815	New Product Development			
Subject: EM	Catalog Nbr: 0220A			
2018 FALL	Primary	Samuel Liggero	Samuel.Liggero@tufts.edu	
2018 FALL	Primary	Gavin Finn	Gavin.Finn@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students learn what questions to ask and actions to take at various phases of new product evolution. Emphasis is placed on customer input and cross-functional team roles and responsibilities. Elements of marketing are presented including: market research tools, product positioning, branding and marketing communications. The central focus of this module is the development of a new product concept by cross-functional student teams that integrates learning from other modules. The student teams formally present their concepts at the end of the semester and develop effective techniques to present to senior management and/or prospective investors. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 220).

142816	Project Management and Software Methodologies			
Subject: EM	Catalog Nbr: 0230A			
2018 FALL	Primary	James Nash	James.Nash@tufts.edu	
2018 FALL	Primary	Kishore Pochampally	Kishore.Pochampally@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students learn the fundamentals and modern heuristics for project management, with a focus on product development/engineering projects. The Project Management Body of Knowledge from the Project Management Institute (PMI) is explored in depth. Additional special topics include: quantitative project management; iterative and agile project lifecycles; software development lifecycles; and project defect models. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 230).

142817	Financial and Managerial Accounting			
Subject: EM	Catalog Nbr: 0230B			
2018 FALL	Primary	Alicia Amaral	Alicia.Amaral@tufts.edu	
2018 FALL	Primary	Frank Apeseche	Frank.Apeseche@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students learn how to analyze and create financial statements including the income statement, balance sheet and cash flow statement. We explore managerial tools for optimizing financial decisions including the economic feasibility of projects and products. In conjunction with the course project in the New Product Development course, student teams are required to develop a complete financial plan including a full set of pro forma financial statements and an analysis of return on investment. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 230).

Course Bulletin

142818	Building Teams and Leading Teams			
Subject:	Catalog Nbr:			
EM	0260A			
2018 FALL	Primary	Mary Viola	Mary.Viola@tufts.edu	
2018 FALL	Primary	Jerome Brightman	Jerome.Brightman@tufts.edu	
2018 FALL	Primary	Louise Strayhorn	Louise.Strayhorn@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

In this two module sequence (260A and 260B), students learn the basic concepts of leadership, management and teamwork. The uniqueness of this course is within the teaching methodology, which has been developed to accelerate the advancement of self-awareness and interpersonal competencies. Specific topics covered in Building and Leading Effective Teams include: personality types (Myers-Briggs type indicator assessment), best practices in forming and maintaining team performance, giving and receiving feedback, individual and team creativity, communicating to inspire and influencing without authority. Topics in Leading Organizations include systems thinking, team decision-making, communication across cultures, shared visions and organizational change. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 260).

142819	Business Communications			
Subject:	Catalog Nbr:			
EM	0260D			
2018 FALL	Primary	Stephen Caplow	Stephen.Caplow@tufts.edu	

Students learn and apply principles of effective written and oral communication for different purposes and different audiences in the workplace. Students reflect on their on communication practices and explore ways to improve their tone, focus, and organization to get better results from both day-to-day and formal communications. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 260).

142820	Capstone Leadership Project Prep 2 Year Only
Subject:	Catalog Nbr:
EM	0282

142822	Design of Experiments and Predictive Models			
Subject:	Catalog Nbr:			
EM	0210B			
2018 FALL	Primary	James Nash	James.Nash@tufts.edu	
2018 FALL	Primary	Kishore Pochampally	Kishore.Pochampally@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students gain expertise with Design of Experiments, a method for characterizing a process or system as a

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transfer function of its input variables, using the transfer function to obtain optimal, real-world settings for the input variables. Other approaches to transfer functions are explored, including big data approaches, regression analysis, and logistic regression. Statistical process control methods for analyzing and maintaining the behavior of systems and processes over time are explored. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 210).

142823	Systems Engineering and Optimization
Subject: EM	Catalog Nbr: 0210C

This module presents statistical approaches to systems thinking and system design engineering. Methods for measuring, analyzing, predicting and improving product reliability are explored. Statistical tolerancing of system components is introduced, together with techniques for aggregating and measuring system-level quality and probability-of-failure. Big data approaches to systems optimization are discussed, including Dependent Variable Analysis and Machine Learning. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 210).

