
Business & Technology & Research



Center for Professional Studies

Programs and Courses

2011

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1.0 Mission Statement

The mission of the Universal Media Institute Center for Professional Studies (UMICPS) is to develop and deliver the highest quality of professional education and training and the areas of business, technology, and research.

2.0 Governing Body and Affiliations

UMICPS is a project of the Universal Media Corporation. It is licensed by the State of New Hampshire Postsecondary Education Commission as a private postsecondary distance learning school for professional studies, as defined in RSA 188-D:19. In addition, UMICPS is a member of the New Hampshire Council for Professional Education.

3.0 Faculty

The faculty is comprised of experts from business and science/technology, from both academia and industry.

4.0 Policies and Regulations

- Enrollment: Contact the program counselor (i.e., cps@uminstitute.com) for enrollment procedures. The following is the type of enrollments offered:
 - Individual Courses
 - Principal Track: Specialization
 - Advanced Principle Track: Advanced Specialization
 - Advanced Cumulative Track: Specialization + Advanced Specialization
 - Inclusive Track: Core Competency + Specialization
 - Distinguished Track: Core Competency + Specialization + Advanced Specialization

NOTE: Core competency courses are optional and teach the basic principles in a given area. They serve as foundation for non core competency courses and they are recommended for those who lack sufficient background for non core competency courses. However, core competency courses are required for those who are considering either inclusive or distinguished track classifications.
- Leave: A leave up to one year is granted to students experiencing unusual/unplanned circumstances. The school is not obligated to provide the same course, if the course has been dropped or canceled. In this case, the student may enroll in another course. No fees will be refunded for leaves.
- Absences: Students have all the business days in a given month to complete their 40 hours of instruction. An extension may be granted if for students experiencing unusual/unplanned circumstances.
- Class Cuts: See above.
- Make-up Work: See above.
- Tardiness: See above.
- Standards of progress (grade required to pass, etc.): There will be an assessment conducted upon completion of each course, on a pass/fail basis.
- Regarding student conduct and conditions for dismissal for unsatisfactory conduct: Harassment of any sort to fellow students, faculty, or administrators will not be tolerated. Immediate dismissal

will be result, without entitlement for refunds of any sort. In addition, students are expected to exhibit highest level of academic honesty.

- Granting credit for previous training: No credit is granted for previous training.

5.0 School Calendar

All courses start at the beginning of each month, i.e., first business day, and run for the entirety of that month, i.e., last business day. The courses are comprised of one week, 40 hours, of instruction. However, the students have the flexibility to utilize the entire month to complete their coursework.

The following are designated 2011 holidays:

New Year's Day: January 3rd

Memorial Day: May 30th

Independence Day: July 4th

Labor Day: September 5th

Thanksgiving: November 24th – 25th

Christmas: December 26th

6.0 Schedule of Fees and Charges

- Tuition: \$2000 per course
- Tuition Refund Policy (days from registration):
 - All courses consist of five eight-hour modules. Each module represents 20% of the course work. Students can finish a course, within five business days or take up to one month to finish their course. The refund policy is as follows:
 - If as student withdraws or is dismissed within four business days, 100% tuition is refunded to the student
 - After the 4 business days, if a student withdraws or is dismissed before completing 60% of the course work, i.e., third module, then the student is refunded 50% of the tuition
 - No refund shall be required for any student who withdraws or is dismissed after completing 60%, i.e., third module, of the course work, unless a student withdraws due to mitigating circumstances, in which case refunds shall be calculated based on the pro rata method described below:
 - Pro rata refund shall be the ratio of the number of units remaining after the last unit completed by the student to the total number of units in the time period, rounded downward to the nearest 10%.

NOTE: The 60% completion limitation does not apply in cases where the student cannot complete the program due to action taken by the school. Examples of school's action shall include school closing or bankruptcy, or cancellation of the program. In these and similar situations, refunds and fees shall be based on the pro rata method described above for up to 100% of the tuition paid.

- Books: Students have to purchase their own required/recommended books.
- Supplies: Students have to purchase their own required/recommended supplies.
- Tools: Students have to purchase their own required/recommended tools.
- Student Activities: Any planned activities for either the school or course will be disclosed to the students upon enrollment.
- Laboratory Fees: Any such fees will be disclosed to the students upon enrollment, if they pertain to a specific course.
- Service Charges: Below is the breakdown of each non-refundable fees:

- Enrolling in an individual course: None
- Certificate of each course completed: None
- Late enrollment: Late enrollment, for a given month of instruction, is considered from the beginning of the month, i.e., first business day, to being of the remaining 40 business hours in that month. Late fee of \$25.00 will be assessed.
- Application fee for each certification track: \$25.00
- Completion of each certification track: \$50.00 (includes a comprehensive exam that students must pass prior to obtaining certification)
- Transcripts: \$10.00
- Rentals: N/A
- Deposits: N/A
- Other Charges: N/A

7.0 General Description of the Available Space, Facilities and Equipment

UMICPS is presently 100% online. The Internet address is: <http://www.uminstitute.com/cps>

Students only require a basic dial-up connection, i.e., 56 Kbps. For a complete list of computer and information technology requirements for accessing the course work, please email: cps@uminstitute.com

8.0 Credits

Each course is comprised of 40 hours of instruction. Upon successful completion of each course, students will be granted 4 CEU credits. Each CEU represents continuing education unit for 10 hours of instruction.

9.0 Courses and Certification Tracks

Individual Courses: (4 CEU Credits)

Principal Track: Specialization (20 CEU Credits)

Advanced Principle Track: Advanced Specialization (20 CEU Credits)

Advanced Cumulative Track: Specialization + Advanced Specialization (40 CEU Credits)

Inclusive Track: Core Competency + Specialization (40 CEU Credits)

Distinguished Track: Core Competency + Specialization + Advanced Specialization (60 CEU Credits)

NOTE: *Courses taken individually maybe be transferred to a certification track program within 3 years of course completion.*

10.0 Courses and Certification Descriptions

10.1 Business Tracks

BUSINESS CORE COMPETENCY

Introduction to Business

Concepts, principles, and operations of the private enterprise system are identified in this course. Students compare and contrast sole proprietorships, partnerships, and corporations, and they learn the

advantages and disadvantages of each. This course also discusses the functions of modern business management, marketing, and ethics and social responsibility. Human resource management is described as well as how employers can motivate their employees. Bookkeeping, accounting, financial management, and financial statements are also examined.

Introduction to Marketing

What is marketing? Why is it important? What does it consist of? In Introduction to Marketing, these questions are answered as students gain an understanding of this dynamic field. The topics covered range from consumer behavior to marketing ethics and include market research, planning, strategy, product, pricing, promotions, distribution, wholesaling, and retailing. The focus is both domestic and global, with several real-world examples of marketing successes and failures.

Principles of Management

This course is designed to help students understand the major functions of management (planning, organizing, leading, and controlling) and the significance of each function in relationship to the existence of the company. This course describes how companies use management to set and accomplish goals through individuals, groups, and other types of resources. It also analyzes communication and ethics in the organization. Other topics include decision making, change, employee development, organizational structures, management control, leadership, conflict resolution, information security, and globalization.

Macroeconomics

Macroeconomics looks at the big picture of the performance of the national economy and its links to the global economy, as opposed to microeconomics, which focuses on the economic behavior of individual consumers and businesses. This course is designed to examine many aspects of the economy from this aggregate perspective. Students will discover some of the basic tools economists use, such as the economic perspective, fundamental concepts, graphing skills, and an overview of the interrelated components of the United States economy. Throughout the course, students will have the opportunity to examine various international issues of particular importance in today's global economy.

Microeconomics

This course provides students with a comprehensive overview of the evolution of the U.S. economy and the ways in which people produce, consume, and exchange goods and services. Major economic principles are presented, including supply and demand, economies and diseconomies of scale, competition, and taxation. Students also explore the characteristics of a labor market, the regulatory restrictions of tariffs, quota, and embargo on trade, and how the optimal quantity of public good is determined. Inequity of wealth and the interaction of economic rent, interest, and profit are also discussed.

BUSINESS PROFESSIONAL

Business Communication

Business Communication is a practical course that examines principles of communication in the workplace. It introduces students to common formats, such as the memo, letter, and report. It helps students review your writing skills to gain greater mastery of grammar, mechanics, and style. More importantly, it introduces students to the strategies successful business professionals employ for a variety of situations. Students are exposed to techniques for writing informational, persuasive, sales, employment, good news, and bad news communications. Students gain information on internal and external communication situations, with practice in audience analysis. Students also gain information on the technological tools available to business communicators today. Students are introduced to the exciting communication possibilities offered by personal computers, cell phones, videoconferencing, desktop publishing, and other cutting edge technology. In essence, it provides students with an introduction to the communication skills needed to enter and advance successfully in their business career.

Business Ethics

This course provides an introduction to business ethics. Part philosophy and part business, the course covers a wide array of ethical issues arising in contemporary business life. Major theoretical perspectives and concepts are presented, including ethical relativism, utilitarianism, and deontology. The lessons explore employee issues and responsibilities, leadership and decision making, morality, diversity, discrimination, and ethics in marketing and advertising. Corporate social responsibility is also examined, as are the topics of environmental responsibilities, global ethics, and regulation concerns in an era of increasing globalization.

Business Law

This course is designed to familiarize students with various kinds of laws, key elements of the American Constitution, and the concepts of the various schools of jurisprudence. Ethics, values, morality, law, and the various ethical theories are compared and contrasted, and the need for promoting corporate social responsibility is discussed. The elements of tort law, the basic elements of a contract, the sources of laws governing contracts, and the conditions for an offer to be valid are examined. Topics include reality of consent, capacity of minors, consequences of illegal agreements, assignment of rights, transfer of title, and the rights of third parties. Delivery of goods, right to inspection, acceptance and revocation of contract, the remedies available to buyers and sellers, and the nature of property are also discussed.

Business Mathematics

This course presents the ways in which basic mathematical concepts are applied in specific business contexts, with an emphasis on developing the skills necessary to analyze business situations critically and to identify the mathematical questions underlying them. Step-by-step methodologies for interpreting business issues and for solving their related mathematical problems are demonstrated. Mastery of the concepts examined in this course will equip students to determine the situations in which mathematical analysis can improve business decision making and to complete the necessary analysis in an efficient and accurate manner. Specific business topics examined range from the time value of money (simple and compound interest, annuities, promissory notes) to cost and pricing (purchase discounts, markups, markdowns, setting sales prices) to asset and liability management (inventory valuation, depreciation, cost allocation and financial statements), among others.

Business Statistics

This course is designed to familiarize students with the basic concepts of business statistics and provides a comprehensive overview of its scope and limitations. Students perform statistical analysis of samples, compute the measures of location and dispersion, and interpret them for descriptive statistics. Linear regression, multiple regression, and correlation analysis are performed, as is model building, model diagnosis, and time series regression using various models. Basic concepts of probability are described, and the discrete and continuous distributions of probability are applied. Other topics include constructing a hypothesis on one and two samples, performing one-way and two-way analysis of variance, and applying nonparametric methods of statistical analysis. Making decisions under risk and under uncertainty are also examined.

ACCOUNTING AND FINANCE

Accounting I

This course focuses on ways in which accounting principles are used in business operations. Students learn to identify and use Generally Accepted Accounting Principles (GAAP), ledgers and journals, and steps of the accounting cycle. This course introduces bank reconciliation methods, balance sheets, assets, and liabilities. Students also learn about financial statements, including assets, liabilities, and equity. Business ethics are also discussed.

Accounting II

Accounting II expands on what the student learns in Accounting I. It is focused on corporate accounting. This course discusses how corporations are structured and formed, with an emphasis on corporate characteristics. Stocks, bonds, notes, purchase investments and analysis of financial statements are included, as well as an in-depth look at managerial accounting. Statements of cash flow, budgets, and budget management are also examined.

