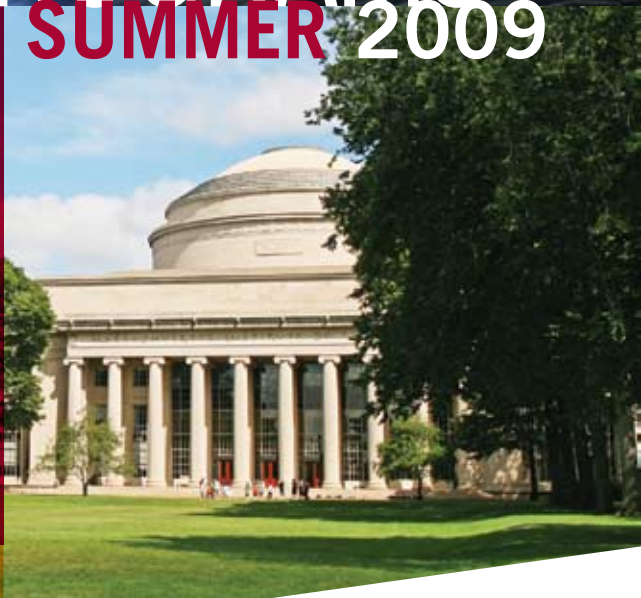




Massachusetts Institute
of Technology

SHORT PROGRAMS

SUMMER 2009



There is no substitute for an
MIT educational experience



PROFESSIONAL
EDUCATION



MIT Professional Education Short Programs are designed by MIT faculty 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.

MIT Short Programs give participants unparalleled access to some of the top experts in their fields. This highly-focused learning experience allows them to zero in on topics of vital interest and to form rewarding collaborations with faculty and an international network of talented colleagues.

In addition to receiving a certificate, MIT Short Programs participants can earn Continuing Education Units (CEUs).

Admission

In order to maintain highest standards, the enrollment in each program is limited according to the available staff and facilities. Applications will be accepted until the program limit has been reached. MIT reserves the right to select those 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 and additional information, including complete program descriptions, policies, and information on accommodations, travel, and payment options are available on our website.



<http://shortprograms.mit.edu/2009>



SUMMER 2009

TOPIC AREAS

- Astrophysics & Cosmology**
- Biotechnology / Pharmaceutical**
- Computing & Networks**
- Data Modeling & Analysis**
- Energy / Transportation**
- High-Speed Imaging**
- Leadership for Engineering & Science**
- Lean Enterprise**
- Mechanical Design & Engineering**
- Nanotechnology**
- Supply Chain / Marketing / IQ**
- Systems Engineering**
- Technology & Organizations**

Short Programs

ASTROPHYSICS & COSMOLOGY

Relativity, Gravity, and Cosmology [8.06s] **P. Joss**
Explore Einstein's theories of relativity and recent breakthroughs in gravitation theory and cosmology. Obtain insightful views into exciting and controversial topics in modern physics and astrophysics. For a general audience. July 13-17, 2009 | \$1,950 | 2.4 CEUs

BIOTECHNOLOGY / PHARMACEUTICAL

Bioreactors and Bioprocessing [20.14s] **J.-F. Hamel**
For professionals new to the field of bioreactors and bioprocessing, this course provides hands-on experience in upstream processing and focuses on the selection, preparation and operation of bioreactors and instrumentation. Includes how to interpret bioreactor data. June 8-12, 2009 | \$4,000* | 2.8 CEUs

Advances in Controlled Release Technology: Polymeric Delivery Systems for Pharmaceuticals, Proteins, and Other Agents [20.02s] **R. Langer**
Review recent advances in the field and assess the prospects of future developments. Cover delivery methods and applications, with emphasis on controlled release in the pharmaceutical and medical fields. Address regulatory and patent considerations. July 13-17, 2009 | \$2,995* | 3.0 CEUs

Nanomaterials for Biological and Pharmaceutical Technologies [10.01s] **T. A. Hatton**
Examine how nanomaterials such as nanoparticles, nanocapsules, micelles, microemulsions, liposomes, nanoporous materials, and polymer multilayers can be prepared, stabilized, surface-functionalized and assembled for biomedical applications, such as biosensing, drug delivery, imaging, separations, catalysis, and molecular diagnostics. July 20-24, 2009 | \$3,000* | 3.0 CEUs

NEW Synthetic Biology [20.80s] **N. Kuldell, D. Lauffenburger**
Explore the reliable engineering of biological systems. Cover foundational tools and technical advances that enable the rational design of genetically-encoded systems, including computational tools for bio-CAD. Discuss early application of these approaches to genome, protein, and pathway redesign; metabolic engineering; and cell-programmed therapeutics. Includes one day of hands-on lab work. July 20-24, 2009 | \$3,250 | 2.6 CEUs