142824	Experience Design
Subject: EM	Catalog Nbr: 0220B

2018 FALL	Primary	Debra Reich	Debra.Reich@tufts.edu
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

This module explores the core principles of experience design and shows how these principles can be applied to the creation of compelling products, services, brands and environments. Topics covered include: the role of brand in experience design; approaches to customer understanding; the development of customer personas and journey maps; envisioning systems; experiential modeling; and designing for products and services. At the final session student teams present class projects and consider the role of experience design in business strategy. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 220).

142825	Sustainability
Subject: EM	Catalog Nbr: 0220C

2018 FALL	Primary	Thomas Mooney	Thomas.Mooney@tufts.edu
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

The Sustainability module introduces lifecycle thinking to product design, as well as the business case for sustainability. Students learn about sustainable product development, cradle-to-cradle lifecycle concepts, life-cycle assessments, nature-inspired design and systems thinking. In addition, students have the opportunity to develop sustainability initiatives for their own workplace and learn how to drive sustainable thinking into product development and the corporation. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 220).

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142826	Systematic Innovations
Subject:	Catalog Nbr:
EM	022D

142827	Supply Chain Management			
Subject:	Catalog Nbr:			
EM	0230C			
2018 FALL	Primary	Gerald Brown	Gerald.Brown@tufts.edu	
2018 FALL	Primary	Abbott Weiss	Abbott.Weiss@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

The module focuses on the strategic impact of supply chain excellence, using case studies and simulations from high tech, retail and large scale manufacturing to convey best practices and decision factors in supply chain management. Success in building a world-class supply chain requires functional integration both within the firm and across the network of companies, and practical application of this concept is a recurring theme in course discussion, reading and assignments. Topics explored include: strategic supplier management, global supply chains, outsourcing decisions, inventory management and replenishment methodologies. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 230).

142828	Operations Management			
Subject:	Catalog Nbr:			
EM	0230D			
2018 SPRG	Primary	Kishore Pochampally	Kishore.Pochampally@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students are introduced to problems and analysis related to the design, planning, control, and improvement of manufacturing and service operations. Topics include: how to map and analyze process flows, determining process capacities and bottlenecks, and designing and coordinating operations in concert with the whole organization. Through cases and an online simulation, students will practice diagnosing and solving problems, and recommending and implementing process improvement actions. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 230).

142829	Business Strategy			
Subject:	Catalog Nbr:			
EM	0240A			
2018 SPRG	Primary	Frank Apeseche	Frank.Apeseche@tufts.edu	
2018 SPRG	Primary	Kevin Oye	Kevin.Oye@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Business Strategy provides the background and insights required to develop a differentiating business strategy for an organization. The lectures and readings cover business fundamentals, the strategic planning process,

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competitive strategies, core competencies, strategic alliances, acquisitions and mergers, and franchising. Working in teams, the students develop a complete business strategy for a high tech company. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 240).

142830	Technology Strategy

Subject:	Catalog Nbr:
EM	0240B

2018 SPRG	Primary	Samuel Liggero	Samuel.Liggero@tufts.edu
2018 SPRG	Primary	Mark Ranalli	No Email on file.
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

This module provides insight into many factors that drive innovation and the successful commercialization on new technologies in established and new businesses. The module includes best practices in new product portfolio management, technology road mapping, and discussion of incremental, radical and disruptive innovation. Reading assignments include "The Innovator's DNA" by Jeff Dyer, Hal Gregersen and Clayton M. Christensen, selected chapters from "Seeing What's Next" by Clayton M. Christensen, Geoffrey Moore's "Crossing the Chasm," as well as several case histories. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 240).

142831	Fundamentals of Economics

Subject:	Catalog Nbr:
EM	0240C

2018 FALL	Primary	Partha Ghosh	Partha.Ghosh@tufts.edu
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

This module offers an overview of both macro and microeconomics and provides students with the background required for the Globalization and Multinational Strategies module. Students learn to (i) analyze current global economic issues that are related to trade balance, government budgets, unemployment, competitiveness of innovation and manufacturing processes, (ii) assess how fiscal and monetary discipline impact economic growth and social & political stability (iii) examine how different economic philosophies shape individual and collective behaviors (iv) analyze market behaviors and (v) develop an understanding of the basics of game theory. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 240).

