

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MIT PROFESSIONAL
EDUCATION

SHORT PROGRAMS 2012

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SHORT PROGRAMS

CONNECTS YOU TO ADVANCED KNOWLEDGE

The courses offered through MIT Professional Education Short Programs are designed by MIT experts to connect busy professionals in industry to late-breaking knowledge at MIT. Immersed in this intense learning environment, professionals from around the globe have the opportunity to gain the crucial information they need to fuel their careers, advance their companies, and have an impact on the world. Short Programs courses give participants unparalleled access to some of the top experts in their fields. This highly-focused learning experience allows them to learn about topics of vital interest and to engage with faculty while creating an international network of talented colleagues.

In addition to receiving a certificate of completion, participants can earn Continuing Education Units (CEUs).

ADMISSION

To maintain high standards, enrollment in each program is limited by the availability of teaching staff and facilities. Applications will be accepted until the program limit has been reached. MIT reserves the right to select applicants whose qualifications and experience suggest that they will receive the most benefit from a given short program. Admission is transferable only by specific authorization from MIT Professional Education.

Applications, detailed program descriptions, and information on policies, accommodations, travel, discounts, and payment options are available on the website.



TOPIC AREAS

- | | |
|--|---|
| 03 BIOTECHNOLOGY / PHARMACEUTICAL | 06 MECHANICAL DESIGN & ENGINEERING |
| 04 ENERGY / SUSTAINABILITY / TRANSPORTATION | 07 CRISIS MANAGEMENT |
| 05 COMPUTING & SECURITY | 07 INNOVATION |
| 05 HIGH-SPEED IMAGING | 07 LEADERSHIP |
| 05 RADAR | 08 DATA MODELING & ANALYSIS |
| 06 SUPPLY CHAIN | 08 LEAN ENTERPRISE |
| 06 MANUFACTURING | 09 SYSTEMS ENGINEERING |

BIOTECHNOLOGY / PHARMACEUTICAL

Controlled Release Technology: Polymeric Delivery Systems for Pharmaceuticals, Proteins, and Other Agents [10.02s]

Lead Instructor: **R. Langer**

July 9–13, 2012 | \$3,250 | 2.7 CEUs

Review the field and assess the prospects of future developments in the delivery and stabilization of chemicals and drugs. Topics include delivery methods and applications, with emphasis on controlled release in the pharmaceutical and medical fields. Regulatory and patent considerations will be addressed.

Downstream Processing [10.45s]

Lead Instructor: **C. Cooney**

August 6–10, 2012 | \$3,950 | 2.7 CEUs

An insightful overview of the fundamentals of downstream processing for biochemical product recovery. Offers practical examples and case studies to illustrate problems/solutions, along with small workshops on specific topics.

Fermentation Technology [10.48s]

Lead Instructors: **D.I.C. Wang, K. Prather**

July 30–August 3, 2012 | \$3,950 | 2.8 CEUs

This course emphasizes the application of biological and engineering principles to problems involving microbial, mammalian, and biological/biochemical systems. The course aims to review fundamentals and provide an up-to-date account of current knowledge in biological and biochemical technology with special emphasis on mammalian cell systems. The lectures will emphasize and place perspectives on biological systems with industrial practices.

Flow Chemistry: Continuous Synthesis and Purification of Pharmaceuticals and Fine Chemicals [10.65s]

Lead Instructors: **T. Jamison, K. Jensen**

June 25–27, 2012 | \$2,200 | 1.5 CEUs

Overview of principles and technologies of continuous synthesis and purification of small molecules. Covers advantages and challenges of flow in comparison to batch, decision process for selecting between continuous or batch methods for a particular problem, automation, and scale-up strategies. Emphasizes cutting-edge methods, technologies, and case studies.

Formulation and Stabilization of Biotherapeutics [10.50s]

Lead Instructors: **B. Trout, M. Manning**

July 9–11, 2012 | \$2,200 | 1.5 CEUs

Biotherapeutics, particularly antibodies, are currently the fastest growing pharmaceuticals. This course addresses the challenge of their stability in aqueous solutions and formulation. Topics range from aggregation to oxidation, deamidation, and hydrolysis with an emphasis on modeling. Includes cutting-edge technologies, tools, and knowledge to solve stability issues.