NEW Team Projects in Bioprocess and Biological Engineering [20.15s] **J.-F. Hamel**
Use state-of-the-art equipment, the latest techniques, and rigorous engineering approaches to tackle real-life industrial and commercial challenges. Students will select two projects to explore in depth and gain experience in teamwork, data analysis, and rapid problem solving. July 20-24, 2009 | \$4,000* | 2.8 CEUs

Fermentation Technology [20.48s] **D. I. C. Wang**
Apply biological and engineering principles to problems involving microbial, mammalian, and biological/biochemical systems. Review fundamentals and explore current trends, emphasizing mammalian cell systems and biological systems with industrial practices. July 27-31, 2009 | \$3,850* | 3.1 CEUs

Downstream Processing [20.45s] **C. Cooney**
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. August 3-7, 2009 | \$3,850* | 2.7 CEUs

COMPUTING & NETWORKS

High-Speed I/O Design Techniques [6.22s] **V. Stojanovic**
Explore the circuit and system design of equalized high-speed I/Os. Examine the basics. Then focus on different link equalization techniques, comparing them from a system perspective and from the performance of resulting circuit implementations. Includes one day of hands-on lab work. June 8-10, 2009 | \$2,000 | 1.8 CEUs

NEW Real-Time Reliable Simulations for Heat Transfer and Continuum Mechanics: Educational Applications [2.09s] **A.T. Patera, N.C. Nguyen**
Learn methods and software for real-time reliable solution of heat transfer and continuum mechanics problems. Understand the underlying certified reduced basis methodology for parametrized PDEs and the associated rBMIT software package. Includes hands-on problem solving. June 14-16, 2009 | \$1,000 | 1.4 CEUs

NEW Graphic Cards for Technical Computing [6.15s] **C. Hill**
Explore the use of programmable graphics chips (GPUs) to accelerate single and multi-computer technical computing calculations. Learn techniques to extract more performance from a computer system. June 22-26, 2009 | \$3,000 | 3.0 CEUs

Data Networks [6.20s] **E. Modiano, M. Medard**
Apply advanced design and performance evaluation techniques to modern data networks. Study network protocols and algorithms. Cover link layer protocols, multiple access, network layer and routing, transport layer, TCP/IP, ATM, wireless, satellite, and optical networks. July 20-24, 2009 | \$2,650* | 2.6 CEUs

Multicore Programming [6.05s] **C. Leiserson, M. Herlihy**
Learn the fundamental issues in the design of concurrent programs and the techniques necessary to make effective use of multicore machines. Explore this paradigm shift in programming with lectures and classwork. July 20-24, 2009 | \$3,250 | 3.3 CEUs

Introduction to Network Coding [6.33s] M. Medard, D. Katabi

Learn theoretical and practical tools for a new area of networking where data is manipulated inside the network to improve throughput, delay, and robustness. Commercial applications include content distribution, peer-to-peer design, and enabling high-throughput wireless networks.
 July 27-31, 2009 | \$2,900* | 3.3 CEUs

DATA MODELING & ANALYSIS**Discrete Choice Analysis: Predicting Demand and Market Shares [14.61s] M. Ben-Akiva**

Examine discrete choice models, specification, estimation, statistical testing, and forecasting. Cover analysis of revealed and stated preferences data, sampling, Bayesian estimation, menu choice, and more. Learn practical applications, discrete choice software, and gain hands-on experience.
 June 8-12, 2009 | \$3,700* | 2.9 CEUs

Design and Analysis of Experiments [14.37s] P. Berger

Learn how to design, carry out and analyze experiments in science, engineering and management. Course includes real-world examples and analysis using several software packages.
 July 13-17, 2009 | \$2,800 | 3.0 CEUs

Data and Models in Engineering, Science, and Business, Part I [12.15s] F. D. Morgan

Learn to fit data to models. Topics include linear and non-linear least squares, singular value decomposition, sensitivity analysis, experiment design, and parameter error estimation (Jackknife). Learn principles to rapidly apply methods. Includes pre-programmed computer exercises.
 July 20-21, 2009 | \$1,500* | 1.2 CEUs

Data and Models in Engineering, Science, and Business, Part II [12.16s] F. D. Morgan

Continuation of 12.15s. Topics include grid search, random (Monte-Carlo) search, simulated annealing, genetic algorithms, neural networks, and parameter error estimation. Learn principles to rapidly apply methods. Includes pre-programmed computer exercises.
 July 22-23, 2009 | \$1,500* | 1.2 CEUs