142832	Globalization and Multinational Strategy

Subject:	Catalog Nbr:
EM	0240D

Students develop a full understanding of the forces behind globalization and the evolution of multinational companies from different regions of world. The module examines the strategic, organizational and operational implications of working and leading in the global environment both in a large multinational organization and in a start-up and discusses how different globalization models work across various industries. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 240).

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142833	Personal Leadership			
Subject:	Catalog Nbr:			
EM	0250A			
2018 SPRG	Primary	Ewa Winston	Ewa.Winston@tufts.edu	
2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

The ability to lead starts with the process of self-discovery. In order to succeed externally, leaders need to develop an ability to understand their own internal environments - their energy, motivation, priorities, core values, etc. They need to develop their self-management skills and cultivate their self-confidence. Learning in this context does not mean simply acquiring new information, but elevating self-awareness, discovering one's authentic self and taking responsibility for her/his development as a leader. This module helps students develop a better understanding of their internal environment and to learn (and implement) techniques for improving their personal effectiveness. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 250).

142834	Ethics of Leadership			
Subject:	Catalog Nbr:			
EM	0250B			
2018 FALL	Primary	Ewa Winston	Ewa.Winston@tufts.edu	
2018 FALL	Primary	Jane Seminara	Jane.Seminara@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

Students learn what constitutes a situation with moral or ethical stakes, how such situations develop and how leaders think through these challenges. Topics discussed include: different types of moral challenges, moral leadership, moral identity and professionalism, as well as moral reasoning, and moral action. This module gives students the intellectual tools and depth of understanding to assess moral issues as they arise in their personal and professional life. Students apply these concepts and insights into their own growth as engineering leaders. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 250).

142835	Practice of Ethical Leadership
Subject:	Catalog Nbr:
EM	0250C

Students are encouraged to look outward and expand their understanding of leadership, the world and their place in it as future engineering leaders. Students are challenged to formulate their own leadership message, to translate it into action and demonstrate it in the real world. Topics discussed include: giving voice to values, taking stand, exercising authority and emergent leadership. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 250).

142836	Leading Organizations
Subject:	Catalog Nbr:

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EM	0260B			
	2018 SPRG	Primary	Mary Viola	Mary.Viola@tufts.edu
	2018 SPRG	Primary	Jerome Brightman	Jerome.Brightman@tufts.edu
	2018 SPRG	Primary	Louise Strayhorn	Louise.Strayhorn@tufts.edu
	2018 SPRG	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu

In this two module sequence (260A and 260B), students learn the basic concepts of leadership, management and teamwork. The uniqueness of this course is within the teaching methodology, which has been developed to accelerate the advancement of self-awareness and interpersonal competencies. Specific topics covered in Building and Leading Effective Teams include: personality types (Myers-Briggs type indicator assessment), best practices in forming and maintaining team performance, giving and receiving feedback, individual and team creativity, communicating to inspire and influencing without authority. Topics in Leading Organizations include systems thinking, team decision-making, communication across cultures, shared visions and organizational change. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 260).

142837	**Conflict Resolution**
Subject:	Catalog Nbr:
EM	0260C

A practitioner-focused module, students are introduced to frameworks, tools, and skills to effectively manage conflict in the workplace. Building on prior modules and tailored to address the specific challenges students have faced (or anticipate facing in the future), this module draws upon relevant literature and uses student examples and action learning to develop insights and approaches. A central feature of this module is an exercise, in which students perform a real life negotiation in a session with two classmates and an instructor. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 260).

142838	**Capstone Leadership Project 2 year format**
Subject:	Catalog Nbr:
EM	0280A

142839	**Prep and Capstone Leadership Project 3 year format**
Subject:	Catalog Nbr:
EM	0280B

143014	**Systematic Innovations**
Subject:	Catalog Nbr:
EM	022D

This module introduces students to the general principles of TRIZ-based systematic innovation. A collection of

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tools is applied algorithmically to identify the right problem, solve the problem efficiently and ensure the solutions align with the business strategy. Students develop skills that can be applied to improve functionality within existing products, develop new generation products, or reduce cost. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 220).