Nanomaterials for Biological and Pharmaceutical Technologies [10.01s]

Lead Instructor: **T.A. Hatton**

July 16–20, 2012 | \$3,200 | 2.7 CEUs

Overview of how nanomaterials such as nanoparticles, nanocapsules, micelles, microemulsions, liposomes, nanoporous materials, and polymer multilayers can be prepared, stabilized, surface-functionalized, and assembled for applications in biotechnology, biomedicine, and pharmaceuticals. Specific applications include biosensing, drug delivery, imaging, bioseparations, biocatalysis, biomolecular assembly, and molecular diagnostics.



ENERGY/SUSTAINABILITY/ TRANSPORTATION

Carbon Capture and Storage: Science, Technology, and Policy [1.724s]

Lead Instructors: **R. Juanes, H. Herzog**
July 23–25, 2012 | \$2,250 | 1.8 CEUs

Covers the science, technology, and policy aspects of carbon capture and storage (CCS). Provides an in-depth understanding of CCS's role in the climate change mitigation portfolio, the technical approaches to CO₂ capture, the science behind geological storage, site selection and risk evaluation, and the role of policy in establishing a market and business opportunities for CCS.

Design of Motors, Generators, and Drive Systems [6.11s]

Lead Instructors: **J. Kirtley, S. Leeb**
June 11–15, 2012 | \$3,350 | 3.3 CEUs

This course focuses on the analysis and design of electric motors, generators, and drive systems, with special emphasis placed on the design of machines for electric drives. The course will focus on fundamentals by using MATLAB software for mathematical analysis in the context of design. Extensive hands-on exposure will be provided through computer-based laboratory exercises and through the opportunity to construct and test an actual power electronic drive for a test motor in our laboratory.

Energy, Sustainability, and Life Cycle Assessment [2.50s]

Lead Instructors: **T. Gutowski**
June 11–13, 2012 | \$2,250 | 1.5 CEUs

This class addresses sustainability starting at a global perspective and working down to the process level. Analysis includes: 1) energy resource analysis, 2) material resource analysis, and 3) life cycle assessment. Examples will be taken from three focus areas: fuels/biomaterials, water/desalination, and manufacturing/materials/design.

Innovations in Personal Urban Mobility [PI.966s]

Lead Instructors: **K. Larson, R. Chin**
June 18–21, 2012 | \$3,200 | 2.4 CEUs

This workshop-style course will focus on the development and deployment of innovations for achieving sustainable personal urban mobility in cities. We will examine the technologies, designs, strategies, and policies to increase energy efficiency, reduce carbon emissions, and improve overall access and mobility for increasingly dense and crowded urban environments.

Modeling and Simulation of Transportation Networks [1.10s]

Lead Instructor: **M. Ben-Akiva**
August 6–10, 2012 | \$2,900 | 2.8 CEUs

An in-depth study of state-of-the-art transportation network modeling and simulation methods including: theory and applications origin-destination estimation and prediction; traffic flow models and alternative simulation methods (microscopic, mesoscopic, and macroscopic); dynamic traffic assignment methods; models of user behavior; public transportation models; equilibrium methods; calibration and validation; and real time traffic information systems.

Nuclear Plant Safety [22.956s]

Lead Instructors: **M. Kazimi, N. Todreas**
June 11–15, 2012 | \$3,200 | 2.8 CEUs

A review of safety and regulatory issues for operating reactors and licensing of new reactors. Emphasis on new developments. Fuel storage and waste repository issues will be covered.

Solar Energy: Capturing the Sun [PI.70s]

Lead Instructor: **D. Nocera**
July 23–27, 2012 | \$3,500 | 3.0 CEUs

This course will focus on sunlight, a sustainable and renewable carbon-neutral energy source. Science targeting efficient utilization of solar energy is inherently interdisciplinary, involving biology, inorganic and organic synthesis, solid state chemistry and physics, electrochemistry, chemical kinetics and mechanism, and theoretical and computational chemistry/biology. In addition, it involves concepts of homogeneous and interfacial science between solids, liquids, and gases. The course will focus on the science needed from these disciplines to develop the fundamental enabling science that will contribute to and ultimately lead to a solution of delivering clean energy, in the form of chemical fuels, produced from the sun.