Financial Accounting

Students in this course explore basic accounting concepts and procedures and the interpretation of financial statements. The principles of accrual and deferral accounting are presented, including proper use of debits, credits, and fiscal year-end procedures. Students also examine merchandising transactions, inventory costing and valuation, cash management, and accounts receivable. The reporting of long-term assets, liabilities, and bonds are also discussed.

Managerial Accounting

This course analyzes managerial accounting principles and systems through both process and job order costing. Additional managerial accounting topics include the following: cost behavior, cost-volume-profit analysis, budgeting and standard cost systems, decentralized operations, and product pricing.

Corporate Finance

This course offers a broad overview of corporate finance, including the goals of financial management. Students examine how the information contained in financial statements is used in analysis and forecasting. The topic of valuation is introduced, with a focus on valuing stocks and bonds. Students review the financial manager's role in estimating risk and return, computing cost of capital, evaluating capital structure policies, making investment decisions, and raising capital. Other topics include financial securities and derivatives, long-term and short-term planning, and innovations in corporate finance.

ACCOUNTING AND TAXES

Accounting

The course deals with the basics of accounting. Topics include; understanding basic financial statements; develop the mechanics to enter, assets, liabilities, income, expenses, financial statements, adjustments.

Federal Taxation I

The course deals with the basics of federal taxation from a personal viewpoint. Topics include, income, adjustments, deductions, credits, techniques of tax topic research, and form preparation.

Federal Taxation II

The course deals with the basics of federal taxation from a corporate and partnership viewpoint. Topics include, 1120 vs 1120A, income, deductions, depreciation methods, and loss carry forward/carryback, limits on certain deductions.

Automating Accounting System Using Peachtree Accounting

The course deals with the basics of automation in accounting using Peachtree tools. Topics include, conversion issues, general ledger, accounts payable, accounts receivable, payroll, and cross-checking for accuracy.

Automating Accounting System Using Microsoft Money Accounting

The course deals with the basics of automation in accounting using Microsoft Money tools. Topics include, conversion issues, general ledger, accounts payable, accounts receivable, payroll, and cross-checking for accuracy.

PEOPLE MANAGEMENT

Principles of Management

The course deals with understanding and appreciation of organizational structures and the role of the manager within these structures, with emphasis on the influence of the social sciences upon current management theory.

Human Resource

The course deals with human resource management including the evolution of the personnel process, organizational models, leadership patterns, and issues touching upon planning, assessment, staffing, training, development, and environmental issues.

Organization Behavior

The course deals with principles, theories and current research in the effective management of organizations. Topics include the basics of systems thinking, as well as team and group dynamics. The role of perception and motivation in the behavior of the individual is addressed.

Supervision

The course deals with how to learn to analyze issues, solve problems, and build management skills realizing that regardless of the technical specialties that may exist in business, there are managerial aspects which are common to every supervisory position.

Team Building and Morale

The course deals with executing team building activities to strengthen organizational morale. Students will learn how to identify situations where conflicts between team members and low morale exists.

OFFSITE MANAGEMENT VIA TECHNOLOGY

Electronic Business

This course deals with electronic tools, which can be utilized to conduct business operations by employees who are located offsite. In addition, students will learn how to effectively communicate and work with everyone in an organization, which is distributed throughout various locations.

Managing Remote Site/Employees

This course deals with management responsibilities and tools needed to manage remote locations and employees. In addition, there will be significant emphasis placed on team building, employee development, morale, and visibility.

Global Workforce and Outsourcing

This course deals with expansion of local workplace to remote locations and countries. Case studies will be presented, which will illustrate pros and cons for various different types of business models.

Infrastructure for Remote Sites

This course deals with tools need to setup and maintain remote sites. Tradeoffs between cost and efficiency will be discussed. In addition, security and redundancies will also be discussed.

Case Studies in Offsite Management

This course deals exclusively with case studies in offsite management using technology. Various successful and unsuccessful cases will be presented. Students will also get an opportunity to discuss any specific cases pertaining to them.

QUALITY MANAGEMENT

Introduction to Quality Management

The course deals with the functions and responsibilities of the quality organization. TQM and ISO concepts, and the tools for continuous improvement are analyzed for sequence of use and deployment.

New ISO Standard

The course deals with the new ISO 9000 series of quality system standards with emphasis on manufacturing and service industry applications. The studies address the standards interpretation, documentation and implementation including preparation for and creation of internal and external audits.

Human Factors

The course deals with the study of human factors, engineering theory, research and applications which are of particular relevance to quality assurance. A systems framework will be utilized, emphasizing feedback on interrelations among system components, including the human operator.

Project Management

The course deals with the theories and techniques in project management. Topics include description of project management techniques as well as procedures for evaluating their overall effectiveness and contribution to production and quality.

Quality Assurance

This course deals with the fundamentals of quality control, the evolution of the total quality system and the modern philosophy of quality. Process variability, fundamentals of probability and the basic concepts of control charts are also included.

ADVANCED QUALITY MANAGEMENT

Customer Satisfaction

This course deals with the study of current methods for obtaining customer satisfaction. Examines the techniques for determining customer needs and the development of customer service strategy quality control criteria.

Quality Measurement

This course deals with the quality metrics and their application throughout the life cycle of a product or service in a business entity. The study includes quality standards, customer satisfaction, etc.

Quality Control

This course deals with the application of statistical quality control (SQC) in controlling processes and delivering customer services are learned. Students will examine methods for establishing and maintaining SPC, QC auditing, and sampling, and continuous improvement in the service, health care, and public sectors.

Service Delivery

This course deals with the processes used to deliver service and methods used to assure satisfaction. Examines the relationship of strategic quality planning, the delivery process, and the usage of TQC.

Supplier Quality

This course deals with the fundamental quality requirements attendant to the successful procurement and delivery of the end item products or services. It includes the basic supplier issues of specifications, site inspection, selection, rating, certification, and related quality audits.

PROJECT MANAGEMENT

Project Management

The course deals with the theories and techniques in project management. Topics include description of project management techniques as well as procedures for evaluating their overall effectiveness and contribution to production and quality.

Managing Cross-Functional Projects

This course deals with managing of cross-functional projects. Topics include, Strategic Planning, Project Charter, Detailing, Work Packages/Estimates, Optimizing, etc.

Managing Complex Projects

This course deals with managing of complex projects. Topics include, Strategic Positioning and User/Client Multi-project Account Management, Work Estimating and Risk Assessment, High Performance Project Teams, Fine-tuning and Modeling Alternatives, etc.

Managing Project Teams

This course deals with managing project teams. Topics include, Developing Effective Project Teams, Leadership Styles, Diversity and Communication Challenges, Team Communication and Building Plan, etc.

Project Team Member

This course deals with team members responsibilities and expectations in a project. Topics include, phases of the project lifecycle, work and duration estimation, work packages, engaging in multiple projects, etc.

SUPPLY CHAIN MANAGEMENT

Supply Chain Management Fundamentals

This course will help you succeed as a supply chain management professional. You'll master the fundamentals of supply chain management, including customer demand forecasting, master production scheduling (MPS), material requirements planning (MRP), capacity planning, and production activity control (PAC).

Supply Chain Management Applications

This course deals with how to apply the essentials of supply chain management (SCM). Discover the finer points of SCM including manufacturing strategy, inventory budgeting and management, lean manufacturing, total quality management (TQM), Six Sigma, total employee involvement (TEI), the theory of constraints (TOC), manufacturing technology, and facility selection. Add increased value to your organization by applying these innovative concepts and improving company processes. Learn how to supplement existing supply chain management fundamentals, such as S&OP, MPS, and MRP with cutting-edge, progressive methods.

Inventory Management, MRP and Capacity Planning

This course begins with identification and purposes of types of inventory, establishing an ABC classification system, independent demand replenishment systems, safety stock determination and order fulfillment policies and associated requirements. Additionally, physical stock-keeping and distribution are discussed. In the second half of the course, functionality of Material Requirements Planning (MRP) is thoroughly examined. Also, inputs and outputs of MRP as well as lot sizing decisions and safety lead time are reviewed. Lastly, the importance of capacity planning (resource planning, rough-cut capacity planning, and Capacity Requirements Planning [CRP]) as a tool in resource allocation and scheduling is discussed.

Production Scheduling and Implementation

This course deals with defining the concepts of Total Quality Management (TQM), Employee Involvement (EI) and Just-in-Time (JIT) are the key topics of this module. Relationships between these three areas and defining strategies for successful implementation are focus areas. Also, control methodologies, concerned with the requirements for successful execution of the production schedule, are presented. Capacity utilization, operational loading, dispatching, lead time usage and performance measurements are areas of discussion. Theory of Constraints is given special treatment.

Procurement and Supply Management

This course provides an overview of the purchasing process within the supply chain context. The student will develop an understanding of the strategic role that purchasing plays in supply chain management. Emphasis is placed on the analysis, planning, and management of domestic and international procurement and supply activities. E-procurement and the business-to-business Web-based marketplace are also examined. Cases and other collaborative activities provide the student with the opportunity

HUMAN RESOURCE MANAGEMENT

Fundamentals of Human Resource Management

This course deals with management of employees with particular attention to recruiting, selection, placement, training, performance evaluation, motivation, wage and salary administration, security, behavior, and union-management relations.

Compensation Management

This course deals with the design and maintenance of employee pay and benefits systems that contribute to the effective implementation of organizational strategy; emphasis on internal equity, external competitiveness, employee motivation, legality, and budgetary issues in compensation administration.

Employee Benefits and Pensions

This course deals with presentation of the characteristics of employer-provided employee benefit programs (health, life, disability, pension, wellness) as well as legally required social insurance programs (social security, workers' compensation, unemployment insurance). Additional topics include, analysis of economic, financial, and motivational aspects of these programs using management and financial theories.

Employment Law

This course deals with examination of topics on wage and hour legislation, equal employment opportunity and civil rights, employee benefits and insurance, workers' compensation, occupational safety and health laws, and employees' personal rights.

Labor Management Relations

This course covers employee and management relations in union and nonunion organizations, labor relations law, the collective bargaining process, employee grievance procedures and arbitration, labor management cooperation, and dispute resolution.

LEAN

Fundamentals of Lean

This course covers the fundamentals of lean. Topics include: tools and concepts; value stream mapping; scorecards; 5S; JIT; etc.

Lean Six Sigma

This course covers the lean six sigma. Topics include: integration of lean and six sigma methodologies; project charters; process mapping; cause-and-effect tools; simple data analysis and process improvement and control methods; etc.

Lean Enterprise

This course covers the lean enterprise. Topics include: customer/market scope techniques; rate-based demand planning and production scheduling; product design configurations; distribution channel integration; etc.

Lean Manufacturing

This course covers the fundamentals of lean. Topics include: lean tools; 5S; 7 wastes; Kanban; zero quality control; total productive maintenance; etc.

Implementing Lean

This is a project course, which demonstrates all the knowledge learned in this track. Students will develop a lean implementation plan, under the guidance of the instructor.

BUSINESS INTELLIGENCE AND ANALYTICS

Introduction to Business Intelligence and Analytics

This course provides students an overview of business analytics and intelligence. Topics include, sources of data, needs for analysis, techniques/tools for analysis, etc.

Business Intelligence

This course deals with the area of business intelligence and how it refers to skills, processes, technologies, applications and practices used to support decision making. Topics include gathering, analyzing and disseminating information with or without support from technology and applications.

Business Analytics

This course deals with the area of business analytics and how they can be used in developing new insights and understanding of business performance. Topics include the study of business data using statistical analysis in order to discover and understand historical patterns with an eye to predicting and improving business performance in the future.

