

846. Organizational Behavior and Personnel Administration
Fall. 3(3-0)

R: Open only to students in the Advanced Management Program.

Management of human resources. Leadership, motivation, communications, employee perceptions, individual and organizational learning. Staffing, interviewing, training, development, appraisal, terminating, and legal issues.

847. Managerial Decision Support Models
Fall. 3(3-0)

R: Open only to students in the Advanced Management Program.

Development and application of analytical models to support decision making. Topics include multiple regression, linear optimization, decisions under uncertainty, forecasting.

855. Labor and Management Relations
Spring. 2(2-0) Interdepartmental with Labor and Industrial Relations.

R: Open only to students in the Advanced Management Program.

Industrial relations in American union and management collective bargaining. Compensation issues. Grievance concepts and arbitration. Dispute resolution.

858. Applied Strategic Management
Spring. 2(2-0)

R: Open only to students in the Advanced Management Program.

Capstone integration and application of previous course work from the general manager's perspective. Topics include environmental analysis, competitive strategies, and strategy formulation and implementation.

870. Strategic Management
Fall, Spring. 3(3-0)

R: Open only to second-year M.B.A. students.

Determination of the strategic direction of the firm and management of strategic processes in the firm. Integration of environmental factors and organizational functions in the analysis and solution of management problems.

890. Independent Study

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 graduate students in Business. Approval of department.

Faculty-supervised independent study.

906. Seminar in Organizational Research Methods
Spring. 3(3-0)

R: Open only to Ph.D. students.

Methods for scientific research in the areas of organizational behavior, personnel and organizational theory. Theory building, hypothesis formation and testing, reliability theory, construct validity, external validity, research design.

907. Seminar in Organizational Behavior
Fall of even-numbered years. 3(3-0)

R: Open only to Ph.D. students.

Directed readings on the behavior of individuals within organizations. Theory and empirical research on perception, decision-making, work motivation, work attitudes, leadership and group dynamics.

908. Seminar in Organizational Theory
Fall of odd-numbered years. 3(3-0)

P: MGT 906. R: Open only to Ph.D. students.

Formal organizations viewed as rational, natural and open systems. Survey of contemporary theory and empirical research.

909. Seminar in Human Resource Management

Spring of odd-numbered years. 3(3-0)

R: Open only to Ph.D. students.

Classic and current empirical research. Job analysis, personnel selection, training, and incentive systems.

910. Seminar in Strategic Management
Fall of even-numbered years. 3(3-0)

R: Open only to Ph.D. students.

Review of recent research literature. Topics include developments in strategic types, identification of strategic groups, strategy formulation, implementation, and decision making.

912. Special Topics Research Seminar
Spring of even-numbered years. 3(3-0)

P: MGT 906. R: Open only to Ph.D. students.

Research in timely and specialized topics in organizational behavior, organization theory, human resource management, organizational policy and strategy.

918. Procurement and Sourcing Theory
Fall of even-numbered years. 3(3-0)

R: Open only to Ph.D. students.

Theoretical models explaining procurement and sourcing strategy. Frameworks to guide research.

919. Procurement and Sourcing Management Strategy

Spring of odd-numbered years. 3(3-0)

P: MGT 918. R: Open only to Ph.D. students.

Management issues affecting the contribution of procurement and sourcing strategies to the competitiveness of the firm.

920. Seminar in Manufacturing Strategy

Fall of even-numbered years. 3(3-0)

P: MGT 801, MGT 803. R: Open only to Ph.D. students.

Research in manufacturing strategy. Quality, technology, flexibility, innovation. Theory building.

921. Seminar in Inventory Management

Fall of odd-numbered years. 3(3-0)

P: MGT 801, MGT 803. R: Open only to Ph.D. students in Business.

Classical, just-in-time, and multi-echelon inventory control models. Forecasting.

922. Seminar in Production Planning and Scheduling

Spring of even-numbered years. 3(3-0)

P: MGT 801, MGT 803, MGT 834. R: Open only to Ph.D. students in Business.