ENERGY / TRANSPORTATION**Design of Motors, Generators, and Drive Systems [6.11s] J. Kirtley, S. Leeb**

Study analysis and design, emphasizing the design of machines for electric drives. Focus on the fundamentals with computer-based (MATLAB) exercises and gain hands-on experience by building and testing a power electronic drive.
 June 8-12, 2009 | \$3,100 | 3.1 CEUs

Biofuels from Biomass: Technology and Policy Considerations [PI.75s] G. Stephanopoulos

Review the state-of-the-art of genetic and bioprocessing technologies aimed at cost-effective biomass to biofuels conversion using cellulosic biomass as feedstock. Discuss related environmental, economic, and agricultural policy issues.
 June 15-19, 2009 | \$3,900 | 2.8 CEUs

Risk-Informed Operational Decision Management [22.97s] G. Apostolakis

Increase your knowledge of PSA – its principles, benefits, strengths, limits, and applications. Identify ways to integrate PSA results into operational decision-making.
 June 15-19, 2009 | \$2,650* | 3.0 CEUs

Nuclear Plant Safety [22.956s] M. Kazimi, N. Todreas

Review safety and regulatory issues of operating reactors and licensing of new reactors. Emphasize new developments. Cover fuel storage and waste repository issues.
 June 22-26, 2009 | \$2,650* | 2.8 CEUs

NEW Energy in the Context of Climate Policy: Strategic Challenges and Opportunities [ESD.128s] M. Webster

Explore energy technologies and fuels, and their prospects in a world with greenhouse gas restrictions. Review the current state and likely future direction of climate policies, focusing on technical and economic tradeoffs between alternative technological pathways for energy, and use models for such analyses.
 July 13-17, 2009 | \$3,500* | 2.8 CEUs

Present and Future Internal Combustion Engines: Performance, Efficiency, Emissions, and Fuels [2.61s] J. Heywood, W. Cheng

Provides practicing engineers with a technical review of the ICE's operating characteristics and future potential. A thorough understanding of how engines function is required to meet stringent new vehicle emission and fuel economy standards, and to address future changes to fuels.
 July 13-17, 2009 | \$2,750 | 2.9 CEUs

NEW Geological Carbon Sequestration: Science, Technology, and Policy [1.724s] R. Juanes, H. Herzog

Cover the scientific, technological, and regulatory aspects of carbon capture and storage (CCS), emphasizing the geological storage component. Understand carbon sequestration's role in the climate change mitigation portfolio, site selection and risk evaluation, and the role of policy in establishing a market and business opportunities for CCS.
 July 20-22, 2009 | \$1,950* | 1.8 CEUs

SUMMER 2009

FOR PROGRAM DETAILS AND APPLICATIONS GO TO

<http://shortprograms.mit.edu/2009>

Modeling and Simulation of Transportation Networks [1.10s] **M. Ben-Akiva**

Lectures and demos of transportation network modeling and simulation methods, including: dynamic traffic assignment methods, models of user behavior, public transportation models, calibration and validation, real time systems, theory and applications of origin-destination estimation and prediction, and more.

July 27-31, 2009 | \$2,900* | 2.9 CEUs

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

Explore the science needed from a broad base of disciplines to develop the knowledge that will lead to a solution for delivering clean, secure, and sustainable energy, in the form of chemical fuels and other energy storage, produced from the sun.

July 27-31, 2009 | \$3,500 | 2.4 CEUs

HIGH-SPEED IMAGING

High-Speed Imaging for Motion Analysis: Systems and Techniques [6.51s] **J. Bales and Edgerton Center Staff**

The broadest experience available in high-speed film and 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.

June 15-18, 2009 | \$2,100 | 2.7 CEUs

LEADERSHIP FOR ENGINEERING & SCIENCE

Leadership Skills for Engineering and Science Faculty [PI.61s] **C. Leiserson, C. McVinney**

Use interactive role-playing activities, self-assessment instruments and group discussions to develop a repertoire of techniques for addressing issues that commonly arise within academic engineering and scientific environments.

Prerequisite: one year of teaching experience.
June 15-16, 2009 or July 13-14, 2009
\$1,600 | 1.4 CEUs

Challenges of Leadership in Teams [10.10s]

C. Colton, B. Burrell

Develop skills and techniques needed to succeed and lead in today's team-based organizations. Experts in both business and psychology address team dynamics, leadership styles, and other key issues.

July 20-24, 2009 | \$4,000 | 2.8 CEUs

LEAN ENTERPRISE

NEW Architecting the Future Enterprise [PI.28s]

D. Rhodes, D. Nightingale

Examine the enterprise as a holistic and highly networked structure wherein planning and decisions must be accomplished by applying a systems perspective and architecting principles, considering all facets of the enterprise.