Web Analytics

This course deals with the area of web analytics and its utilization in the measurement, collection, analysis and reporting of Internet data for purposes of understanding and optimizing web usage.

Case Studies and Software Applications

This course deals with the available software and implementation examples of business analytics and intelligence domain. Students will learn about various software applications that are available from the industry and their features and limitations.

10.2 Science/Technology Tracks

10.2.1 ARTS

ARTS CORE COMPETENCY

Color Theory, Drawing and Lighting

This course covers the basics of the color theory, drawing and lighting. Topics include: psychological and cultural based aspect of color; 3-dimensional objects; etc.

Audio and Video

This course covers the basics of audio and video. Topics include: audio theory and systems; video theory and system; digital audio and video systems; etc.

Production, Direction and Copyright Law

This course covers the basics of production, direction and copyright law. Topic include: production and direction techniques; competitive business practices with focus on protection on intellectual property; etc.

Scriptwriting and Production Management

This course covers the basics of the scriptwriting and production management. Topics include: scriptwriting techniques/process; production techniques/process; etc.

Computers and Web for Art Production

This course covers the basics of computers and web, relevant for art production. Topics include: computing systems for art production; software applications for art production and publishing; etc.

DIGITAL DESIGN**Electronic Design**

This course covers electronic design. Topics include: placement and manipulation of visual elements; layout; integration of photographs, illustrations, displays and types; etc.

Digital Illustration

This course covers digital illustration. Topics include: computer generated compositions; advertising; design and illustration fields; etc.

Digital Imaging for Multimedia and Web

This course covers digital imaging for multimedia and web. Topics include: photo retouching; compositing; color adjustment; filters; etc.

Design and Technology

This course covers design and technology. Topics include: computer applications interfacing the graphics and applied arts; advertising and graphics design; topography; image manipulations and presentation techniques; etc.

Project

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a digital design project, under the guidance of the instructor.

MEDIA ARTS**Acting, Movement and Communication**

This course covers acting, movement and communication. Topics include: observing and reproduce human and non-human movements; gestures; etc.

Camera and Light Techniques

This course covers camera and light techniques. Topics include: camera movements; perception; etc.

Modeling and Animation

This course covers modeling and animation. Topics include: developing two and three dimensional models; applications of lightings and materials; character development; timings charts; etc.

Digital Editing

This course covers digital editing. Topics include: audio and video manipulation; linear and non-linear editing systems to output; etc.

Project

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a media arts project, under the guidance of the instructor.

GRAPHIC DESIGN**Multimedia for Graphic Design**

This course covers multimedia for graphic design. Topics include: applications of multimedia; utilization of software for integration of various formats; etc.

Graphic Illustration

This course covers graphic illustration. Topics include: application of design elements in stylized illustration; detail and rendering techniques; etc.

Information Graphics

This course covers information graphics. Topics include: processing and translation of information in visual format; print-media and online communications; etc.

Web Animation

This course covers web animation. Topics includes: vector based software; raster based software; etc.

Project

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a graphic design project, under the guidance of the instructor.

WEB DESIGN**Digital Imaging for Multimedia and Web**

This course covers digital imaging for multimedia and web. Topics include: preparing graphics and types for display; resolution; bit depth; color modes; channel operations; etc.

Information Design

This course covers information design. Topics include: information management; database design; etc.

Computer Animations for Multimedia and Web

This course covers computer animations for multimedia and web. Topics include: computerized techniques for animations; integration of various formats for multimedia and web delivery; etc.

Web Scripting

This course covers web scripting. Topics include: dynamic web design; interactive applications; client/server methodologies; etc.

Project

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a web design project, under the guidance of the instructor.

10.2.2 BIOLOGY

BIOLOGY CORE COMPETENCY

Introduction to Biology

This course consists of an overview of the major concepts of Biology, including: cell theory, bioenergetics, molecular biology, reproduction, nutrition, growth, development, homeostatic controls, and ecological issues. This course is intended for students seeking a broad overview of contemporary Biology with emphasis on human issues and current topics.

Environmental Biology

This course provides an introduction to natural ecosystems, population growth, and the interaction between human populations and our environment. Major areas of discussion include Ecosystems, Populations, Biodiversity, Pollution, and Environmental Economics. This course is designed for students seeking a broad overview of ecological systems and the effect of humans on the ecosystems.

Biodiversity

This course is an integrated survey of the plant and animal kingdoms which stresses general concepts and economically important species. Particular attention will be paid to special structures and mechanisms evolved by selected representatives of major phyla of plants and animals for solving problems of life in various environments.

Microbiology

This course will focus on unicellular organisms with special reference to those of the kingdom Bacteria, and describe their taxonomy, morphology, and physiology. Special attention will be given to those organisms that are of ecological concern or serve a useful industrial purpose. The importance of microbes and viruses in public health will be presented. This course is designed for all biology majors and other students who seek a good general education in modern biology.

Plant Diversity

An introductory course stressing general concepts related to the vast array of plant species, taxonomic links, and uses of major plant phyla in both society and industry. Some emphasis will be given to economically important species chosen from agronomic and non-agronomic situations. Recommended background: high school biology or equivalent.

BIOMEDICAL ENGINEERING

Introduction to Biomedical Engineering

Lectures, demonstrations, hands-on experimentation, and scientific literature readings in the major branches of biomedical engineering. A series of laboratory demonstration/experiments are utilized to complement key concepts covered in various lectures.

Bioelectric Foundations

An introduction to the origins and characteristics of the electric and electromagnetic signals that arise in biological tissues. Topics include the behavior of excitable cells and tissues, the intrinsic electrical and magnetic properties of biological tissues, and the response of excitable cells to electric and magnetic field stimulation. Laboratory projects include the measurement of bioelectric signals (EMG, EKG, EEG, EOG, and evoked response) and the fundamentals of data acquisition, analysis, and statistics. The principles of writing and maintaining a laboratory notebook are also developed and used.

Foundations in Biomechanics

This course is an introduction to the analysis of the musculoskeletal systems using principles of engineering mechanics. Basic principles of mechanics, stress, strain and deformation in beams are

presented and used to characterize the material properties of tissues such as skin, tendon, ligament, bone and cartilage. Principles of biomechanics are also applied to the design of medical devices and bioengineered tissues. Topics include forces, moments of forces, free body diagrams, principal stresses, transverse shear stresses and beam loading.

Foundations in Biological Transport Phenomena

This course is an introduction to the analysis of complex biological systems using principles of transport phenomena. Basic theories of momentum transport, mass transport and energy transport are presented and applied to cellular and mammalian physiology. Principles of transport phenomena are also applied to the design of medical devices and bioengineered tissues. Topics include differential and integral balances, rheology of Newtonian and non-Newtonian fluids, diffusion in reacting systems and homogeneous vs. heterogeneous reaction systems.

Bioinstrumentation and Biosensors

A study of the basic principles of biomedical electronics and measurement with emphasis on the operational performance and selection of transducers, instruments and systems for biomedical data acquisition and processing. Biopotential electrodes. Analysis and selection of physical, optical, electrical, mechanical, thermal transduction mechanisms which form the basis of the sensor design. Clinical laboratory instrumentation. Electrical safety problems in the clinical environment.

ADVANCED BIOMEDICAL ENGINEERING

Biomedical Instrumentation

Origins and characteristics of bioelectric signals, recording electrodes, biopotential amplifiers, basic sensors, chemical, pressure, sound, and flow transducers, noninvasive monitoring techniques and electrical safety.

Biological Systems

Review of control theory with applications to biological control systems. Development of mathematical models of selected biological control systems and the application of computer techniques in the simulation of these systems.

Tissue Engineering

This biomaterials course focuses on the selection, processing, testing and performance of materials used in biomedical applications with special emphasis upon tissue engineering. Topics include material selection and processing, mechanisms and kinetics of material degradation, cell-material interactions and interfaces; effect of construct architecture on tissue growth; and transport through engineered tissues. Examples of engineering tissues for replacing cartilage, bone, tendons, ligaments, skin and liver will be presented.

Biological Signal Processing

Basic principles of digital processing of biological signals and its application on PC-compatible computers. The theoretical fundamentals and practical examples of signal processing. The major emphasis is on linking the theoretical knowledge with easy-to-comprehend, practical examples.

Composites with Biomedical and Materials Applications

Introduction to fiber/particulate-reinforced, engineered and biologic materials. This course focuses on the elastic description and application of materials that are made up of a combination of submaterials, i.e., composites. Emphasis will be placed on the development of constitutive equations that define the mechanical behavior of a number of applications, including: biomaterial, tissue and materials science.

BIOTECHNOLOGY

Introduction to Biotechnology

Current topics and issues in Biotechnology will be investigated using a problem solving approach. Some examples of topics which may be investigated in detail include: cloning, DNA fingerprinting and molecular forensics, transgenic organisms, "green" engineering and bioremediation, bioprocess and metabolite engineering, bioinformatics, and mathematical modeling of biological systems

Process Biotechnology

This course is a survey of the applications of biotechnology, emphasizing the pharmaceutical industry and the operation of fermentation systems. Case studies of downstream separation and purification protocols employed on an industrial scale.

Applied Microbiology

This course is designed to introduce you to microorganisms in foods; their applications in industry, agriculture, environment, and medicine; physical and chemical factors of growth and control in relation to industrial and natural processes.

Methods in Recombinant DNA Technology

This course is designed to introduce you to the many techniques used in molecular biology, all of which rely on advances possible through recombinant DNA technology. While you will learn through hands-on experience many of the techniques in laboratory sessions, time does not permit an all-inclusive presentation.

Molecular Genetics

This course covers the principles of genetics at the molecular level, including the chemical nature of hereditary material. The genetic code, regulatory mechanisms, the molecular basis of mutation, DNA replication and recombination.

BIOINFORMATICS

Fundamentals of Bioinformatics

This course introduction the field and its tools. Topics include: Unix environment; file management; database survey. Discovery technologies including high-throughput sequence and functional analyses, and structural analyses.

Sequence Analysis

This course deals with the principles and methods related to information processing in biological systems. Topics include: homology, identity, and similarity; mechanisms and measures of molecular evolution; introduction to databases; search algorithms; pair wise sequence alignment using dynamic programming; and progressive methods for multiple alignment.

Molecular Modeling

This course deals with the molecular modeling of biological macromolecules. Topics include: homology-based molecular modeling, molecular dynamics, energy minimization, docking, secondary and tertiary structure prediction, fold recognition; emphasis will be placed on understanding the algorithms.

Database Systems and Computational Genomics

This course deals with the analysis of public and proprietary databases, their management, metadata, sequence analysis and manipulation.

Platforms and Application Development

This course deals with the bioinformatics programming. Topics include: Perl and selected application scripts as used to automate processes; operating systems, computing strategies; and hardware platforms.

HEALTHCARE INFORMATICS

This program has the following three categories:

For Health Care Professionals

For IT Professionals

For Training Professionals

Each of these categories will be based up what direction is taken. Below are the course descriptions and what they address:

Introduction to Healthcare Informatics

This course provides students an overview of healthcare information technology. Topics include, basic computer and software skills needed from end-users, electronic health records, workflow/procedures, etc.

Electronic Health Records I

This course deals with issues concerning electronic health records (EHRs). Topics include, infrastructure, databases, standards, business and clinical processes, quality improvement, physician adoption, legal and regulatory issues, privacy, security, etc.

Electronic Health Records II

This course continues with the issues concerning electronic health records. Topics include, EHR selection and process, how to use consultants, process analysis, product evaluation, vendor evaluation, creating RFP and contract negotiations, EHR implementation, project management, workflow, HIPPA, etc.