Aggregate and disaggregate planning, master scheduling, material requirements planning, lot-sizing, short-term capacity planning, and scheduling.

923. Topics in Operations Management

Spring of odd-numbered years. 3(3-0)

P: MGT 801, MGT 803. R: Open only to Ph.D. students in Business.

Current research in the field. Topics vary.

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 Management.

MARKETING AND LOGISTICS

ML

**Department of Marketing and Logistics
The Eli Broad College of Business
and The Eli Broad Graduate
School of Management**

300. Managerial Marketing

Fall, Spring, Summer. 3(3-0)

P: EC 201 or EC 251H; ACC 201 or ACC 230 or ACC 251H. R: Open only to juniors and seniors.

Analysis of and strategic integration of buyer behavior, segmentation, positioning, demand analysis, information, pricing, promotion, channels, product policies, and ethics in consumer, reseller, industrial, and service markets.

302. Consumer and Organizational Buyer Behavior

Fall, Spring, Summer. 3(3-0)

P: ML 300. R: Open only to juniors and seniors.

Application of consumer behavior principles to customer satisfaction, market planning, and marketing mix decisions. Ethical, diversity, and international issues.

303. Materials and Logistics Management

Fall, Spring, Summer. 3(3-0) Interdepartmental with Management. Administered by Management.

P: EC 201 or EC 251H; ACC 202 or ACC 230 or ACC 251H. R: Open only to juniors and seniors in the College of Business or in programs for which MGT 303 is a catalog-listed requirement.

Role of manufacturing, operations, purchasing, sourcing, and transportation and distribution in determining organizational competitiveness. Quality, flexibility, cost, and lead time.

304. Operations and Purchasing Management

Fall, Spring, Summer. 3(3-0) Interdepartmental with Management. Administered by Management.

P: MGT 303. R: Open only to juniors and seniors in Materials and Logistics Management.

Functions of operations and purchasing managers. Tactical issues in implementing internal and external resource plans.

310. International and Comparative Dimensions of Business

Fall, Spring, Summer. 3(3-0)

P: EC 202 or EC 251H; MGT 302 or concurrently, ML 300 or concurrently. R: Open only to juniors and seniors.

International and cross-cultural study of business decisions, enterprises, markets, and institutions. Globalization of industries and firm competitiveness. International business transactions and entry strategies.

317. Quantitative Business Research Methods

Fall, Spring, Summer. 3(3-1) Interdepartmental with Statistics and Probability.

P: STT 315. R: Open only to juniors and seniors.

Application of statistical techniques, including forecasting, to business decision making. Includes applications of linear regression and correlation, analysis of variance, selected non-parametric tests, time series, and index numbers.

319. Marketing Research

Fall, Spring. 3(3-0)

P: ML 300, STT 315. R: Open only to juniors and seniors.

Research methods designed to obtain information for marketing decisions. Research design, data collection, and interpretation of information to provide a customer orientation.