143027	**Systematic Innovations**			
Subject:	Catalog Nbr:			
EM	0220D			
2018 FALL	Primary	Sergei Ikovenko	Sergei.Ikovenko@tufts.edu	
2018 FALL	Primary	Rebekah Plotkin	Rebekah.Plotkin@tufts.edu	

This module introduces students to the general principles of TRIZ-based systematic innovation. A collection of tools is applied algorithmically to identify the right problem, solve the problem efficiently and ensure the solutions align with the business strategy. Students develop skills that can be applied to improve functionality within existing products, develop new generation products, or reduce cost. This course is only open to students in the MS Engineering Management Program and is a subcomponent of a larger course (EM 220).

143209	**Senior Capstone Project in Data Science I**			
Subject:	Catalog Nbr:			
COMP	0087			
2018 FALL	Primary	Alva Couch	alva.couch@tufts.edu	

Application of data science and analytic principles to the solution of a real-world problem in a group setting. Requirements analysis, review of available data sources, and proposal of a solution strategy to the problem.

143210	**Senior Capstone Project in Data Science II**
Subject:	Catalog Nbr:
COMP	0088

A continuation of COMP 87. Analysis of the problem proposed in COMP 87 is completed and a final paper summarizes data gathered, analytic results, lessons learned, and opportunities for future study.

143211	**Special Topics in Data Infrastructure and Systems**
Subject:	Catalog Nbr:
COMP	0051

A special topics course in data infrastructures and systems, suitable for fulfilling requirements of the Bachelor of Science in Data Science.

143212	**Special Topics in Data Infrastructure and Systems**
Subject:	Catalog Nbr:
COMP	0151

A special topics course in data infrastructures and systems, suitable for fulfilling requirements of the Bachelor

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of Science in Data Science.

143213	Special Topics in Data Analysis and Interfaces
Subject:	Catalog Nbr:
COMP	0052
A special topics course in data analysis and interfaces, suitable for fulfilling requirements of the Bachelor of Science in Data Science.	

143214	Special Topics in Data Analysis and Interfaces
Subject:	Catalog Nbr:
COMP	0152
A special topics course in data analysis and interfaces, suitable for fulfilling requirements of the Bachelor of Science in Data Science.	

143215	Special topics in Computational and Theoretical Aspects of Data Science.
Subject:	Catalog Nbr:
COMP	0153
A special topics course in computational and theoretical aspects of data science, suitable for fulfilling requirements of the Bachelor of Science in Data Science.	

143216	Special topics in Computational and Theoretical Aspects of Data Science
Subject:	Catalog Nbr:
COMP	0053
A special topics course in computational and theoretical aspects of data science, suitable for fulfilling requirements of the Bachelor of Science in Data Science.	

143234	Musical Instrument Design And Manufacture
Subject:	Catalog Nbr:
ME	0073
2018 FALL	Primary Matthew Mueller Matthew.Mueller@tufts.edu
(Cross-listed as ES 73) Review of the underlying engineering and the basic fabrication of musical instruments, including an introduction to musical acoustics, computer-based simulation tools, laboratory measurement, and manufacturing. The bulk of the class is dedicated to designing, simulating, building, and testing of an instrument.	

143282	Fundamentals of Biostatistics
Subject:	Catalog Nbr:
CEE	0006

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	2018 FALL	Primary	Mark Woodin	mark.woodin@tufts.edu

(Cross listed as CH 136) Examination of statistical methods used in biomedical and public health studies. Descriptive statistics, probability, basic hypothesis testing, ANOVA, linear regression, logistic regression, and an introduction to survival analysis. Instruction in the use of statistical software will be provided throughout the course. CEE 6 and CEE 156 cannot both be taken for credit

143283	**Integrated Planning and Management of Civil Infrastructure Systems**
Subject:	Catalog Nbr:
CEE	0080

Decision making for integrated, complex and adaptive civil infrastructure systems. Rigorous exploration of economic efficiency, robustness, and resilience of infrastructure design and management. Simulation and optimization. Explicit consideration of technical, environmental, societal, and climate risks and uncertainties. Recommendations: ES55 and ES56 or equivalent

143284	**Structural Health Monitoring**
Subject:	Catalog Nbr:
CEE	0127

2018 FALL	Primary	Babak Moaveni	Babak.Moaveni@tufts.edu

Vibration-based structural health monitoring including system identification of linear systems. Data acquisition, signal processing, modal identification, parameter estimation, and optimization. Recommendations: ES55 and ES56, or consent