Healthcare Informatics Software and Case Studies

This course deals with the available software and implementation examples of healthcare information technology. Students will learn about various software applications that are available from the industry and their features and limitations. In addition, student will study some case studies regarding how healthcare industry is benefitting from information technology.

Healthcare Informatics Design/Training

The course deals with healthcare informatics design or training.

Direction 1: Process/Flow Design

Students will design a process and/or flow in the domain of healthcare informatics. This direction designates the healthcare professional category.

Direction 2: Infrastructure Design

Students will design an IT component in the domain of healthcare informatics. This direction designates the IT professional category.

Direction 3: Training

Students will be expected to develop a complete training program including assessments. This direction designates the training professional category.

10.2.3 CHEMISTRY

CHEMISTRY CORE COMPETENCY

Fundamentals of Chemistry

The theme of this course is the idea of molecularity: that all matter in the universe is composed of atoms bonded together in a limited number of ways. Molecularity is one of a small number of fundamental themes of chemistry (and of all science); it is important for us to address it immediately because it permeates all of chemistry. Specific concepts that we will discuss are presented below:

- Introduction to the Molecular View
- Structures of Simple Molecules
- Types of Compounds: The Periodic Table
- Chemical Calculations
- Types of Reactions
- The Quantum Structure of the Atom

Fundamentals of Forces and Bonding

The theme of this course is forces and bonding. We will examine the origin and strength of electrical forces within molecules (covalent bonds), between positive and negative ions in a lattice (ionic bonds), and between atoms or molecules of a pure substance (intermolecular forces). Energy changes accompanying the rupture or formation of such bonds will be discussed. Specific concepts that we will discuss are presented below:

- Molecular Structure and Shape
- Gases
- Solids
- Intra-and Intermolecular Forces
- Liquids
- Energy (First Law of Thermodynamics)

Fundamentals of Equilibrium

The theme of this course equilibrium. We will examine the nature of dynamic equilibrium at the molecular level, and will develop an understanding of the mathematical aspects of equilibrium. Phase equilibrium, further aspects of thermodynamics (entropy, free energy), equilibrium of chemical reactions in the gas phase, and equilibrium of chemical reactions in solution will be discussed. Specific concepts that we will discuss are presented below:

- Phase Equilibrium
- Chemical Equilibrium of Gas Phase Reactions
- Solutions
- Chemical Equilibrium of Reactions in Solution
- Entropy and Free Energy

Fundamentals of Dynamics

The theme of this course is dynamics. We will examine the nature of molecular motions and their interaction with light, which provides us with all of our structural information about molecules. Various types of molecular spectroscopy will be discussed. Then we will turn to the dynamics of interactions between molecules, examining the rates of chemical reactions, and discussing the detailed molecular pathways by which they occur. Specific concepts that we will discuss are presented below:

- NMR Spectroscopy
- Vibrational Spectroscopy
- Electronic Spectroscopy
- Dynamics of Physical Processes (Diffusion, phase changes, phase distribution)
- Dynamics of Chemical Processes

Fundamentals of Organic Chemistry

A systematic survey of the major reaction types and functional groups in organic chemistry. The course will provide a representative collection of characteristic reactions and transformations of a variety of types of organic molecules. Most of the examples will be drawn from aliphatic chemistry. Some theoretical models will be introduced with a view toward establishing a general overview of the material.

The course is intended for chemists, chemical engineers, pre-medical students and all those interested in the biosciences. A familiarity with the material presented in the general chemistry courses is assumed.

CHEMICAL ENGINEERING

Introduction to Chemical Engineering

This course provides an introduction to the broad and vital discipline of chemical engineering including conventional and developing chemical technologies. An introduction is provided to the first principles of chemical engineering, as well as environmental, health, safety and ethical issues in chemical engineering practice. An overview is provided of the chemical engineering profession, career choices, the course of study, and a survey of the chemical industry, e.g., polymer, pharmaceutical, food processing, microelectronic, electrochemical, biotechnology, process control, energy, and petroleum refining.

Chemical Engineering Fundamentals

This first course in chemical engineering is designed to give students the ability to use techniques and solve problems of interest to chemical engineers. Students will learn fundamental material by completing analysis, design, and/or laboratory projects. Topics covered include: material balances and stoichiometry, pressure, volume, and temperature behavior of pure fluids, 1st law of thermodynamics, vapor-liquid equilibria with ideal thermodynamics, and staged separation processes.

Elementary Chemical Processes

This course aims to build a strong foundation in analysis of chemical processes via a project-based approach. Topics covered include analysis and design of stagewise separation processes such as distillation, 1st and 2nd law (of thermodynamics) analysis of power and refrigeration cycles, and application of material and energy balances in industrial chemical processes, including those with recycle and non-ideal systems.

Applied Chemical Engineering Thermodynamics

This course uses a project-based approach to build confidence and competence in the use of chemical engineering thermodynamics for the analysis and design of chemical processes. Topics covered include extractive separation systems, solution thermodynamics and nonreacting multicomponent mixtures, phase equilibria and property changes on mixing.

Advanced Chemical Processes

This course builds on prior work in material and energy balances, chemical engineering thermodynamics, and stagewise separation processes to facilitate student mastery and design of more complex processes. Topics covered include chemical reaction equilibria, material and energy balances for non-steady state systems, combined material and energy balances, humidification, and batch distillation.

ADVANCED CHEMICAL ENGINEERING

Kinetics and Catalysis

Theories of reaction kinetics and heterogeneous catalysis for simple and complex reactions. Kinetics and mechanisms of catalyzed and uncatalyzed reactions, and effects of bulk and pore diffusion. Techniques for experimentation, reaction data treatment, and catalyst preparation and characterization.

Fluid Mechanics

Advanced treatment of fluid kinematics and dynamics. Stress and strain rate analysis using vectors and tensors as tools. Incompressible and compressible one-dimensional flows in channels, ducts and nozzles. Nonviscous and viscous flow fields. Boundary layers and turbulence. Flow through porous media such as fixed and fluidized beds. Two-phase flows with drops, bubbles and/or boiling. Introduction to non-Newtonian flows.

Advanced Thermodynamics

Examination of the fundamental concepts of classical thermodynamics and presentation of existence theorems for thermodynamics properties. Inequality of Clausius as a criterion for equilibrium in both chemical and physical systems. Examination of thermodynamic equilibrium for a variety of restraining conditions. Applications to fluid mechanics, process systems and chemical systems. Computation of complex equilibria.

Separation Processes

Thermodynamics of equilibrium separation processes such as distillation, absorption, adsorption and extraction. Multistaged separations. Principles and processes of some of the less common separations.

Fuel Cell Technology

The course provides an overview of the various types of fuel cells followed by a detailed discussion of the proton-exchange membrane (PEM) fuel cell fundamentals: thermodynamics relations including cell equilibrium, standard potentials, and Nernst equation; transport and adsorption in proton-exchange membranes and supported liquid electrolytes; transport in gas-diffusion electrodes; kinetics and catalysis of electrocatalytic reactions including kinetics of elementary reactions, the Butler-Volmer equation, reaction routes and mechanisms; kinetics of overall anode and cathode reactions for hydrogen and direct methanol fuel cells; and overall design and performance characteristics of PEM fuel cells.

10.2.4 COGNITIVE PSYCHOLOGY

PSYCHOLOGY CORE COMPETENCY

Introduction to Psychology

This course deals with a broad survey of the field of modern psychology, primarily for the nonmajor. Focuses on the natural science study of behavior, emphasizing biological, evolutionary, cognitive, and developmental perspectives while placing this work in historical, social, and philosophical context. The conceptual issues which unify the subfields of psychology highlighted along with a consideration of the techniques and methods by which knowledge about brain, mind, thought, and behavior is acquired and refined. The implications for life and society of contemporary scientific approaches and technologies considered throughout the course.

Biological Bases of Behavior

This course provides an introduction to the methods, models, and reasoning that have led to discoveries about brain-behavior relations, and a critical evaluation of the current theories that guide our thinking about the neurobiology, development and evolution of sensory and cognitive processes, sleep, pain, emotion, hunger, and thirst as well as maternal and sexual behavior patterns.

Personality and Social Behavior

This course deals with the determinants of socially significant human behavior those residing in the person, those that are the product of interpersonal context, and those resulting from the interaction of both sources. Formative as well as contemporary influences considered. Emphasis on the reasoning, research designs and methods used to examine the complex interplay of individual and social context.

Culture and Thought

This course deals with the cultural basis of understanding, including feeling, motivation, and cognitive tasks such as reasoning and categorizing. Reconstruction of cultural assumptions from discourse. Evidence for cross-cultural variation and cultural universals in human thought. Reading and three research exercises that require cultural analysis of interviews and other kinds of discourse.

Research Methods in Psychology

This course provides a systematic approach to the problem of designing and conducting psychological research putting that research into a larger scientific context featuring both experimental and nonexperimental methods, including observational, archival, and case-study methods. Problems of validity and control. Analysis of theorizing coupled with examination of psychological constructs used in behavioral neuroscience, cognitive science, developmental psychology, sensation and perception, as well as psychological aspects of the social and health sciences.

COGNITIVE PSYCHOLOGY

Introduction to Cognition

This course provides an overview of cognitive processes including pattern recognition, concept formation, attention, memory, imagery, mental representation, language, problem solving, and modes of thinking. The basic approach is both empirical (using data collection and analysis) and theoretical (building models using inductive/deductive reasoning).

Mind, Brain, and Cognition

This course deals with how humans function in a complex world given their biology and their experience. Emphasis on the methods, models and reasoning used by scientists in investigating the mind and behavior. The perceptual and memory systems used as examples to examine how psychologists study the mind and integrate their findings with insights from anthropology, biology, and philosophy.

Intelligence

This course deals with alternative definitions of intelligence, history of intelligence testing, basic principles of psychological tests and measurements, hereditarian views of intelligence, critique of hereditarian views, environmentalist views of intelligence, critique of environmentalist views, current perspectives on the nature vs. nurture controversy, 'The Bell Curve' and its critics, and alternatives to the psychometric approach to intelligence and intellectual development.

Perception

This course deals with perception as the means by which we become aware of the world and of ourselves. An introduction to the senses and the means by which meaningful experience is derived from their functioning. Emphasis given to visual perception.

Learning & Adaptive Behavior

This course deals with the principles of instrumental learning in animals and humans. Topics include elicitation, classical conditioning, reinforcement, punishment, problem solving, behavioral economics, and verbal behavior. Focus on empirical data, quantitative analysis, research methodology, and technologies generated from learning research.

ADVANCED COGNITIVE PSYCHOLOGY

Cognitive Neuroscience

This course deals with biological bases of higher mental functions including attention, memory, language, emotion, executive functions, and consciousness. Emphasis on evaluation of experimental designs,

methodological approaches, and current theories. Quantitative approaches that have significantly contributed to the growing understanding of the cognitive processes.

Emotions and the Brain

This course provides a broad perspective of the expanding field of affective neuroscience. How emotions are mediated in the brain. Overview of neural theories of emotion along with the relevant neuroanatomy and psychopharmacology, animal models of emotion, insights from human cognitive and clinical neuroscience. Emphasis on understanding the mechanisms by which emotion influences cognitive processes, including perception, attention, learning, and memory.

Advanced Learning Theory

This course deals with selected topics in the data and theory of basic processes of learning, memory, and motivation in animals and humans. Emphasis on the nature of theory construction and evaluation, and the relation of current perspectives to older ones.

Brain and Language

This course provides a focus on cognitive processes and brain mechanisms involved in language comprehension and production. Psycholinguistic models and how these models may be implemented in the brain.

Learning, Memory, and Cognition

This course deals with current concepts and controversies in the way people and other animals perceive, think, and remember.