Sustainability: Principles and Practice [ESD.45s]

Lead Instructor: **N.E. Selin**
July 9–13, 2012 | \$3,000 | 2.6 CEUs

Introduces the goals, principles, and practical applications of sustainability. Examines sustainability definitions in the context of major environmental issues and trends from a scientific and practical perspective through lectures, case studies, and hands-on activities. Presents practical skills for integrating sustainability into business practices, operations, and policies.

The Future of Vehicular Transportation: Propulsion, Fuels, and Emissions [2.65s]

Lead Instructors: **J. Heywood, W. Cheng**
June 18–22, 2012 | \$3,000 | 2.9 CEUs

This course will examine present and future vehicle powerplant and fuel options, addressing the engineering basics of how these propulsion systems and their fuels perform, and their future development potential. It will also explore the impacts that deploying these propulsion technologies would have on petroleum consumption, other energy streams, and emissions.

COMPUTING & SECURITY

NEW Applied Cyber Security [6.85s]

Lead Instructors: **J.R. Williams, A. Sanchez**
June 25–26, 2012 | \$1,800 | 1.6 CEUs

The course covers securing computers, applications, networks, digital forensics, and the ethical and legal practices affecting all computer users. Also covered are the strategies, implementation, and management of a business information continuity plan; mitigation of cyber vulnerabilities; and incident response and analysis. The content is targeted at ensuring the privacy, reliability, and integrity of information systems.

Cryptography and Computer Security [6.87s]

Lead Instructors: **S. Goldwasser, M. Bellare**
August 6–10, 2012 | \$3,500 | 2.8 CEUs

Discover how cryptography can be used to meet challenges posed by the internet. Covers privacy, authentication, and key distribution, as well as the design of secure protocols for applications such as e-commerce and electronic voting.

HIGH-SPEED IMAGING

High-Speed Imaging for Motion Analysis: Systems and Techniques [6.51s]

Lead Instructors: **J. Bales and Edgerton Center Staff**
June 18–21, 2012 | \$2,400 | 2.6 CEUs

The broadest experience available in high-speed film and high-speed electronic imaging capture and analysis. Use state-of-the-art equipment and perform experiments—all in the home of "Doc" Edgerton's Stroboscopic Light Laboratory, where much of the history of the field was written.

RADAR

NEW Build a Laser Radar: Design Principles, Technologies, and Applications [PI.85s]

Lead Instructors: **J. Shapiro, K. Holman**
July 16–20, 2012 | \$4,250 | 2.8 CEUs

In this one-week, project-based course, you will learn the fundamentals, operating principles, and applications of laser radar systems. You will also have the opportunity to use a radar to perform experiments that demonstrate the basic operations for ranging, 3D imagery, and coherent sensing.

NEW Build a Small Phased Array Radar Sensor [PI.81s]

Lead Instructors: **M. Watts, B. Perry**
August 6–10, 2012 | \$3,700 | 2.8 CEUs

Learn how phased-arrays work by reviewing applied electromagnetics, circuit design, and antennas. Then build your own radar and perform field experiments including ranging and moving-target imaging. This course will appeal to those who want hands-on experience learning about phased-arrays, developing radar systems, and using radar technology for imaging.

Build a Small Radar System [PI.80s]

Lead Instructors: **M. Watts, B. Perry**
June 25–29, 2012 | \$3,400 | 2.8 CEUs

Learn how radar systems work by reviewing applied electromagnetics, circuit design, and antennas. Then build your own and perform field experiments including ranging, Doppler, and SAR imaging. This course will appeal to those who want to learn how to develop radar systems or SAR imaging, use radar technology, or make components or sub-systems.

SUPPLY CHAIN

Analytics for S&OP and Network Design [PI.195s]

Lead Instructor: **J. Shapiro**

June 25–29, 2012 | \$3,750 | 3.1 CEUs

The course will cover predictive and optimization analytics for Sales & Operations Planning, Supply Chain Network Design, and their coordination. The implementation of business processes to exploit these analytics will be presented. Sessions will address fundamentals and case studies. Participants will join in hands-on, data-driven modeling exercises.