143285	**Advanced Soil Mechanics**
Subject:	Catalog Nbr:
CEE	0242

2018 FALL	Primary	Christopher Swan	chris.swan@tufts.edu

Soil composition, index properties, classification. Mohr circles and stress paths. Consolidation behavior; consolidation theory including radial and 3-D solutions; secondary compression. Shear strength of soils; effects of soil composition, stress history, drainage conditions, and rate of loading. Recommendation: CEE 42 or equivalent

143286	**Parallel Computing**
Subject:	Catalog Nbr:
EE	0155

Programming modern parallel computer architectures, especially GPUs and multi-core CPUs. Rationale for modern multi-core CPUs. Challenges of multi-threaded programming. High-performance software taking advantage of hardware caches, cache coherency, memory systems and parallel computation. Recommendations: EE 126 or COMP 40.

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143301	Professional Preparation for Cooperative Education
Subject: ES	Catalog Nbr: 0085
2018 FALL	Primary Qiaobing Xu Qiaobing.Xu@tufts.edu
Introduction to work-based learning, strategies to optimize work experience and learn skills and habits to best transition into a professional work environment. Writing an effective resume, strategic interviewing, professional networking strategies, and developing a list of goals to achieve and skills to develop in a professional environment. Effective approaches to oral and written communications.	

143348	A Machine-Centric Approach to Programming, Data Structures and Algorithms
Subject: EE	Catalog Nbr: 0200
2018 FALL	Primary Steven Bell Steven.Bell@tufts.edu
Programming in C and C++ with coverage of data structures (linked lists, binary trees, hash tables, graphs), abstract data types (stacks, queues, maps, sets) and algorithms (sorting, graph search, minimal spanning tree). Efficiency of these structures and algorithms is compared via Big-O analysis. Brief coverage of concurrent (multi-threaded) programming. Object-oriented design: inheritance, templates and virtual methods. Embedded, high-performance and close-to-hardware applications. Defensive coding and use of standard UNIX development tools. Requirements: graduate standing	

143349	Fundamentals of Computer Systems and Engineering
Subject: EE	Catalog Nbr: 0201
Fundamentals of digital systems and computer architecture for master's students whose undergraduate background did not cover this material. Topics covered include digital logic, assembly programming, computer architecture, memory hierarchies and technologies, I/O, hardware implementation in VHDL, operating systems and networking. Analysis and hands-on implementation of complex digital systems. EE201 and EE126 cannot both be taken for credit. Requirements: graduate standing	

143350	Methods for Human Factors Engineering
Subject: ENP	Catalog Nbr: 0064
Qualitative and quantitative methods and techniques used in human factors engineering research. Usability testing, structured observation, questionnaire design, focus group design, psychophysical methods, signal detection theory, and field studies. Examples of good and bad methods/techniques. Recommendations: PSY53	

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143398	Synthetic Biology
Subject: CHBE	Catalog Nbr: 0159
Overview of Synthetic biology. Origin, techniques, current status, and applications to chemical, pharmaceutical, energy, environmental, and agriculture industries. Recommendation: Bio 41 or equivalent, and Bio 152/Chem 171 or equivalent	

143423	Medical Technology Development
Subject: ENP	Catalog Nbr: 0109
Medical technology development and healthcare delivery. Human anatomy, medical conditions, roles of clinicians, and effect of medical care environments on medical care quality. User interfaces of diagnostic, therapeutic, and monitoring technologies. Design of medical devices to optimize medical care, user satisfaction, and patient safety. Visits to clinical care environments. Guest lectures by clinicians. Individual and group projects structured around real world problems. Recommendations: Junior Standing	

143424	Engineering Forensics
Subject: ENP	Catalog Nbr: 0112
Prevention of recurrence for high-profile accidents in transportation and related industries. Accident-investigation methods, discovery of system-safety faults, and identification of user-interface design errors. Case studies with emphasis on individual analysis and presentation. Site visits and guest lectures. Recommendations: PSY 53, ENP 64 and junior standing.	