10.2.5 COMPUTER SCIENCE AND TECHNOLOGY

COMPUTER/IT CORE COMPETENCY

Introduction to Computers

This course deals with the basics of computers. From the history of computers to running basic applications, students will become computer proficient. This course serves as a vital element for all courses.

Introduction to Internet

This course deals with the basics of the Internet. From the history of networking to running basic applications, students will become Internet proficient. They will be able to communicate with other users for sharing messages to data.

Introduction to C++

This course deals with the basics of the C++ programming language. Topics include, fundamentals of programming, variables, decisions, loops, functions, arrays, pointers, and classes.

Introduction to Algorithms and Data Structures

This course deals with the basics of algorithms and data structures for engineering students. Topics include, data structures such as arrays, stacks, queues, and lists and the algorithms that manipulate these structures.

Introduction to Databases

This course deals with the basics of database systems. Database system architecture; relational data model and languages; implementation of database applications; physical data organization, design and tuning; and query processing.

ARTIFICIAL INTELLIGENCE

Introduction to Artificial Intelligence

This course deals with making computers act intelligently. Topics include major theories, tools and applications of artificial intelligence, aspects of knowledge representation, searching and planning, and natural language understanding.

LISP Programming

This course deals with the LISP language for artificial intelligence applications. It is a dynamic language: editing changes take effect immediately, without the need for recompilation. It is primarily a functional language: all work can be done via function composition and recursion. The course only covers the core of LISP, and should be useful for practically any LISP system.

Prolog Programming

This course deals with the Prolog language invented in the early seventies. Prolog stands for programming in logic. It is a logic language that is particularly used by programs that use non-numeric objects. For this reason, it is a frequently used language in artificial intelligence where manipulation of symbols is a common task.

Expert Systems

This course deals with the expert systems or knowledge based systems (KBS). The course has been divided into two major sections, each addressing one of the major aspects of KBS, theory and practice.

Knowledge Discovery and Management

This course deals with the data analysis methods, data mining tools and techniques, data engineering, data warehousing, and evolutionary computation. Case studies illustrating applications of knowledge discovery and management in engineering, medicine, and service applications are discussed.

ADVANCED ARTIFICIAL INTELLIGENCE

Computer Graphics

This course deals with the computer to model and graphically render two- and three-dimensional structures. Topics include graphics devices and languages, 2- and 3-D object representations, and various aspects of rendering realistic images. Students will be expected to implement programs which span all stages of the 3-D graphics pipeline, including clipping, projection, arbitrary viewing, hidden surface removal and shading.

Machine Vision

This course deals with the current issues in the computer implementation of visual perception. Topics include image formation, edge detection, segmentation, shape-from-shading, motion, stereo, texture analysis, pattern classification and object recognition. We will discuss various representations for visual information, including sketches and intrinsic images.

Human Computer Interaction

This course deals with the research in human-computer interaction. Topics include the design and evaluation of interactive computer systems, basic psychological considerations of interaction, interactive language design, interactive hardware design and special input/output techniques.

Neural Networks

This course deals with the powerful class of model, the Neural Network. In fact, this is a broad term, which includes many diverse models and approaches. We will first motivate networks by analogy to the brain. The analogy is loose, but serves to introduce the idea of parallel and distributed computation. We then introduce one kind of network in detail: the feedforward network trained by backpropagation of error.

Natural Language Processing

This course deals with the computational modeling of human language, the ongoing effort to create computer programs that can communicate with people in natural language, and current applications of the natural language field such as automated document classification, intelligent query processing, and information extraction.

HUMAN-COMPUTER INTERACTION

Cognitive Psychology of HCI

This course introduces the concepts of sensation, perception, memory, decision making, the biological basis of behavior, models of cognitive thought processes, and design strategies for human computer interfaces.

Developing User Interfaces

This course will introduce students to implementation issues for graphical user interfaces. The goal is to understand the basic software architectures that govern the development of modern graphical user interfaces. The basic principles of 2D computer graphics will be covered. We will cover a range of topics, including traditional GUIs, event-driven and threaded apps, undo/redo, cut/copy/paste, multiple views, animation, custom widgets and we'll touch on collaborative systems. As a result of this course, students will be able to learn new interface toolkit systems and effectively develop the interface portions of applications.

Virtual Reality

This course deals with virtual reality concepts and applications. Physiology of the human perception system, immersive displays, 3-D devices, 3-D sound, real-time software development, sample applications in science and engineering. Practical issues in creating effective virtual environments will be emphasized.

Advanced Studies in Visual Communication

This course deals with theory and investigation of systems, structures, principles of visual organization, and typography for communication. Studio problems will be influenced by social, cultural, environmental, or technological factors.

Exhibition Design

This course deals with visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ADVANCED HUMAN-COMPUTER INTERACTION

Intelligent Multiagent Systems

This course deals with specification, design, implementation, and applications of multi-agent systems. Intelligent agent architectures; infrastructures, languages and tools for design and implementation of distributed multi-agent systems; Multi-agent organizations, communication, interaction, cooperation, team formation, negotiation, competition, and learning. Selected topics in decision theory, game theory, contract theory, bargaining theory, auction theory, and organizational theory. Agent based distributed computing. Agent-oriented software engineering. Applications in distributed intelligent information networks for information retrieval, information integration, inference, and discovery from heterogeneous, autonomous, distributed, dynamic information sources.

Introduction to Cybernetics and The Design of Systems

A introduces students to the discipline of cybernetics and suggests how it may provide a theoretical framework for thinking about design processes in general – and more specifically how cybernetic frameworks may be used to enhance the design of complex systems. The course does not require a technical background and is relevant to those interested in design, computer-human interface development, semiotics, philosophy, or the nature of understanding.

Dynamic Multimedia

This course provides a detailed look at execution machinery reveals how a system interacts with physical devices, and an overview of human interface construction suggests how one might express ideas. Throughout, the course stresses the artistic value of constant and consistent interaction, blurring the distinction between programming and composition. With a general architectural understanding, students develop and pursue their own artistic goals.

Cognitive Fundamentals of the Analysis of Interactive Systems

In this course, we investigate how cognitive processes such as perception, learning, reasoning, and problem solving, inform the design and analysis of complex, interactive systems. We study both these important cognitive processes, and analyze the ways in which they operate in important real-world contexts. Major topics include: cognitive architectures, analysis of skilled performance, complex learning and discovery, adaptive interfaces, user assistance systems, and special topics according to students' interests. We try to consider issues related to overlooked populations, such as the elderly, people with special cognitive needs (e.g., dyslexia), and children.

Phenomenological Foundations of Language, Cognition, and Computation

This course provides a critical analysis of theoretical foundations of the cognitive approach to language, thought, and computation. Contrast of the rationalistic assumptions of current linguistics and artificial intelligence with alternatives drawn from phenomenology, theoretical biology, critical literary theory, and socially-oriented speech act theory. Emphasizes relevance of theoretical orientation to the design, implementation, and impact of computer systems as it affects human-computer interaction.

INTERNET/WEB DEVELOPMENT

Introduction to HTML

This course deals with the basics of HTML. Students will learn to develop webpages with pictures, links, tables, forms, etc.

Perl and CGI Programming

This course deals with the basics of Perl and its utilization as a CGI (common gateway interface) tool. Student will write basic functions, which will be used with HTML to build dynamic webpages.

PHP Programming

This course deals with PHP programming. It provides the PHP framework and syntax, and covers in depth the most important functions used to build dynamic data enriched web applications. Students learn how to connect to a database, and perform hands on practice with a MySQL database to create database-driven HTML forms and reports. Students will also learn how to configure PHP and Apache Web Server.

JavaScript Programming

This course deals with the basics of JavaScript programming. Topics include the document object hierarchy, syntax, variables, expressions, evaluation, data types, operators, control structures, functions, arrays, the window object, the form object, Strings, Math, Dates, scripting frames and multiple windows, images, rollovers, cookies, and dynamic HTML.

Web Site Development

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a website, under the guidance of the instructor.

INTERNET/WEB ADMINISTRATION

Introduction to Web Servers

This course deals with the basics of web servers. Topics include: different types/vendors, i.e., IBM, Microsoft, Oracle, and Apache; web services; security; authentication; and redundancy.

Apache Web Server

This course deals exclusively with the Apache web server. Topics include: basic installation and configuration; understanding and customization of error reporting; and execution on various platforms, i.e., Windows and Unix.

Web Hosting

This course deals with the basics of web hosting. Topics include: hardware configuration; DNS; virtual domains; web services; security; authentication; and user management.

Advanced Web Hosting

This course deals with more advanced concepts in web hosting. Topics include: SSL and secure mode; electronic transactions; certificates; cookies; high availability; and fault tolerance.

Server Development

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a web server, under the guidance of the instructor.

LINUX BASICS

Introduction to Linux

This course deals with a general overview of the Linux operating system. Topics include partitioning and the boot process, basic system configuration, file management, and text stream processing. The course also covers user management, group management, and file permissions.

Shell Programming

This course deals with the basics of shell programming using the Bourne shell then covers additional features of the Korn and C shells. Topics include: Write basic Bourne Korn and C shell programs; Add statements to perform commands conditionally; Build repetitions into a program; Use functions for programming efficiency; Handle unexpected signals from executing programs; and select a shell language for writing shell scripts.

Perl Programming

This course deals with Perl programming. It is a scripting language which allows for rapid prototyping of projects formerly done with a programming language or a shell. It incorporates all the functionality of C (including a Linux system interface), the Shells, grep, sed, and awk. The topics in the course will aid all computer users - from end user to programmer to administrator alike.

System Administration

This course deals with a Linux system administration. It covers installing Linux, and setting up and maintaining file systems and user accounts. Topics include: Plan and perform the installation of Linux on a machine; Boot and shut down the system safely; Describe system states; Modify startup scripts; Set up UNIX file systems and maintain them; Perform file system backups; and create or remove a user account.

User/Hardware Management Tool

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a user/hardware management tool, under the guidance of the instructor.

LINUX NETWORKING AND ADMINISTRATION

Advanced System Administration

This course deals with a Linux system administration. It covers Linux system accounting performance monitoring device management and security. Topics include: Manage UNIX accounting systems understand the factors that affect system performance; Optimize resources so that the system performs at its best; Set up configure and maintain devices; Evaluate security needs; and identify the tools used to improve a system's security

Managing DNS/BIND

This course deals with management of DNS/BIND. DNS is the world largest distributed database with over 1 million servers interacting in real time. Studies have shown that over 50% of all DNS servers have configuration errors. Topics include: Emerging standards/technologies; DNS for Windows 2000; SecureDNS; DNS for mobile phones (GPRS); and international characters in DNS (non-ASCII, non-European).

Security and Firewalls

This course deals with security and firewalls. The Implementing Network Security using Firewalls WBT acquaints the students with the firewall concepts. It also describes the process of managing firewalls. Additionally, the course explains the methods of using and configuring firewalls.

Integrating Linux and Windows Environments

This course deals with Linux and Windows integration. This course explores approaches to integrating heterogeneous systems that are currently available. This includes file sharing systems such as NFS, systems such as Samba that allow Linux systems to become a part of the NetBios world, systems that permit DCOM and Corba to interwork with one another, as well as Internet and Intranet based approaches, and approaches allowing mainframes to coexist with smaller servers.

Advanced User/Hardware Management Tool

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop an advanced user/hardware management tool, under the guidance of the instructor.

EMAIL MANAGEMENT

Configuration and Management of Sendmail

This course deals with basics of Sendmail setup. It is the most popular open source Mail Transfer Agent (MTA) due to it being long established, stable and fully documented. Additionally, all UNIX/Linux systems come with Sendmail installed. This course will cover the basics of MTA's as well as the configuration and administration of a Sendmail server.