June 8-9, 2009 | \$1,595 | 1.2 CEUs

LAI Lean Academy® Course [PI.23s] **A. Weigel**

Obtain a hands-on introduction to Lean and Six Sigma fundamentals. Learn how to eliminate waste to create value for all enterprise stakeholders. Apply tools and concepts in a team situation with the help of a Lego® enterprise simulation.

July 13-15, 2009 | \$2,200* | 2.1 CEUs

LAI Lean Engineering Seminar™ [PI.211s]

A. Weigel, E. Rebentisch

Explore Lean Six Sigma principles and tools for product development engineering. Focus on strategies for selecting the right product, tools for eliminating waste through value stream mapping, plus organizational and implementation strategies.

Prerequisite: PI.23s or equivalent class or experience.
July 16-17, 2009 | \$1,200* | 1.2 CEUs

NEW LAI Lean Healthcare Academy™ [PI.22s] **E. Murman**

Introduction to Lean and Six Sigma fundamentals for healthcare applications. Focus on concepts and tools for eliminating waste and improving quality in healthcare processes. Apply concepts and tools in a clinical simulation.

For healthcare professionals and administrators.
July 16-18, 2009 | \$2,300 | 2.1 CEUs

MECHANICAL DESIGN & ENGINEERING

Tribology: Friction, Wear, and Lubrication [2.81s] **N. Saka**

Learn the fundamentals of the tribological phenomena: friction, wear, and lubrication. Discuss a wide variety of practical problems and economical solutions for minimizing friction and wear.

June 22-26, 2009 | \$3,000 | 2.7 CEUs

Advanced Mechanical and Precision Machine Design: Theory, Concepts, and Principles [2.75Ts] **M. Culpepper**

Cover precision engineering theory, principles, modeling, design, manufacturing practices, and applications. Study cases from fields such as optics, biomedical instruments, consumer products, machine tools, and MEMS.

August 3-4, 2009 | \$1,000* | 1.1 CEUs

Advanced Mechanical and Precision Machine Design: Modeling and Practice [2.75Ps] **M. Culpepper**

Use concepts, theory and principles from 2.75Ts to fabricate, characterize and operate a precision machine. Focus on the fabrication, integration, and use of structures, flexures, kinematic couplings, and linear/rotary bearings. Use precision instruments to measure performance. Prerequisite: 2.75Ts

August 4-5, 2009 | \$1,250* | 0.7 CEUs

Design of Flexures and Compliant Mechanisms: Fundamentals and Practical Applications [2.90s]

M. Culpepper

Explore compliant mechanism theory, modeling, design, fabrication practices, and applications. Discuss examples from fields such as robotics, nanopositioning, and macro-through nano-scale mechanisms.

August 6-7, 2009 | \$1,000* | 1.1 CEUs

*Save by taking multiple courses. To see which courses offer a package discount please visit our website. Restrictions apply.

NANOTECHNOLOGY

Organic, Molecular, and Nanostructured Electronics – Physics and Technology [6.17s] V. Bulovic, M. Baldo

Examine the use of organic thin films in active organic devices – including organic LEDs, solar cells, photodetectors, transistors, chemical sensors and memory cells. Then make your own active organic devices in the lab.

June 8-12, 2009 | \$2,850 | 2.6 CEUs

NEW Nanostructure Fabrication [6.75s] K. Berggren

Examine methods of lithography, microscopy, and pattern transfer in the sub-100-nm to sub-10-nm domain for future nanostructure and nanodevice fabrication. Explore fundamental optics and materials science for processing at these scales. Discuss research and practical topics.

July 20-24, 2009 | \$3,250 | 2.7 CEUs

SUPPLY CHAIN / MARKETING / IQ

Data-Driven Marketing: Pricing, Bundling, and Customer Targeting [6.66s] M. Dahleh

Study the creation of innovative promotions using historical data sets to achieve strategic objectives such as maximizing profit or market share. Explore promotion design that integrates state-of-the-art data analytics, marketing science, and optimization.

June 8-9, 2009 | \$1,500 | 0.9 CEUs

Information Quality for Executives [ESD.IQEs]

R. Wang, Y. Lee

Learn how to set up practical IQ programs encompassing IQ principles, policies, and strategies. Gain new skills to solve problems, reduce costs, deliver benefits of improved IQ, and increase the value of enterprise architecture, data governance, and data warehouse initiatives.