Descriptions — Marketing and Logistics of Courses

- 335. Food Marketing Management**
Spring. 3(3-0) Interdepartmental with Food Systems Economics and Management.
P: FSM 200 or ML 300. R: Open only to juniors and seniors.
Management decision-making in food industry organizations (processors, wholesalers, retailers). Marketing and sales in response to customer and consumer needs. Distribution and merchandising systems in domestic and international contexts.
- 345. Logistics Management**
Spring. 3(3-0) Interdepartmental with Management.
P: MGT 303. R: Open only to juniors and seniors.
Activities and decisions necessary to plan, implement, and control private and public physical distribution and transportation channel systems. Physical, human, informational, and organizational system components.
- 351. Retail Management**
Fall, Spring, Summer. 3(3-0)
P: ML 300. R: Open only to juniors and seniors.
Domestic and international retailing structure, environment, and development. Managerial strategy. Locational, purchasing, organizational, personnel and promotional techniques. Retail budgeting and control. Social and ethical considerations.
- 401. Procurement and Supply Management**
Fall, Spring, Summer. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors in Materials and Logistics Management.
Strategic issues in procurement and supply management. Purchasing process, procurement cycle, purchasing research, relationships with suppliers, negotiation, and commodity planning. Cost, price, and value analysis.
- 402. Manufacturing Planning and Control**
Fall, Spring, Summer. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors in Materials and Logistics Management.
Production planning, demand management, master scheduling, materials requirements, and capacity planning. Shop floor control, computer-integrated manufacturing, and just-in-time systems.
- 403. Topics in Purchasing and Sourcing Management**
Fall of even-numbered years. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors in Materials and Logistics Management.
Current topics in sourcing and negotiation strategy such as price and cost analysis, and purchasing research techniques.
- 404. Topics in Operations Management**
Spring of odd-numbered years. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors in Materials and Logistics Management.
Managerial aspects of current issues such as total quality, computer integrated manufacturing and simultaneous engineering.
- 413. Personal Selling and Sales Management**
Fall. 3(3-0)
P: ML 302. R: Open only to juniors and seniors.
Planning, implementing, and controlling the firm's personal selling function. Analysis of sales territories; management of recruitment, selection, training, and motivation of sales personnel; evaluation of sales performance. Diversity and ethical issues.
- 415. International Marketing Management**
Fall, Spring. 3(3-0)
P: ML 300, ML 310. R: Open only to juniors and seniors.
Marketing decisions, strategies, and operations of the firm involved in international business. Researching global market opportunities and formulating market entry strategies. Developing and implementing the international marketing program.
- 439. Food Business Analysis and Strategic Planning**
Fall. 3(3-0) Interdepartmental with Food Systems Economics and Management.
P: ML 335 or FSM 335; STT 201 or STT 200 or STT 315. R: Open only to juniors and seniors.
Principles and techniques of business analysis and strategic planning applied to food firms. Food trend forecasts, market potential, competition and cost analyses, business and strategic planning.
- 442. Traffic and Transportation Management**
Fall. 3(3-0) Interdepartmental with Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors.
Analysis of purchasing and operating transportation services including carrier selection, pricing and rates, and negotiation. Managing the transportation function including consolidation, fleet management, and transportation strategies. International and intermodal distribution.
- 446. Physical Distribution Operations**
Spring. 3(3-0) Interdepartmental with Management.
P: MGT 304, ML 345. R: Open only to juniors and seniors.
Analysis of distribution operations from a firm and facility perspective. Customer service strategy. Information and order processing systems. Warehouse design and operations. Material handling systems and assessment of performance.
- 460. Marketing Strategy (W)**
Fall, Spring, Summer. 3(3-0)
P: ML 302, ML 319, and one other ML course. R: Open only to seniors in the College of Business. Completion of Tier I writing requirement.
Identification and analysis of managerial marketing issues. Integration of marketing concepts and theories through case analysis. Ethical and international applications.
- 470. Materials and Logistics Policy (W)**
Fall, Spring. 3(3-0) Interdepartmental with Management.
P: MGT 304, ML 345, one additional course in materials and logistics management. R: Open only to juniors and seniors in College of Business and in programs for which ML 470 is a catalog-listed requirement. Completion of Tier I writing requirement.
Case studies of strategic and tactical decisions in materials and logistics management. Identification and definition of problems, evaluation of integrated alternatives, and development of recommendations.
- 490. Independent Study**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
Supervised program of independent library or field research designed to supplement classroom study.
- 490H. Honors Independent Study**
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to Honors College juniors and seniors.
Supervised program of independent library or field research designed to supplement classroom study.
- 491. Topics in Marketing**
Fall, Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.
P: ML 300. R: Open only to juniors and seniors.
Current issues in specialized marketing, logistics knowledge of marketing, and environmental analysis. Strategy development for control.
- 800. Materials and Logistics Management**
Fall, Spring. 3(3-0) Interdepartmental with Management. Administered by Management.
R: Open only to graduate students in Business.
Fundamentals of materials and logistics management. Strategic impact of the transformation process in a global economy. Quality, inventory management, logistics strategy, customer service, international procurement, management of technology.
- 801. Materials Management: Tactical and Strategic Perspectives**
Fall, Spring. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 800. R: Open only to graduate students in Business.
Integration of procurement and operations management for competitive advantage. Strategic and tactical approaches to customer requirements. Management of supply-chains procurement, process assessment, quality, manufacturing planning and control, and technology.
- 802. Procurement and Sourcing Strategies**
Fall, Spring. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 800. R: Open only to graduate students in Business.
Sourcing strategies and applications. Negotiation planning and execution.
- 803. Operations Management Strategy**
Fall. 3(3-0) Interdepartmental with Management. Administered by Management.
P: MGT 801. R: Open only to graduate students in Business.
Operations management issues including quality, technology, group technology, computer integrated manufacturing, and just-in-time manufacturing.
- 805. Marketing Management**
Fall, Spring. 3(3-0)
R: Open only to graduate students in Business or students in programs for which ML 805 is a catalog-listed requirement.
Strategic and decision-making aspects of marketing functions. Analysis, coordination, execution of marketing programs. Development of strategies and tactics. Segmentation, marketing mix, market response modeling, and ethics in a global context.
- 806. Decision Support Systems for Marketing**
Fall, Spring. 3(3-0)
P: ML 805. R: Open only to graduate students in Business.
Analytical marketing decision-making using existing data bases. Expert system development and application in marketing management.
- 807. Customer-Driven Strategies**
Fall, Spring. 3(3-0)
P: ML 806. R: Open only to graduate students in Business.
Marketing strategies based on the analysis of consumer and organizational buyers. Strategy development designed to meet or exceed customers' expectations.
- 808. Market-Driven Strategies**
Fall, Spring. 3(3-0)
P: ML 806. R: Open only to graduate students in Business.
Marketing strategies based on the analysis of competitors. Alternative approaches to competitive strategies.