Introduction to LDAP

This course deals with Lightweight Directory Access Protocol (LDAP). It is a means of serving data on individuals, system users, network devices and systems over the network for e-mail clients, applications requiring authentication or information. This course will cover the setup and configuration of an LDAP server on Linux, the loading of data and use.

Introduction to Fighting Spam

This course deals with fighting spam. It is also known as Unsolicited Commercial E-mail (UCE) -- is not only an annoyance. It costs money, and the larger the organization, the greater the cost. Similar to the truism for security mechanisms, there is no guaranteed effective solution to counter spam in a usable system. There are available tools and techniques to fight spam. The trick is to balance the cost of dealing with it and the cost of ignoring it.

Advanced Spam Fighting

This course deals with advanced techniques fighting spam. Topics include: various spam filters; spam bots; artificial intelligence techniques in training spam filters; and user responsibilities to minimize/combat spam.

Email Management Tool

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop an email management tool, under the guidance of the instructor.

.NET PLATFORM

Introduction to .NET

The course deals with the fundamentals of the .NET platform and capabilities, benefits, etc. Topics include: basic framework, associated technologies, distributed computing, etc.

Visual Basic.NET Programming

The course deals with object-oriented and event-driven programming. The emphasis of the course will be towards building business solutions. Topics will include: forms, events, properties, syntax, file processing, and error handling. The lab component will include developing business applications.

Visual C++.NET Programming

The course deals with C++ programming within the Visual C++ platform and how it relates to the .NET framework. It focuses on effective structured design of code with variables, decisions, loops, functions, arrays and introduction of pointers.

C# Programming

The course deals with C# programming. Topics include: control structures, methods, arrays, OOP, exception handling, GUI concepts, multithreading, strings, and characters.

.NET Development

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a .NET framework, under the guidance of the instructor.

JAVA PLATFORM

Java Programming

This course deals with the fundamental of Java programming. Topics include: applications/applets; object-oriented programming; basic GUI development; exception handling; multithreading; files and streams; and networking.

Java Web Services I

This course deals with the fundamental of Java web services. Topics include: Creating Markup with XML; Document Type Definition (DTD); Document Object Model (DOM™); XSL: Extensible Stylesheet Language Transformations (XSLT); SOAP-Based; Web-Services Platforms; Web Services Description

Language; UDDI, Discovery and Web Services Registries; and Java API for XML-Based Remote Procedure Calls

Java Web Services II

This course is a continuation of “Java Web Services I”. Topics include: Java API for XML-Based Remote Procedure Calls (JAX-RPC); Java API for XML Registries (JAXR); JAXM and SAAJ; Computer and Internet Security; Web Services Security; and Wireless Web Services and Java 2 Micro Edition

Advanced Java/J2EE

This course deals with advanced concepts in Java programming. Topics include: advanced GUI and graphics; Java Beans; security; Java Database Connectivity (JDBC); and servlets/JSP.

Java Development

This is a project course, which demonstrates all the knowledge learned in this track. Students will propose and develop a Java client/server model, under the guidance of the instructor.

COMPUTER/IT SECURITY

Introduction to Computer/IT Security

This course provides an introduction to computer/IT security. Topics include: cyber crime and security; networks and the Internet; Internet fraud; denial of service; safeguards and countermeasures; Trojan horses and viruses; security hardware and software; etc.

Network Security

This course deals with how to secure networks from unauthorized activity. Topics include: cryptography; authentication applications; email, IP, web, and network management security; intruders; malicious software; firewalls; etc.

Techniques for Security Testing

This course deals with effective techniques for security testing. Topics include: fault model for a software security testing; creating unanticipated scenarios; attacking software dependencies; breaking security; attacking design and implementation; etc.

Security Auditing and Threat Analysis

This course deals with various tools to assist in the auditing process. Topics include: international standards, time-tested methods for auditing a network efficiently; analysis of the hacker process and associated methodologies; counteract attacks using specific, practical tools, including enterprise-grade security-scanning and intrusion-detection programs; etc.

Privacy and Ethical Issues in Computer Security

This course deals with privacy and ethical issues. Topics include: protecting programs and data; information and the law; rights of employees and employers; use of computer services; ethics of hacking and cracking; proprietary resources; etc.

COMPUTER/IT NETWORKING

Fundamentals of Computer/IT Networking

This course provides an introduction to computer/IT networking. Topics include: LAN, WAN, different types of configurations and topologies, wired, optical, wireless, security, Internet, on multiple platforms, etc.

Local and Wide Area Networks

This course deals with the theory and practice of the design of computer and communications networks, including the ISO seven-layer reference model. Analysis of network topologies and protocols, including performance analysis, is treated. Current network types including local area and wide area networks are introduced, as are evolving network technologies.

Wireless Networks

This course deals with the wireless networking technologies, applications and standards. Topics include: Basic RF theory, propagation, Wireless LAN, Bluetooth, RFID, WiFi, security, etc.

Microsoft Windows and Linux Networking

This course deals with networking issues in both the Microsoft Window and Linux platforms. Topics include: Email, print services, file serving, web services, DNS, user management, access control, interoperability, etc.

“**Network Security**” course from the “Computer/IT Security Certificate”

WIRELESS NETWORKING (either CS or EE core competency)

“**Local and Wide Area Networks**” course from the “Computer/IT Networking Certificate”

Wireless Communications I

This course deals with a diverse range of topics in wireless communications for applications such as cellular mobile radio, personal communication services (PCS), and wireless LANs (local area networks). Cellular system design, frequency reuse, channel assignment, handoff, power control, cell splitting, sectorization and system capacity. Radio propagation, path-loss models, log-normal shadowing, determination of coverage area, multipath and fading, statistical models for indoor and outdoor channels. Signal design principles: spectrum-efficient modulation methods (GMSK, QPSK), spread-spectrum modulation techniques (direct-sequence and frequency-hopping). Radio reception, receiver/transmitter architectures.

Wireless Communications II

This course is a continuation of “Wireless Communication I”. Adaptive equalization (maximum-likelihood, linear and decision-feedback methods). Diversity techniques (selection, maximum ratio combining, equal gain combining). Bit error rate and outage probability on fading channels. Multiple access for wireless systems: frequency, time, code and space division multiple access (FDMA, TDMA, CDMA, SDMA). Standards for wireless systems: AMPS, IS-54, IS-95 (U.S. digital cellular based on CDMA), GSM (Global Systems Mobile) and the PCS standards. Future (third generation) systems and the International Mobile Telecommunications (IMT-2000).

Wireless LAN

This course deals with the Wireless LAN technologies, applications and standards. Other important topics such as protocol layers, quality of service, throughput, coverage, interoperability, interference and security are discussed. Basic RF theory, propagation, link budget math, troubleshooting, WLAN security foundations and site survey are explored.

Bluetooth

This course deals with Bluetooth as a low power radio interface standard that is a major enabling technology for many new and innovative business and consumer products. This fast-track course covers the latest developments in Bluetooth technology, standards, products, and the creation of Bluetooth networks.

ELECTRONIC BUSINESS

Information Systems for E-Business

This course deals with computer/IT foundation necessary for making electronic business possible. Topics include: system framework of business operations and how it applies to the various applications and systems of information technologies; information and databases; types of information systems; the basics of e-commerce; human and ethical issues; networks and telecommunications; artificial intelligence; etc.

Fundamentals of E-Business

This course deals with basics of electronic business and commerce. Topics include: infrastructure; environment; supply chain management; procurement; marketing; change management; implementation; etc.

Secure E-business

This course deals with the security issues in electronic business. Topics include: Internet; networking; transaction scenarios; legal issues; cryptography, digital signatures; key management; authentication; certificates; etc.

Strategies for E-business

This course deals with the strategies used for electronic business. Topics include: evolution of e-business; building e-business competence through concepts and cases; strategy options for value creation in market spaces; impact of the Internet on both horizontal and vertical boundaries of an organization; case studies; mobile commerce; etc.

E-Business Implementation

This course deals with providing a step-by-step guide to implementing successful e-business solutions. Topics include: critical business procedures and activities to support e-commerce transactions; changes its internal procedures to take advantage of the e-commerce technologies; e-business processes and their synchronization to conventional business; measurements; outsourcing; etc.

ON-DEMAND COMPUTING

On-Demand Technologies and Strategies

This course deals with the on-demand technologies and strategies. Topics include: on-demand business; on demand Operating Environment (odOE), autonomic computing; grid computing; New-Generation Operations Software and Systems (NGOSS); etc.

Autonomic Computing

This course deals with autonomic computing as the technology of self-management. Topics includes: IT complexity; products and applications; industry demand; future of IT; etc.

Grid Computing

This course deals with grid computing. Topics include: organizations and their roles; anatomy; road map; merging the grid services architecture with the web services architecture; Open Grid Services Architecture (OGSA); etc.

On-Demand Technology Initiatives

This course deals with on-demand technology initiatives. Topics include: on-demand computing initiatives from IT vendors, i.e., IBM, HP, SUN, Microsoft, etc. and case studies of various on-demand computing deployments.

On-Demand Computing Research/Development

The course deals with on-demand computing research or development. Student may either conduct research or engage in project work to develop a prototype in the domain of on-demand computing.

SERVICES COMPUTING

“**On-Demand Technologies and Strategies**” course from the “On-Demand Computing Certificate”

“**Grid Computing**” course from the “On-Demand Computing Certificate”

Service-Oriented Architecture

This course deals with service-oriented architecture (SOA). Topics include: SOA reference and service models, business case, service design principles, infrastructure, governance, web services, identity, security, etc.

Cloud Computing

This course deals with cloud computing as the next revolution in the resource delivery and usage model. Cloud computing has the potential to overturn the software industry completely, as applications are purchased, licensed and run over the network instead of an end user's system. This affects not only business models, but the framework of how we manage the development and deployment of applications.

Services Computing Research/Development

The course deals with services computing research or development. Student may either conduct research or engage in project work to develop a prototype in the domain of services computing.

GREEN COMPUTING

Green Information Technology

This course deals with how information technology (IT) can be made “green” to reduce the carbon footprint and ultimately improve the bottom line. Topics include, reducing energy usage, virtualization, grid computing, cloud computing, etc.

Green Data Center

This course deals with how data centers can be made “green” to reduce the carbon footprint and ultimately improve the bottom line. Topics include, servers, storage, virtualization, cloud computing, etc.

“**Cloud Computing**” course from the “Services Computing Certificate”

Sony Playstation 3 Desktop/Server

This course deals with configuring the Sony Playstation 3 (PS3) gaming system to operate like a desktop and/or server with the Linux operation system. PS3's CPU, i.e., Cell Broadband Engine was jointly developed by IBM, Sony and Toshiba, has more computing capabilities than many other CPUs in the market and hence it is capable of delivering services and performance which consuming much less power than its counterparts.

Green Computing Research/Development

The course deals with green computing research or development. Student may either conduct research or engage in project work to develop a prototype in the domain of services computing.

BUSINESS OFFICE APPLICATIONS

Word Processing

This course deals with utilization of word processing applications. Topics include formatting, tables, figures, equations, importation, automation, etc. Tools from various companies, i.e., Microsoft, OpenOffice, etc., will be used.

Presentation

This course deals with utilization of presentation applications. Topics include formatting, tables, figures, equations, importation, automation, etc. Tools from various companies, i.e., Microsoft, OpenOffice, etc., will be used.

Spreadsheet

This course deals with utilization of spreadsheet applications. Topics include formatting, tables, figures, equations, importation, automation, etc. Tools from various companies, i.e., Microsoft, OpenOffice, etc., will be used.

Database

This course deals with utilization of database applications. Topics include creating basic records, queries, and views. Tools from various companies, i.e., Microsoft, MySQL, etc., will be used.

