921 Seminar in Inventory Management
Fall of odd years. 3(3-0) RB: (MSC 803) R: Open only to Ph.D. students SA: ML 921, MTA 921, MGT 921
Classical, just-in-time, and multi-echelon inventory control models. Forecasting.

923 Topics in Operations Management
Spring of odd years. 3(3-0) RB: (MSC 803) R: Open only to Ph.D. students SA: ML 923, MTA 923, MGT 923
Current research in the field. Topics vary.

930 Theory of Logistics Systems
Fall of odd years. 3(3-0) R: Open only to Ph.D. students.
Development and management of firm logistics systems within the context of an integrated supply chain strategy. Elements of network, economic, behavorial, and systems theory in the design, management, and control of logistics systems.

931 Simulation Methods for Marketing and Logistics
Spring of odd years. 3(3-0) R: Open only to Ph.D. students.
Techniques and methodology for marketing and supply chain system design, customer service, and policy formulation. Methodological focus on simulation and analytical techniques to develop empirical results documenting current and anticipated system performance.

932 Logistics and Public Policy
Fall of even years. 3(3-0) RB: (MSC 930) R: Open only to Ph.D. students.
History and rationale of government in the development, maintenance, and control of transportation and supply chain infrastructure. Interaction of users, carriers, government, and public to create, interpret, and refine national economic and environmental policies.

940 International Business Theory
Fall of even years. 3(3-0) RB: (MSC 860 or MSC 862) R: Open only to Ph.D. students. SA: ML 940, MTA 940
Theories explaining international business phenomena. Varying perspectives on international business activities, concepts, and frameworks.

941 International Business Research Issues
Spring of odd years. 3(3-0) RB: (MSC 940) R: Open only to Ph.D. students. SA: ML 941, MTA 941
Scientific methods of research on international business. Topics include cultural bias and organizing multi-country studies.

990 Independent Study
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Ph.D. students. SA: ML 924, MTA 924
Intensive reading and research on a marketing topic of mutual interest to a faculty member and a Ph.D. student.

995 Directed Research Paper
Fall, Spring, Summer. 1(1-0) R: Open only to Ph.D. students in the Department of Marketing and Supply Chain Management. SA: ML 995, MTA 995
Production of research paper under the direction of a senior faculty member.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in the Department of Marketing and Supply Chain Management. Approval of department. SA: ML 999, MTA 999
Doctoral dissertation research.

MASTER OF BUSINESS ADMINISTRATION — MBA

The Eli Broad College of Business
The Eli Broad College of Business and The Eli Broad Graduate School of Management

800 The Global Organization and the Firm's Strategic Position
Fall, Spring. 2(2-0) R: Open only to MBA students.
Organizational goals, design, and control of the global business enterprise. Maximization of shareholder value, competitive forces, configuring the value-added chain. Strategies for implementing new organizational forms. Designing and managing strategic change.

802 Financial Accounting
Fall. 2(2-0) R: Open only to MBA students.
Financial accounting model underlying financial statements of firms. Information in financial statements and role of these statements in capital markets. Information intermediaries, regulators, and role of independent auditor. Standard setting and the impact of changing standards. Globalization of standards. Offered first half of semester.

804 Applied Data Analysis for Managers
Fall. 2(2-0) RB: (STT 315) R: Open only to MBA students. Not open to students with credit in MSC 833.
Analysis of business and economic data to support managerial decision-making. Building, interpreting, and applying regression models. Time series and forecasting. Offered second half of semester.

806 Business Ethics and the Legal Environment
Spring. 2(2-0) R: Open only to MBA students.
Framework for identifying, analyzing, and resolving ethical dilemmas in business. Key legal topics in business using critical thinking analysis.

808 Leadership and Teamwork
Fall. 1(1-0) R: Open only to MBA students.
Understanding team management and leadership through experiential and skill-based learning. Effective communication, including the use of electronic communication technologies for team development and maintenance. Active practice of teamwork, communication, and leadership skills. Offered first half of semester.

812 Managerial Accounting
Spring. 2(2-0) R: Open only to MBA students.
Performance measurement and incentive system design. Organization structure, budgeting, and transfer pricing. Target costing. Relevant costs and management decision models. Activity-based costing. Aligning management accounting and firm strategy. Accounting for quality. International perspective on management accounting issues. Offered second half of semester.

814 Applied Economics
Spring. 2(2-0) R: Open only to MBA students.
Economic view of the firm. Modeling market mechanics in supply and demand, marginal concepts, elasticity, market characteristics, pricing with market power, and strategic behavior. Applications to business problems and situations. Principal-agent relationships and wealth maximization. Offered first half of semester.