MANUFACTURING

Energy, Sustainability, and Life Cycle Assessment [2.50s]

Lead Instructor: **T. Gutowski**

June 11–13, 2012 | \$2,250 | 1.5 CEUs

This class addresses sustainability starting at a global perspective and working down to the process level. Analysis includes: 1) energy resource analysis, 2) material resource analysis, and 3) life cycle assessment. Examples will be taken from three focus areas: fuels/biomaterials, water/desalination, and manufacturing/materials/design.

Modern Manufacturing Systems and Technology [2.30s]

Lead Instructors: **D. Hardt, B. Anthony**

June 25–27, 2012 | \$2,310 | 1.8 CEUs

This course focuses on Manufacturing and the entire process of going from customer needs to order fulfillment, with a particular emphasis on creating products on a commercial scale. It will focus on the conversion of material into components and components into products that are then delivered into a supply chain. This course also encompasses the engineering and business aspects of these industries.

MECHANICAL DESIGN & ENGINEERING

Advanced Mechanical Design and Manufacturing [2.77s]

Lead Instructor: **M. Culpepper**

June 11–15, 2012 | \$3,500 | 3.1 CEUs

This course provides intensive coverage of the bearings, structures, fixtures, error models, and best practices that are used to create advanced mechanical systems. Theory and hands-on learning are combined to provide an introduction to the principles and practice of mechanical design with a focus on modeling, design, fabrication, assembly, and implementation. We will cover materials issues and emerging applications and perform hands-on experiments to solidify understanding.

Tribology: Friction, Wear, and Lubrication [2.81s]

Lead Instructor: **N. Saka**

June 25–29, 2012 | \$3,000 | 2.8 CEUs

Did you know that waste from high friction and wear represents more than 6% of the GNP? Gain a systematic understanding of tribology—the science and technology of interacting surfaces—including experimental techniques and useful problem-solving methods.



CRISIS MANAGEMENT

Crisis Management and Business Continuity [PI.90s]

Lead Instructors: **R. Larson, S. Goldman**
July 23–27, 2012 | \$3,000 | 2.4 CEUs

With an effective combination of lecture, case studies, and class interaction, this course provides attendees with the tools and knowledge to benchmark, assess, and improve their business continuity, disaster recovery, and crisis management programs. Also included are subject-matter-expert assessments of current issues including terrorism, pandemic, cyber security, and crisis communications.

INNOVATION

From Technology to Innovation: Putting Ideas to Work [PI17.50s]

Lead Instructors: **S. Weiner, J. Womack**
July 9–12, 2012 | \$3,600 | 2.3 CEUs

Both public and private organizations are concerned with innovating to keep pace with a fast-changing environment. Yet attempts to innovate are usually disruptive, cause internal dissension, and often fail. This course explores failures and successes to identify strategies that can sustain significant innovation.

Radical Innovation [PI.33s]

Lead Instructor: **S. Sarma**
June 18–20, 2012 | \$2,500 | 1.8 CEUs

Innovation is a challenge within a medium or large company. We will discuss methods to encourage innovation, ranging from creativity exercises to incentive systems and from IP strategies to internal venture. We will examine innovation from the financial, operational, and cultural standpoints, and discuss when a spin-out or an acquisition might be best.

LEADERSHIP

Challenges of Leadership in Teams [10.10s]

Lead Instructors: **C. Colton, B. Burrell**
July 23–27, 2012 | \$4,600 | 2.8 CEUs

Develop the skills and techniques you need to succeed and lead in today's team-based organizations. Experts in both business and psychology will address team dynamics, leadership style, and other key issues.

Leadership Skills for Engineering and Science Faculty [PI.61s]

Lead Instructors: **C. Leieron, C. McVinney**
June 18–19, 2012 | \$1,600 | 1.4 CEUs

Human-centered strategies for leading effective teams in academic engineering environments. Using interactive role-playing activities, self-assessment instruments, and group discussions, you will develop a repertoire of techniques for addressing issues that commonly arise within engineering research groups and teaching staff.