Internet

This course deals with utilization of Internet applications. Topics include email, news, web browsers, FTP, etc. Tools from various companies, i.e., Microsoft, Netscape, etc., will be used.

10.2.6 ELECTRICAL

ELECTRICAL ENGINEERING CORE COMPETENCY

Introduction to Electric Circuits

This course deals with basic electric circuit theory, the nature of electricity, resistance, current, and voltage. Direct current, alternating current, Ohm's law, series circuits, parallel circuits, as well as energy and power relationships are covered in detail. This course also covers D-C circuit analysis techniques including mesh and nodal analysis, and network theorems such as Norton's, Thevenin's, and maximum power transfer.

Circuit Analysis

This course deals with A-C circuit analysis techniques including mesh and nodal analysis, and network theorems such as Norton's, Thevenin's, and maximum power transfer. Treatment is given to circuits containing dependent and independent sources of voltage and current. Resonance and basic filters are covered in detail as well as magnetism.

Digital Circuits

This course deals with basic logic gates, base 2, 10, and 16 number systems, BCD, Gray and ASCII codes, Boolean algebra, Karnaugh maps, flip-flops, counters, programmable logic devices and other related digital devices.

Signals and Systems

This course provides an introduction to the time and frequency domain analysis of continuous-time (analog) signals and linear systems. Topics include: signal characterization and operations; singularity functions; impulse response and convolution; Fourier series; the Fourier transform and its applications;

frequency-domain characterization of linear, time-invariant systems such filters; and the Laplace transform and its applications.

Filter Design

This course deals with basics of passive filter design. Topics include: network models and equations; poles and zeros of network functions; complex frequency; LC, RC, RLC networks; ladder method, symmetrical lattice, etc.

COMMUNICATIONS

Analog Communication Theory

This course provides an introduction to analog communications systems. The bandpass transmission of analog data is motivated and typical systems are analyzed with respect to bandwidth considerations and implementation techniques. Baseband and passband digital transmission systems are introduced and investigated. Modulation techniques such as AM and FM are investigated in detail.

Digital Communication Theory

This course covers the fundamentals of digital communications and coding and the basic structure of a communication system. Topics include modeling of information sources; entropy; rate distortion function; lossless and lossy source coding theorems; Huffman coding; Lempel-Ziv algorithm; scalar and vector quantization; digital modulation schemes and their spectral characterization including PAM, PSK, FSK, PAM, QAM, MSK, GMSK; Covers noncoherent detection and DPSK systems and their performance. Discusses channel capacity, and Shannon's noisy channel coding theorem. Other topics include coding systems, linear block codes, soft and hard decision decoding, performance of linear block codes, cyclic codes, convolutional codes, Viterbi decoding, error probability bounds.

Digital Signal Processing

This course provides an introduction to the time and frequency domain analysis of discrete-time signals and linear systems. Topics include the characteristics of discrete signals and systems, sampling and quantization, and A/D conversion; the Z-transform, the Fourier transform, and the discrete Fourier transform; fast Fourier transform algorithms; design techniques for IIR and FIR digital filters; multirate digital filters; and quantization effects in digital signal processing.

Practical Real-time DSP Programming

This course provides a basic introduction to the principles of real-time digital signal processing (DSP). Topics include: DSP architectures, design of real-time DSP systems, sampling and quantization of continuous-time signals, design and implementation of FIR and IIR digital filters, and theory and application of the Fast Fourier Transform (FFT). The emphasis of the course is on the design and implementation of DSP algorithms. The algorithms are implemented in C and are meant to be implemented on portable DSP development boards.

Error Correcting Codes

Algebra and Galois field theory is covered in detail. Topics include: linear block codes, Hamming codes, cyclic codes, their encoding and decoding algorithms, BCH and Reed-Solomon Codes, the Berlekamp-Massey decoding algorithm, convolutional codes, their properties, Viterbi Algorithm, performance of the ML decoding, sequential decoding of convolutional codes.

RF/MICROWAVE

Distributed Circuit Analysis

This course deals with distributed circuit theory and analysis. Topics include, Telegraph equations, transmission lines, characteristic impedance, γ , S-parameters, Smith chart, etc.

RF Components and Systems

This course deals with components used at high frequencies. Topics include, low-noise amplifiers, mixers, noise sources, cables, calibration instruments/kits, vector network analyzers, and spectrum analyzers.

Amplifier Design

This course deals with amplifier design. Topics include, various types of gains, return loss, group delay, matching circuits, maximum power transfer, unilateral/bilateral configurations, narrow band designs, and broadband designs.

Oscillator Design

This course deals with oscillator design. The course covers both the feedback and reflection-port methods of design and analysis. Topics include, small-signal linear analysis, closed loop linear analysis and electromagnetic simulation of layout effects are illustrated.

Antenna Design

This course deals with the important and timely issues involving modern antenna design and theory. Developed specifically for engineers and designers who work with radar and radio communications, this course will give participants the understanding of antenna theory and techniques, the skills to analyze, design and measure various antennas, and the knowledge of antenna measurements.

TEST AND MEASUREMENT

DC and AC Testing

This course deals with the basics of DC and AC testing. Topics include, theory of analog instruments, DC/AC potentiometers, standard reference voltage sources, magnetic measurements, etc.

Digital Testing

This course deals with the basics of digital testing. Topics include, state/timing mode logic analysis, trigger sequencer, counters and timers, complex triggering, setup and hold, etc.

Analog and Mixed-Signal Testing

This course deals with the basics of analog and mixed signal testing. Topics include: problems, difficulties and features of analog and mixed-signal testing; methods, technique and approaches to analog and mixed-signal testing; CAD tools for analog testing; new effective technique: DFT, BIST and hierarchical tests.

RF/Microwave Testing

This course deals with the basics of RF/microwave testing. Topics include: basic RF theory; RF connectors and transmission lines; microwave power, receiver noise, phase noise, load-pull, and S-parameter measurements; and time-domain network analysis.

Calibration and Correlation

This course deals with the basics of calibration and correlation. Topics include: VNA error models; VNA uncertainty; fixtures and probes; calibration equipments/kits; deembedding; NIST traceability; and correlation process.

10.2.7 ENVIRONMENTAL

CHEMISTRY CORE COMPETENCY (see chemistry)

ENVIRONMENTAL ENGINEERING

Environmental Engineering Fundamentals

This course deals with concepts from aqueous chemistry, biology, and physics applied in a quantitative manner to environmental problems and solutions. Mass and energy balances, chemical reaction engineering. Quantitative and fundamental description of water and air pollution problems. Environmental regulations and policy, pollution prevention, risk assessment.

Environmental Engineering Chemistry

This course deals with thermodynamics and kinetics of acid/base, coordination, precipitation/dissolution, and redox reactions. In addition, organic chemistry nomenclature will also be covered.

Environmental Modeling

This course deals with systematic approach for analyzing contamination problems. Systems theory and modeling will be used to assess the predominant processes that control the fate and mobility of pollutants in the environment. Assessments of lake eutrophication, conventional pollutants in rivers and estuaries and toxic chemicals in groundwater.

Environmental Rate Processes

This course deals with application of thermodynamics, chemical kinetics and transfer operations to environmental problems; In addition, water pollution control will also be covered.

Pollution

This course deals with water and air pollution. Water purification and water quality control; aeration and mass transfer, biological mechanisms and kinetics; design of biological reactors and sludge treatment facilities; design and operation of physical purification methods; alternative processes for industrial wastewater treatment. Gaseous pollutants and their properties; basic analytical techniques for air pollutants; particulate pollutants and their properties; equipment design for removal of gaseous and particulate materials; economic and environmental impact of air pollutants; federal and state regulations.

10.2.8 INDUSTRIAL

MECHANICAL ENGINEERING CORE COMPETENCY (see mechanical)

INDUSTRIAL ENGINEERING

Optimization of Industrial Systems

This course provides an introduction to deterministic mathematical programming. Topics will include linear programming, duality, transportation problems, assignment problems, integer programming formulation, and goal programming.

Industrial Simulation

This course deals with general principles of stochastic simulation. Use of general purpose simulation languages to simulate integrated systems in manufacturing and service industry such as material handling, production and inventory control, facility layout, and quality control.

Manufacturing Engineering

This course deals with the types of processes available to manufacture various products. The characteristics of these processes and how they interact with design requirements, tolerances, safety and the environment. Integration of basic concepts into complete processes. Determination of the process to manufacture various assigned products.

Manufacturing Processes

This course deals with production technique and equipment. Topics include: casting and molding, forming, machining, joining and assembly, computer-integrated manufacturing, rapid prototyping, and electronics manufacturing.

Reliability Engineering

This course provides an introduction to probabilistic models and reliability mathematics. Topics include: Analyzing failure data; Load-strength interference models and reliability prediction and modeling; Reliability principles applied to mechanical and electrical systems; Reliability in design; Measuring and improving reliability; Reliability management.

10.2.9 MATERIALS

CHEMISTRY CORE COMPETENCY (see chemistry)

MATERIALS ENGINEERING

Introduction to Materials Engineering

This course deals with the structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations. Laboratory exercise in materials property measurements.

Thermodynamics in Materials Engineering

This course deals with the basic laws of thermodynamics applied to materials systems. Thermodynamics of chemical reactions. Homogeneous and heterogeneous equilibrium. Phase diagrams for materials systems.

Integrated Materials Design

This course deals with the design of devices, parts, processes or systems (including experiments) taking into account physical, chemical, mechanical, economic and ethical principles. Project planning, including scheduling and cost estimation. Application of design tools such as CAD, CAM and FEM. Analysis of problems, design and development of solutions. Safety, concept of shared responsibility, teamwork, communication. Testing and data collection. Interpretation of results and reporting.

Structural Characterization of Materials

This course deals with the structural characterization of ceramic, electronic, polymeric and metallic materials. Techniques include optical and electron microscopy, x-ray diffraction, and thermal analysis. Identification of materials type, microstructure, and crystal structure.

Principles of Materials Engineering

This course provides the introduction to the structure of metals, polymers and ceramics. Crystal structure and imperfections in metals. Diffusion, mechanical properties, and failure mechanisms. Phase equilibrium diagrams and heat treatment principles for steels, cast irons, composite materials, and aluminum alloys. Corrosion and electrical properties. Engineering applications.

ADVANCED MATERIALS ENGINEERING

Computational Methods in Materials

This course deals with the use of mathematical and statistical computer tools for materials design and analysis. Applications of statistical principles to problems concerned with materials. Computer-assisted design of experiments.

Ceramic Processing

This course deals with the raw materials, characterization of ceramic powders and slurries, ceramic forming methods - slip casting, injection molding, extrusion, dry pressing, drying and evaluation of green microstructures, relationship between forming method and resulting microstructure. High temperature ceramic firing, interpretation of phase diagrams, analysis of silicate systems, liquid and solid-state sintering, grain growth, microstructure development and advanced fabrication methods.

Metals Processing and Fabrication

This course provides the emphasis on secondary processing of metals and alloys. Machining, deformation and texturing effects, joining (welding, brazing, soldering), casting, powder metallurgy.

Integrated Materials Design

This course deals with the design of devices, parts, processes or systems (including experiments) taking into account physical, chemical, mechanical, economic and ethical principles. Project planning, including scheduling and cost estimation. Application of design tools such as CAD, CAM and FEM. Analysis of problems, design and development of solutions. Safety, concept of shared responsibility, teamwork, communication. Testing and data collection. Interpretation of results and reporting.

Advanced Electronic Materials

This course deals with the advanced concepts in band theory of solids including chemical bonding in solids and the linear combination of atomic orbitals, phase transitions in electronic, magnetic, and optical materials. Dielectric materials, ferroelectricity, piezoelectricity, sensors, and non-stoichiometric conductors. Optical properties, optical spectra of materials, optoelectronic devices. Magnetic and superconducting materials.