816 Business Presentations
Fall. 1(1-1) R: Open only to MBA students.
Development of effective interpersonal communications skills. Oral communications in business settings.

820 Marketing Management
Fall. 3(3-0) R: Open only to MBA students.
Leadership principles. Decision-making. Fundamental marketing concepts such as segmentation, target marketing, positioning, growth strategies, revenue management, product management, and communication strategies. Problem-solving and marketing planning.

821 Supply Chain Management
Fall. 3(3-0) R: Open only to MBA students.
Integrative approach to product design, development, and delivery. Flow of products from concept development through delivery to the final user, including product and process development, managing information and product flows, total quality management, and resource and capacity management.

822 Financial Management
Fall. 3(3-0) R: Open only to MBA students.
Investment decisions by firms. Value creation, risk and return, pricing models, and financial markets. Financing alternatives, market efficiency, capital budgeting, and leverage and risk relationships. Optimizing firm value. Agency problems and effects on investment and financing decisions.

823 Information Technology Management
Spring. 2(2-0) R: Open only to MBA students.
Role of information technology in operations, decision making, and learning in organizations. Competitive and economic benefits from managing information technology resources. Competitive advantage, efficient operations, and improved decision quality. Offered second half of semester.

824 Managing the Workforce
Spring. 2(2-0) R: Open only to MBA students.
Role of workforce management in fulfilling the goals and mission of the organization. Theories and applications of management principles to acquiring, motivating, and rewarding employees and structuring their work. Domestic and international issues in the workplace. Offered first half of semester.

826 International, Comparative, and Cross-Cultural Business
Spring, Summer. 2(2-0) R: Open only to MBA students.
International businesses' approaches to global markets, economic trade issues, methods of entry, and organizational alternatives. Cross-cultural differences and their impacts on business practices. Trade agreements, strategic alliances, negotiations, and cultural consequences. Offered half of semester.

841 Studies in the Global Marketplace
Summer. 3(1-4) Summer: International trip. R: Open only to MBA students.
Commercial, economic, cultural, and political aspects of global environments. Exposure to leading executives and government representatives in world markets. Comparative framework for competitive strategy in a multi-country context. International field trip required.

850 Strategic Management
Fall. 2(2-0) R: Open only to MBA students.
Concepts and methods that integrate previous training in functional areas of management. Total firm perspective and ways top managers create and sustain competitive advantage in today's challenging global marketplace.

891 Special Topics in Business Management
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to MBA students.
Current and emerging issues in management. New and changing developments affecting managers.

893 MBA Internship Experience
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 2 credits in all enrollments for this course. RB: Completion of at least one semester in the MBA program. R: Open to MBA students except students in the Advanced Management Program or Program in Integrative Management.
Internship in business organizations; application of business knowledge and management techniques in a work environment.

MATERIALS SCIENCE AND ENGINEERING — MSE

Department of Chemical Engineering and Materials Science
College of Engineering

101 Materials and Society
Fall. 2(2-0) RB: High school physics, chemistry, mathematics.
Material capabilities, limitations, and their utilization in the service and advancement of society.

250 Materials Science and Engineering
Fall, Spring, Summer. 3(2-2) P: (CEM 141 or CEM 151 or LBS 171) SA: MSM 250
Structure of metals, ceramics and polymers. Phase diagrams, thermomechanical treatments, physical and mechanical properties, diffusion, microstructure studies, environmental effects.

310 Phase Equilibria in Materials
Fall. 3(3-0) P: (MSE 250 or concurrently) and (MTH 234 or MTH 254H or LBS 220) R: Open only to juniors or seniors in the College of Engineering. SA: MSE 351
Enthalpy. Entropy. Free energy. Phase changes in metal, ceramic, and polymer materials systems. Application to alloying, phase diagram determination, and electrochemistry.

320 Mechanical Properties of Materials
Fall. 3(3-0) P: (ME 222 or concurrently) and (MSE 250) R: Open only to juniors or seniors in the Materials Science and Engineering major. SA: MSE 355
Mechanical behavior of metals, ceramics, and polymers. Three-dimensional stress-states. Stress, strain, and compliance tensors. Test methods. Elastic, viscoelastic, and plastic deformation. Fracture, fatigue, and creep.

324 Biomaterials and Biocompatibility
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. P: (PSL 250 or concurrently) and (MSE 250) R: Open only to students in the College of Engineering. SA: MSM 424
Materials science of human implants. Design requirements imposed by the human body. Need for bodily protection.