809. Logistics and Transportation Strategy
Fall, Spring. 3(3-0) Interdepartmental with Management.

P: MGT 800. R: Open only to graduate students in College of Business.
Planning, control and measurement for logistics and transportation systems. Customer service, transportation, inventory, order processing, warehousing and materials handling.

810. Product Innovation and Management
Fall. 3(3-0)

P: ML 805 or approval of department. R: Open only to graduate students in the College of Business and College of Engineering.
Analytic, decision-making, and planning tools. Topics include new product policy and development, organizational issues, and product modification and deletion.

811. Marketing Communication
Spring. 3(3-0)

P: ML 805. R: Open only to graduate students in Business.
Marketing communication programs for consumer, industrial, and service firms. Communication mix objectives, positioning, budgeting, media, trade promotion, and brand name strategies. Regulation and ethical issues.

812. Logistics Research and Analysis
Fall. 3(3-0) Interdepartmental with Management.

P: ML 809. R: Open only to graduate students in College of Business.
Research methodology in the design and analysis of transportation and distribution systems. System design, customer service, and policy studies.

813. Marketing Research Methods
Spring. 3(3-0)

P: ML 806. R: Open only to graduate students in Business.
Collection, analysis, and interpretation of primary data from problem definition to report writing.

816. Transportation Policy and Plans
Spring. 3(3-0) Interdepartmental with Management.

P: ML 809. R: Open only to graduate students in College of Business.
Policy models and managerial perspectives on future national and corporate transportation policies. Interaction of government, carrier management, and user logistics and distribution strategies.

818. Strategic Planning
Fall. 2(2-0)

R: Open only to students in the Advanced Management Program.
Models and methods of business planning. Relationship of strategic intent, business missions and planning hierarchies. Linking marketing, financial, and human resource strategic plans.

822. Marketing Management
Spring. 3(3-0)

P: ML 818. R: Open only to students in the Advanced Management Program.
Analysis, coordination, and execution of marketing programs. Segmentation, marketing mix, market response modeling, and ethics.