143425	Ergonomic Design for Wearables, Devices & Workspaces
Subject: ENP	Catalog Nbr: 0114
Design of physical products and workspaces. Design of wearables and handheld devices. Research and evaluation using sensors, and subsequent application to design. Anthropometry, functional anatomy, ergonomics, body mechanics, prototyping, and human factors research methods. Extensive in-class activities, group work, and collaborative discussion. Engagement with local industry and professionals. Conference/journal research and portfolio-enhancing deliverables. Recommendations: Junior standing	

143426	Industrial Design
Subject: ENP	Catalog Nbr: 0165
History and current state of industrial design, the industrial design process, and industrial design principles.	

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Application of industrial design for user needs and expectations. Product safety, efficacy and consumer satisfaction. Recommendations: Junior standing

143427	**GPS & Satellite Navigation**
Subject: ME	Catalog Nbr: 0186
Positioning by trilateration; satellite-based, global radio-navigation systems; requisite technologies including global coordinate frames, ultra-stable clocks; GPS satellite constellation and orbits; GPS Time; WGS 84 coordinate frame; signal theory including spread spectrum signals, code division multiple access (CDMA); GPS system theory including receiver algorithms for acquisition and tracking of GPS signals; estimation of position, velocity and time from measurements of pseudoranges including least-squares and Gauss-Newton method; hands-on data collection with a GPS receiver. Recommendation: Senior standing	

143428	**Global Climate Change and Human Health**
Subject: CEE	Catalog Nbr: 0151
Human health implications of global climate change, including extreme weather events and air pollution. Climate change effects on infectious disease transmission, vector distribution, agricultural productivity, and ecological systems. Use of risk assessment, statistical modeling, and data visualization tools to identify and predict current and future health impacts resulting from climate change. Recommendation: ES55 and (ES56 or CEE156)	

143429	**Environmental Health Data-Lab**
Subject: CEE	Catalog Nbr: 0152
Use of publicly available environmental and health data for in-depth analysis of environmental health topics such as air pollution, exposure disparities, water quality, and contaminant source contributions, with knowledge of contaminant fate and transport, statistics, and data visualization. Recommendation: ES55 and (ES56 or CEE156)	

143430	**Water, Sanitation, and Hygiene (WASH) Design**
Subject: CEE	Catalog Nbr: 0159
User-centered design of WASH systems for low-cost, community- and household-level treatment. Topics include technologies, health impacts, societal contexts, and monitoring for achieving sustainability. Emphasis on applying topics to develop a WASH design for a self-selected project. Recommendation: CEE32 and CEE52 or consent of instructor	

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143431	Special Topics in Social Context of Computing
Subject: COMP	Catalog Nbr: 0055
Study of various topics in the social and ethical context of computing. Content and prerequisites to be announced. Please see departmental website for specific details.	

143432	Special Topics in Social Context of Computing
Subject: COMP	Catalog Nbr: 0155
ABET CAC requires us to include more social context in our curriculum, and this course provides a vehicle for such interaction, by allowing us to cross-list specific courses in A&S and Fletcher as satisfying that requirement via this number. Thus, this number can be used to change the description of the BSCS to include social context courses as required by ABET. We desire both undergraduate-only and undergraduate/graduate numbers for this option, depending upon course level.	

143433	Big Data
Subject: COMP	Catalog Nbr: 0119
Principles, practices, and tools for analyzing and interpreting large data sets. Distributed data stores and maintaining data consistency. Query languages for data analysis, including SparQL. Scalable indexing strategies for data search, including SOLR. Map/Reduce and other parallel programming paradigms for data reduction and analysis. Supercomputing, high-performance storage, and strategies for assuring data locality and movement. Principles illustrated by applying common data analysis algorithms to large data sets. Prerequisites: COMP 15 and MATH 70, or graduate standing	

143434	Special Topics in the Practice of Data Science
Subject: COMP	Catalog Nbr: 0154
Study of various topics in the practice of Data Science, suitable for fulfilling requirements of the Master of Science in Data Science. Content and prerequisites to be announced. Please see departmental website for specific details. Prerequisite: Graduate standing	

143435	Masters Project in Data Science
Subject: COMP	Catalog Nbr: 0283
Guided individual study of an approved topic suitable for a master's project in Data Science. Please see departmental website for specific details.	

143474	Computational Biology

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Subject:	Catalog Nbr:			
BME	0167			
2018 FALL	Primary	Lenore Cowen		lenore.cowen@tufts.edu
(Cross listed as COMP 167) Computational Biology.Please see departmental website for specific details.				