331 Materials Characterization Methods I
Fall. 1(0-3) P: (MSE 310 or concurrently and MSE 320 or concurrently) R: Open only to juniors or seniors in the Materials Science and Engineering major. SA: MSE 375
Thermal analysis. Optical and Scanning Electron Microscopy Laboratory for characterizing microstructure-property relationships. Effects of processing on microstructures, properties, and fracture surfaces in metal, ceramic and polymer systems.

350 Electronic Structure and Properties of Materials
Spring. 3(3-0) P: (PHY 184 or concurrently) and (CEM 141 or CEM 151 or LBS 171) Not open to students with credit in MSE 455.
Fundamentals of electrical, thermal, magnetic and optical properties of metals, dielectrics, semiconductors and polymers. Crystal structure, reciprocal space, quantum mechanics, electron band structure, and phonons. Materials applications in electronics and optoelectronics.

360 Fundamentals of Microstructural Design
Spring. 3(3-0) P: (MSE 310 and MSE 350 or concurrently) R: Open only to juniors or seniors in the College of Engineering. SA: MSE352
Fick's laws of diffusion. Models of solid state diffusion. Arrhenius plots. Use of non-equilibrium energy storage from solidification, phase changes, and deformation to predict and control microstructural changes and stability during processing in metal, ceramic, and polymer systems.

370 Physical Processing of Materials
Spring. 3(3-0) P: (MSE 310 and MSE 350 or concurrently) R: Open only to juniors or seniors in the Materials Science and Engineering major. SA: MSE 365, MSE 380
Physical processing of powders. Mixing and casting. Surface modification of ceramic, polymeric, and metallic materials in order to engineer the microstructure, properties, and form of components.

381 Materials Characterization Methods II
Spring. 2(1-3) P: (MSE 360 or concurrently) and (MSE 370 or concurrently) R: Open only to juniors or seniors in the Materials Science and Engineering major. SA: MSE 376
X-ray and infrared spectroscopic analysis laboratory for the characterization of microstructure-property relationships. Effects of processing on microstructures, properties, and fracture surfaces in metal, ceramic, and polymer systems.

401 Quantitative Human Biology
Spring. 3(4-0) Interdepartmental with Biomedical Engineering; Radiology; Human Anatomy. Administered by College of Engineering. P: (MTH 235 and PHY 184) and (PSL 250 or concurrently or PSL 431 or concurrently) and (CEM 141 or CEM 151) and (ANTR 350 or concurrently) RB: (CSE 131 or concurrently or CSE 231 or concurrently or PSL 410)
Qualitative description and quantitative engineering analysis of selected, tractable human-biological systems. Multi-disciplinary problem-solving among medical and engineering professionals.

426 Introduction to Composite Materials
Spring. 3(3-0) Interdepartmental with Mechanical Engineering. P: (ME 222) R: Open only to juniors or seniors in the College of Engineering. SA: MSM 444
Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Material characterization. Failure and damage. Composite structure design.

451 Microscopic and Diffraction Analysis of Materials
Spring. 3(2-3) P: (PHY 184 or PHY 184B) RB: (MSE 350 and MSE 381) R: Open only to seniors or graduate students in the Colleges of Engineering or Natural Science. SA: MSM 451
General properties, generation, and detection of x-rays. Interaction with solids. Crystallography, reciprocal lattice, diffraction analysis, and techniques. Single crystal methods. Stereographic projection. X-ray microanalysis.

454 Ceramic and Refractory Materials
Fall. 3(3-0) P: (PHY 184) RB: (MSE 350 and MSE 381) R: Open only to seniors in the College of Engineering. SA: MSM 454
Ceramic and glassy materials. High temperature processes. Mechanical and physical properties of technical ceramics.

465 Design and Application of Engineering Materials (W)
Spring. 3(3-0) P: (MSE 331 and MSE 381) and completion of Tier I writing requirement. R: Open only to students in the Engineering Mechanics or Materials Science and Engineering major. SA: MSM 465
Fundamental principles of strengthening: toughening, specific strength and stiffness. Material development based on environmental, temperature, wear, damping, fatigue and economic considerations.

466 Fracture and Failure Analysis
Fall. 3(2-3) P: (MSE 250) RB: (MSE 331 and MSE 320) R: Open only to seniors in the College of Engineering. SA: MSM 466
Modes and causes of failure in mechanical components. Non-destructive evaluation. Legal and economic aspects of materials failure. Analysis illustrated in student projects requiring integration of prior course work.