823. Operations Management
Spring. 3(3-0) Interdepartmental with Management. Administered by Management.

R: Open only to students in the Advanced Management Program.
Strategic issues in manufacturing operations, purchasing, and distribution. Impact of business systems on productivity and profits. Competitive strategies in an international economy.

824. Marketing Channel Management
Spring. 3(3-0)

P: ML 805. R: Open only to graduate students in Business.
Design, selection, and performance measurement of channel structures in domestic and international settings.

831. Food Marketing Management
Fall. 3(3-0) Interdepartmental with Agricultural Economics.

P: ML 805 or approval of department. R: Open only to graduate students in Business or approval of department.
Marketing management decisions in food firms. Consumer orientation, computer technologies, food system cost reduction, global opportunities, environmental and social issues.

841. Materials and Logistics Policy
Fall, Spring. 3(3-0) Interdepartmental with Management.

P: ML 801, MGT 809. R: Open only to graduate students in College of Business.
Case study of strategy, policy, and planning. Customer satisfaction, quality, organization, information use, and strategic alliance issues.

850. Business Communication I
Fall, Spring. 2(1-2)

R: Open only to MBA students.
Analysis of planning and execution of business communications. Development of oral and written communication skills.

851. Business Communication II
Fall, Spring. 1(1-0)

P: ML 801. R: Open only to MBA students.
Integrating and applying written and oral business communication skills with other courses in the MBA program.

860. International Business
Fall, Spring. 3(3-0)

R: Open only to graduate students in Business.
Management of the firm in the multinational environment. Assessment of international modes of operations, markets, financial strategies, services, and resources. Competitive strategy.

862. International Marketing
Spring. 3(3-0)

P: ML 805, ML 860. R: Open only to graduate students in Business.
Marketing decisions, strategies, performance and operations of the international firm. Attention to multinational enterprises, exporters, service marketers, and contractors.

865. Emerging Topics in Business
Spring. 3(3-0)

R: Open only to second-year MBA students.
Perspectives on new and emerging issues of business administration. Topics vary.

880. Seminar in Marketing and Logistics
Fall, Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.

P: ML 805. R: Open only to graduates in College of Business.
Issues in marketing and logistics in an environment of rapid change. Topics vary.

890. Independent Study

Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
P: ML 805. R: Open only to graduate students in Business. Approval of department.
Faculty-supervised independent study.

905. Theory Development and Research Design in Marketing
Fall. 3(3-0)

Research concepts and scientific methods for the study of marketing. Formulation of hypotheses, concepts of measurement, and quantitative methods.

906. Quantitative Methods in Marketing
Spring. 3(3-0)

P: ML 905 or approval of department.
Concepts and methods in the scientific investigation of marketing phenomena. Focus on the use of multivariate analytic tools.

907. Causal Modeling in Marketing
Fall. 3(3-0)

P: ML 906. R: Open only to Ph.D. students in the College of Business.
Statistical methods in marketing, emphasis on causal modeling.

908. Marketing Decision Models
Fall. 3(3-0)

P: ML 906.
Applications of marketing decision models in new product development, pricing, distribution, advertising, and sales promotion.

920. History of Marketing Thought
Fall. 3(3-0)

P: ML 805. R: Open only to Ph.D. students in Business.
Evolution of marketing institutions, techniques, theories, and critiques. Influence of changing environmental and technological factors.

921. Theories of Competition in Marketing
Spring. 3(3-0)

P: ML 920. R: Open only to Ph.D. students in Business.
Relationships among competition, marketing, and corporate and economic growth. Competition phenomena studied through a variety of disciplines, including marketing, economics, political science, sociology and social psychology.

922. Seminar in Social Sciences in Marketing
Spring. 3(3-0)

P: ML 906 or concurrently. R: Open only to Ph.D. students in Business.
Social science perspectives on marketing.