July 13-14, 2009 | \$1,595 | 1.2 CEUs

Supply Chain Network Design [PI.19s] J. Shapiro

Address practical applications of optimization models to supply chain network design, including case studies in global manufacturing, distribution center location, post-merger consolidation, and selection of green strategies.

July 13-14, 2009 | \$1,500* | 1.2 CEUs

Demand-Driven Supply Chain Management [PI.20s]

J. Shapiro

Data-driven models for supply chain management enable its coordination with demand management at all levels of planning. Case studies show how to analyze inventory pull strategies that support Sales and Operation Planning and to integrate supply chain, marketing, and sales decisions that maximize net revenues.

July 15-16, 2009 | \$1,500* | 1.2 CEUs

SYSTEMS ENGINEERING

Axiomatic Design for Complex Systems [2.882s]

S. G. Kim, T. Lee

Learn how Axiomatic Design helps top-down thinking when designing complex systems. Explore design principles that enable us to define problems free from preconceived solutions and see the functional interdependence among subsystems.

June 15-17, 2009 | \$2,000 | 1.8 CEUs

Value-Driven Tradespace Exploration for System Design [PI.27s] D. Rhodes, A. Ross

Value-driven tradespace exploration allows analysts and decision makers to compare many system designs on a common basis to ensure “right” decisions are made at the *beginning* of system development. Discuss policy and other non-technical impacts, and issues of change, uncertainty, risk, flexibility, and other “ilities.”

June 22-25, 2009 | \$2,900 | 2.4 CEUs

Systems Architecture and Engineering with SysML and Object-Process Methodology [6.18s] E. Crawley, D. Dori

Understand systems architecture and design principles via the theoretical foundations of systems engineering and architecture (using SysML and OPM). Student teams will model a system using a systems engineering and lifecycle support software environment.

July 27-31, 2009 | \$3,400* | 3.0 CEUs

NEW Project and Product Lifecycle Management [ESD.36s] O. de Weck, D. Dori

Learn principles, techniques, and tools to effectively plan and manage complex system and product development projects.

Examine Project-Product Lifecycle Management to see how integrating project and product models improves project performance and product quality. Includes a mini-project.

August 3-7, 2009 | \$3,500* | 3.0 CEUs

TECHNOLOGY & ORGANIZATIONS

From Technology to Innovation: Putting Ideas to Work [17.50s] S. Weiner, J. Womack

Attempts to innovate have the potential to disrupt, cause internal dissension, and fail. This course explores failures and successes to identify strategies that can sustain significant innovation in public and private organizations concerned with keeping pace with fast-changing environments.

July 13-16, 2009 | \$3,600 | 2.3 CEUs

Pandemics and Bioterrorism: From Realistic Threats to Effective Policies [17.60s] S. Weiner, J. Guillemin

Addressing bioterrorism and global pandemics poses new challenges for public health, law enforcement and national security agencies. Discuss strategies to overcome obstacles to policy implementation, such as entrenched professional norms and change-resistant organizational cultures.

July 27-29, 2009 | \$2,200 | 1.7 CEUs

Nondiscrimination Policy The Massachusetts Institute of Technology is committed to the principle of equal opportunity in education and employment. The Institute does not discriminate against individuals on the basis of race, color, sex, sexual orientation, gender identity, religion, disability, age, veteran status, ancestry, or national or ethnic origin in the administration of its educational policies, admissions policies, employment policies, scholarship and loan programs, and other Institute administered programs and activities, but may favor US citizens or residents in admissions and financial aid.* The Vice President for Human Resources is designated as the Institute's Equal Opportunity Officer and Title IX Coordinator. Inquiries concerning the Institute's policies, compliance with applicable laws, statutes, and regulations (such as Title VI, Title IX, and Section 504), and complaints may be directed to the Vice President for Human Resources, Room E19-215, 617-253-6512, or to the Coordinator of Staff Diversity Initiatives/Affirmative Action, Room E19-215, 617-253-1594. In the absence of the Vice President for Human Resources or the Coordinator of Staff Diversity Initiatives/Affirmative Action, inquiries or complaints may be directed to the Executive Vice President, Room 3-211, 617-253-3928, or to the Director of Labor and Employee Relations, Room E19-235N, 617-253-4264, respectively. Inquiries about the laws and about compliance may also be directed to the Assistant Secretary for Civil Rights, US Department of Education. *The ROTC programs at MIT are operated under Department of Defense (DOD) policies and regulations, and do not comply fully with MIT's policy of nondiscrimination with regard to sexual orientation. MIT continues to advocate for a change in DOD policies and regulations concerning sexual orientation, and will replace scholarships of students who lose ROTC financial aid because of these DOD policies and regulations.



PROFESSIONAL EDUCATION

Short Programs



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