DATA MODELING & ANALYSIS

Data and Models in Engineering, Science, and Business [12.156s]

Lead Instructor: **F.D. Morgan**

July 23–27, 2012 | \$3,500 | 2.8 CEUs

A course that allows participants to fit data to models. Topics include linear least squares, non-linear least squares, Marquardt and Ridge Regression algorithms, Singular Value Decomposition, sensitivity analysis, Levenberg-Marquardt and Ridge Regression algorithms, experiment design, parameter error estimation (Jackknife), genetic algorithm, annealing algorithm, and neural networks. Introduces principles leading to rapid application of methods. Lectures are given in the mornings, and pre-programmed computer exercises after lunch.

NEW Decision-Making, Design, and Strategy Under Uncertainty [ESD.73s]

Lead Instructor: **M. Webster**

July 30–August 3, 2012 | \$3,500 | 2.8 CEUs

Using a best-guess forecast and optimizing the strategy for that forecast systematically leads to undesirable outcomes by not explicitly considering uncertainty. This course is designed to increase your appreciation for WHY uncertainty matters and to give you the tools to design flexible strategies that will be robust to uncertainty.

Design and Analysis of Experiments [14.37s]

Lead Instructor: **P. Berger**

July 9–13, 2012 | \$3,100 | 3.0 CEUs

After quickly reviewing the modest statistical background useful for the material in the course, we emphasize the design, implementation, and analysis of experiments in the areas of science, engineering, and management. We describe several real-world examples and include illustrations of analysis using several software packages. Our goal is to have you be able to carry out detailed experiments immediately upon your return to your company.

Discrete Choice Analysis: Predicting Demand and Market Shares [14.61s]

Lead Instructor: **M. Ben-Akiva**

June 11–15, 2012 | \$3,900 | 2.7 CEUs

An in-depth study of discrete choice models (logit, nested logit, cross-nested logit, generalized extreme value, probit, logit mixtures, latent class), data collection, specification, estimation, statistical testing, forecasting, and application. Advanced topics include the analysis of revealed and stated preferences data, sampling, simulation-based estimation, discrete panel data, Bayesian estimation, discrete-continuous models, menu choice, models with latent variables, and behavioral mixture models. Participants will learn practical applications, be provided with discrete choice software, and gain hands-on experience by estimating and testing alternative methods using real databases.

LEAN ENTERPRISE

Architecting the Future Enterprise [PI.28s]

Lead Instructors: **D. Rhodes, D. Nightingale**

July 30–August 1, 2012 | \$2,500 | 1.8 CEUs

Enterprises evolve over time, but transformation efforts too often fail to achieve intended outcomes. We teach a holistic approach to understand the ‘as-is’ enterprise, generate and evaluate alternative concepts, and select a ‘to-be’ architecture. Students learn techniques for stakeholder analysis and for ‘future-proofing’ to evaluate fitness of architectures for alternative futures.

Principles of Enterprise Transformation [PI.29s]

Lead Instructors: **D. Nightingale, J. Srinivasan**

July 16–17, 2012 | \$1,800 | 1.3 CEUs

This course highlights the importance of going beyond classical lean thinking to truly embracing the enterprise paradigm to achieve successful and sustainable transformation. Over two days, we provide a set of enterprise principles and a transformation roadmap that serve as the foundation for the holistic analysis framework that captures the current state, envisions the future state, and determines actions needed for transformation.

SYSTEMS ENGINEERING

Product Platform and Product Family Design: From Strategy to Implementation [ESD.39s]

Lead Instructors: **O. de Weck, T. Simpson**

July 30–August 2, 2012 | \$3,600 | 2.6 CEUs

Explore the strategic and implementation aspects of using product architecture and platforms to manage a product family in a competitive manner. Learn the latest theory and tools through case studies, interactive discussion, and hands-on exercises.

Systems Engineering, Architecture, and Lifecycle Design: Principles, Models, Tools, and Applications [6.18s]

Lead Instructors: **E. Crawley, D. Dori**

July 23–27, 2012 | \$3,950 | 3.0 CEUs

Combines theoretical foundations of systems engineering and architecture with practical exercises to instill solid understanding of systems architecture and design principles. Foundations are formally presented using SysML and Object-Process Methodology, while student teams model a system of their interest using a systems engineering and lifecycle support software environment.