923. Seminar in Spatial and Temporal Marketing
Spring. 3(3-0)

P: ML 920. R: Open only to Ph.D. students in College of Business.
Theory concerning marketing strategies and programs in logistics, channels, and pricing. Field research needs.

924. Special Topics Seminar
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 in College of Business.
Intensive reading and research on a marketing topic of mutual interest to a faculty member and a Ph.D. student.

930. Theory of Transportation-Distribution Systems
Fall of odd-numbered years. 3(3-0)

P: ML 805. R: Open only to Ph.D. students in the College of Business.
Transportation-distribution research on systems integration. Elements of networks, systems, and economic theory in the design, evaluation, and control of logistics systems. Topics include strategic logistics, forecasting, and system integration models.

**Descriptions — Marketing and Logistics
of
Courses**

931. Transportation and Distribution Research Methods
Spring of odd-numbered years. 3(3-0)
P: ML 930. R: Open only to Ph.D. students in Business. Techniques and methodology of system design, customer service and policy formulation.

932. Transportation and Distribution Development Policy
Fall of even-numbered years. 3(3-0)
P: ML 805. R: Open only to Ph.D. students in College of Business. The interaction of government, carrier, and user logistics and distribution strategies, particularly at the macro-corporate and national policy levels.

940. International Business Theory
Fall of even-numbered years. 3(3-0)
P: ML 860 or ML 862. Theories explaining international business phenomena. Varying perspectives on international business activities, concepts, and frameworks.

941. International Business Research Issues
Spring of odd-numbered years. 3(3-0)
P: ML 940. Scientific methods of research on international business. Topics include cultural bias and organizing multi-country studies.

995. Directed Research Paper
Fall, Spring, Summer. 1(1-0)
P: ML 921. R: Open only to Ph.D. students in Marketing and Transportation Administration. 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: Approval of department.

**MATERIALS SCIENCE AND
MECHANICS** **MSM**

**Department of Materials Science
and Mechanics
College of Engineering**

160. Engineering Communications
Fall, Spring. 3(2-3)
P: MTH 116 or concurrently. Computer-aided design and drafting. Freehand sketching. Two and three dimensional visualization. Preparation of spread sheets and technical reports.

205. Statics
Fall, Spring. 3(3-0)
P: MTH 132. Vector description of forces and moments. Two and three dimensional equilibrium of particles and rigid bodies. Analysis of trusses, frames and machines. Coulomb friction.

211. Mechanics of Deformable Solids
Fall, Spring. 3(3-2)
P: MSM 205, MTH 133 or concurrently. Tension compression and shear stresses. Axially loaded bars. Torsion of circular shafts. Beam theory. Combined stresses. Mohr's circles. Columns.

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

306. Dynamics
Fall, Spring. 3(3-0)
P: MSM 205, MTH 235. R: Open only to College of Engineering students. Kinematics of particles, rigid bodies, and mass moments of inertia. Kinetics of particles and rigid bodies. Energy and momentum principles.

311. Introduction to Biomedical Engineering
Fall. 3(3-0) Interdepartmental with Biomedical Engineering, Mechanical Engineering, and Electrical Engineering. Administered by Biomedical Engineering.
P: BS 111, MTH 235, PHY 184. Physical and mechanical properties of soft and hard tissues. Biomaterials. Biocompatibility. Biochemical processes, biological transport, and thermodynamics. Bioelectronics and instrumentation.

351. Thermochemistry of Materials
Fall. 3(3-0)
P: CEM 151. C: MTH 234. R: Not open to students with credit in CHE 311 or ME 201. State variables, laws of thermodynamics, phase and chemical equilibria. Gas and condensed phase relationships, solutions, interfaces, point defects, electrochemistry.

352. Diffusion in Solids
Spring. 3(3-0)
P: MSM 250, MSM 351. R: Open only to Materials Science and Engineering majors or approval of department. Diffusion and mass transport. Kinetics of diffusion-controlled processes. Point defects, nucleation and growth, interface motion.

355. Mechanical Behavior of Materials
Fall. 3(3-0)
P: MSM 211, MSM 250. R: Open only to Materials Science and Engineering, Mechanics, Mechanical Engineering majors or approval of department. Stress and strain, crystal elasticity, anelasticity and viscoelasticity. Mechanical properties in tension and torsion. Crystallographic aspects of plasticity.

356. Deformation Mechanisms
Spring. 3(3-0)
P: MSM 355. R: Open only to Materials Science and Engineering majors. Elementary dislocation theory, slip and twinning. Deformation of single and polycrystals. Temperature and strain rate effects. Work hardening, solution and particle strengthening. Creep, fatigue and fracture in metals, ceramics and polymers.

365. Physical Metallurgy I
Fall. 3(3-0)
P: MSM 250; MSM 351 or concurrently. R: Open only to Materials Science and Engineering, and Mechanics majors or approval of department. Complex binary and ternary phase diagrams. Solidification. Recovery, recrystallization and grain growth. Phase transformations.

366. Physical Metallurgy II
Spring of even-numbered years. 3(3-0)
P: MSM 365. R: Open only to Materials Science and Engineering majors. Theory of alloy phases. Surfaces and interfaces. Diffusion controlled phase transformations in ferrous and non-ferrous alloys. Martensitic transformation. Amorphous structures.

375. Materials Science Laboratory I
Fall. 1(0-3)
P: MSM 355 or concurrently, MSM 365 or concurrently. R: Open only to Materials Science and Engineering, and Mechanics majors. Phase transformations. Recrystallization. Precipitation and aging. Microscopy. Structure-property relations.

376. Materials Science Laboratory II
Spring. 1(0-3)
P: MSM 355. R: Open only to Materials Science and Engineering, and Mechanics majors. Strengthening. Yielding, creep, and fracture. Plasticity. Thermal activation. Damping. Martensite and shape memory.

380. Polymeric Materials
Spring. 3(3-0)
P: CEM 152. R: Open only to Materials Science and Engineering majors. Polymers and engineering plastics. Chemical, physical and mechanical properties. Environmental effects on polymers. Manufacturing processes. Coatings.

401. Intermediate Mechanics of Deformable Solids
Fall. 3(3-0)
P: MSM 211. R: Open only to College of Engineering majors. Stress, strain and linearly elastic behavior. Plane stress and plane strain. Torsion. Yield criteria. Elastoplastic behavior of beams, shafts and cylinders. Unsymmetrical bending. Curved beams.

402. Computational Mechanics
Spring. 3(3-0)
P: MSM 401 or ME 471. R: Open only to College of Engineering majors. Energy methods with applications. Finite element methods. Buckling and stability. Green's functions.

403. Intermediate Dynamics
Fall of even-numbered years. 3(3-0)
P: MSM 306. R: Open only to College of Engineering majors. Kinematics and kinetics of particle and rigid body systems. Virtual work, Lagrangian method, and Euler equations. Basic vibrations of discrete and continuous systems. Elementary wave propagation.

405. Experimental Mechanics
Fall of odd-numbered years. 3(2-3)
P: MSM 211. R: Open only to College of Engineering majors. Measurement of stress, strain, vibration, and motion using strain gauges, accelerometers, photoelasticity, holography, Moire patterns, laser speckle and electronic imaging. Transducer design.

424. Biomaterials and Biocompatibility
Spring of even-numbered years. 3(3-0) Interdepartmental with Biomedical Engineering. Administered by Biomedical Engineering.
P: BME 311, PSL 250. Materials science of human implants. Design requirements imposed by the body's milieu and the need to protect the body.

441. Tissue Mechanics
Spring of odd-numbered years. 3(3-0) Interdepartmental with Biomedical Engineering. Administered by Biomedical Engineering.
P: BME 311. Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.

444. Introduction to Composite Materials
Spring. 3(3-0)
P: MSM 211. R: Open only to Materials Science and Engineering or Mechanics majors or approval of department. Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Material characterization. Failure and damage. Composite structure design.