10.2.10 MECHANICAL

MECHANICAL ENGINEERING CORE COMPETENCY

General Physics – Mechanics

Introductory course in Newtonian mechanics. Topics include: kinematics of motion, vectors, Newton's laws, friction, workenergy, impulse-momentum, for both translational and rotational motion.

Principles of Physics – Mechanics

An introductory course in Newtonian mechanics that stresses invariance principles and the associated conservation laws. Topics include: kinematics of motion, vectors and their application to physical problems, dynamics of particles and rigid bodies, energy and momentum conservation, rotational motion.

Introduction to 20th Century Physics

An introduction to the pivotal ideas and developments of twentieth-century physics. Topics include: special relativity, photoelectric effect, X-rays, Compton scattering, blackbody radiation, DeBroglie waves, uncertainty principle, Bohr theory of the atom, atomic nuclei, radioactivity, and elementary particles.

Oscillations and Waves

An introduction to oscillating systems and waves. Topics include: free, clamped forced, and coupled oscillations of physical systems, traveling waves and wave packets, reflection, and interference phenomena.

Advanced Mechanics

This course emphasizes a systematic approach to the mathematical formulation of mechanics problems and to the physical interpretation of the mathematical solutions. Topics covered include: Newton's laws of motion, kinematics and dynamics of a single particle, vector analysis, motion of particles, rigid body rotation about an axis.

MECHANICAL ENGINEERING

Principles of Mechanical Engineering

Intended for students other than mechanical or manufacturing engineering students, this course is oriented towards developing competence in mechanical engineering concepts on the level that the technology interfaces directly with their own discipline. The course is designed specifically to help students meet that challenge through the development of a broad systems perspective and an understanding of the principal elements of mechanical engineering technology.

Materials Processing

An introduction to material processing in manufacturing. This course provides important background for anyone interested in manufacturing, design engineering design, sales, or management. Processing of polymers, ceramics, metals and composites is discussed. Processes covered include: rolling, injection molding, forging, powder metallurgy, joining and machining. The relationships between materials, processes, processing parameters and the properties of manufactured parts are developed. During the course the students should develop the ability to choose materials, processes, and processing parameters for designing manufacturing procedures to take a prototype part to production

Kinematics of Mechanisms

An introduction to the synthesis and analysis of linkages, cams and gear trains is presented. The design process is introduced and used to solve unstructured design problems in linkage and cam design. Algebraic and graphical techniques to analyze the displacement, velocity and acceleration of linkages and cams are developed.

Dynamics of Mechanisms and Machines

This course provides an in-depth study of forces in dynamic systems. Dynamic force analysis is developed using matrix methods. Computer programs are used to solve the sets of simultaneous equations derived by students for realistic, unstructured design problems. Inertial and shaking forces, elementary mechanical vibrations, torque-time functions, rotational and reciprocating balance and cam dynamics are covered using the internal combustion engine as a design example.

Compressible Flow

The application of basic thermodynamics and fluid mechanics to model the flow phenomena of compressible fluids. The assumptions leading to various flow models and the limits of these models are emphasized. The approach is, in the main, a one-dimensional control volume analysis, and the course is designed for engineering students. Topics covered include: reversible flow, flow with heat transfer, flow with friction, normal and oblique shock waves, flow with chemical reaction, and flow with applied electric and magnetic fields.

ADVANCED MECHANICAL ENGINEERING

Computational Fluid Dynamics

Computational methods for incompressible and compressible viscous flows. Navier Stokes equations in general coordinates and grid generation techniques. Finite volume techniques including discretization,

stability analysis, artificial viscosity, explicit and implicit methods, flux-vector splitting, TVD schemes and multigrid methods. Finite elements. Concepts of vectorization and parallel computing.

Mechanical Vibrations

Vibration analysis for both discrete and continuous linear systems. Start with an enhanced review of the fundamentals of single-degree-of-freedom vibration analysis. Both Newton-D'Alembert's vectorial approach and Lagrangian equations are discussed. General properties of related stiffness, mass and damping matrices are addressed. Modal analysis for linear systems is emphasized. Computational methods in vibration analysis are introduced.

Applied Linear Control

Modeling of complex systems used in various areas of engineering. Analytical description of dynamic physical systems, time and frequency domain representations. System characteristics such as controllability, observability and stability. Design of feedback controllers using state-space methods including pole placement and optimal control. State observers and introduction to Kalman filters. Performance limitation of control systems and trade-offs in control design.

Finite Element Method and Applications

This course serves as an introduction to the basic theory of the finite element method. Topics covered include matrix structural analysis variation form of differential equations, Ritz and weighted residual approximations, and development of the discretized domain solution. Techniques are developed in detail for the one- and two-dimensional equilibrium problem. Examples focus on elasticity and heat flow with reference to broader applications.

Crystallography, Diffraction and Microscopy of Materials

The fundamentals of crystallography and X-ray diffraction of metals, ceramics and polymers will be presented and discussed. The techniques for the experimental determination of phase fraction and phase identification via X-ray diffraction will be highlighted. The theory and practice of optical and electron microscopy will also be included. Both scanning and transmission electron microscopy will be theoretically and experimentally investigated.

ROBOTICS

Mathematical Fundamentals for Robotics

Fourier transforms, the Nyquist sampling theorem, differential equations, numerical methods, calculus of variations, differential geometry, and related topics.

Fundamentals of AI for Robotics

Introduction to methods of artificial intelligence. Strong focus on the fundamental theories, algorithms, and techniques required for designing adaptive, intelligent systems that make optimal use of available information and time. Covers a wide range of topics including search, probabilistic reasoning, machine learning, computational game theory, and natural intelligence.

Sensor-Based Robotic Motion Planning

Sensor based robotic motion planning incorporates sensor information, reflecting the current state of the environment, into a robot's planning process, as opposed to classical motion planning, which assumes the robot has full knowledge of the world prior to the planning event.

Mechanics of Manipulation

Kinematics, statics, and dynamics of robotic manipulator's interaction with a task, focusing on intelligent use of kinematic constraint, gravity, and frictional forces. Automatic planning based on mechanics. Application examples drawn from manufacturing and other domains.

Introduction to Mobile Robots

Components of mobile robots; perception, mechanism, planning, and architecture; detailed case studies of existing systems.

ADVANCED ROBOTICS

Mechatronic Design

Mechatronics is the synergistic integration of mechanism, electronics, and computer control to achieve a functional system. Because of the emphasis upon integration, this course will center around laboratory projects in which small teams of students will configure, design, and implement several mechatronic devices or systems. Lectures will complement the laboratory experience with comparative surveys, operational principles, and integrated design issues associated with the spectrum of mechanism, electronics, and control components.

Planning, Execution and Learning

This course will explore both classical and modern approaches to planning. Issues to be discussed include: how to represent actions and world state, how to search for plans efficiently, how to deal with uncertainty in actions and the world state, how to represent time, and how to dynamically combine planning and execution. Specific planning techniques to be covered include: means-ends analysis, linear and non-linear planning, GraphPlan, SatPlan, hierarchical planning, conditional planning, probabilistic planning using Markov models (MDPs and POMDPs), integration of planning, perception and execution, execution monitoring and replanning, planning and learning, and robot (geometric) planning.

MicroElectroMechanical Systems (MEMS)

The promise of better performance, lower cost, and miniaturization of sensor and actuator systems has motivated growth in the area of MicroElectroMechanical Systems (MEMS): silicon-based integrated microsystems. MEMS technology has broad applications such as inertial navigation, data storage, biochemical analysis, micromanipulation, optical displays, and microfluidic jet systems.

Mobile Robot Programming

This is an advanced research and development course. In this class, teams of students conduct research and prototype working robot architectures that are research-quality.

Machine Perception and Modeling of Human Behavior

This course will survey methods for monitoring and modeling human behavior, with a focus on assistive applications and applications that improve quality of life. We will cover measurement approaches including instrumented environments, everyday objects, and wearable devices. We will cover a variety of modeling techniques from psychology, speech recognition and language modeling, graphics, and machine perception.

10.2.11 NANOTECHNOLOGY

ELECTRICAL ENGINEERING CORE COMPETENCY (see electrical)

NANOTECHNOLOGY

Fundamentals of Nanoscience

This course deals with the capability to observe and manipulate systems at the molecular or atomic scale and its affect on all traditional sciences. This course, focusing on the impact and application of nanotechnology on the biology, chemistry, and physics. Topics covered include the basics of scale, the micro- and nanometer range, cell structure, biochemistry, proteomics, biomechanical systems, molecular

composition of materials, determination of chemical properties, influence of particle shape and size in a solution, photonics, x-ray diffraction methodology, electronics, and the ways in which macro properties change as size is reduced.

Nanoelectronics

This course deals with the examination of the field. Students will become familiar with the important, enduring concepts that apply to small electronic devices, and understand where the field is heading and what are the opportunities and challenges. Research on the Internet will be a significant part of this course.

Nanobiotechnology

This course deals with the application of nano- and micro-fabrication methods to build tools for exploring the mysteries of biological systems. It will cover the basics of biology and the principles and practice of microfabrication techniques with a focus on applications in biomedical and biological research.

NanoMaterials

This course deals with the nanotechnology as it relies on nanomaterials, and developing an understanding of the structure and chemistry of these materials is the key to engineering new technologies. Developments of nanomaterials have already led to improved cracking catalysts, stronger fibers, energy efficient light emitting diodes (used in new traffic lights), low dielectric constant films (that allow for faster, smaller integrated circuits), and magnetic data storage devices with higher storage densities.

Micro and Nano Fabrication

This course deals with three main topics. The first topic is high vacuum technology which is, in many ways, the backbone of many micro- and nano-fabrication technologies. The rest of the course goes on to cover thin film materials, specifically the aspects of thin film growth and characterisation and properties of thin films. This course lays the foundation for further study in the area of micro- and nano-fabrication including microelectronics, MEMS, microfluidics, and nanotechnology.

10.2.12 P R O C E S S

CHEMISTRY CORE COMPETENCY (see chemistry)

PROCESS ENGINEERING

Introduction to Process Engineering

This course introduces the core technical skills and professional responsibilities common to all process engineering and places them into the context of process operations; namely the core technical skills of (i) understanding processes and quantifying process flows, (ii) understanding and quantifying chemical process reactions and (iii) understanding and quantifying process mass transfer, heat transfer and fluid flow. These technical skills are introduced within the overall professional responsibilities of process engineers to ensure that the operations are safe, economically effective and socially responsible.

Process Control and Instrumentation

This course introduces the key elements of process control as they apply in the context of process operations; namely, (i) quantifying the process benefit from improved process control, (ii) understanding and quantifying process dynamics and process control systems, (iii) process measurement and instrumentation and (iv) the role of process control in the safe operation and management of processes.

Physical and Chemical Processes

This course develops the technical skills necessary to analyse and quantify the physical and chemical processes that occur within processing plants and to apply this knowledge within the framework of process operations. The technical skills will be developed by reference to three key process analysis methodologies; namely, unit operations, reaction engineering and transport processes.

Industrial Process Management

This course introduces the key elements of industrial process management and applies this knowledge within the framework of process operations. The course material will address the key issues of (i) effective organisation and management of human resources as applied within the process industries (ii) effective management of risk and associated safety systems, (iii) effective selection and management of improvement projects.

Process Simulation, Modelling, & Optimization

This course develops the technical skills required to mathematical model the performance of processes where the objective is to (i) analyse the process performance, (ii) analyse the operating regime and determine the optimum operating conditions and (iii) improve the process and equipment design. The technical skills will be developed by applying spreadsheet techniques and by reference to commercially available packages for process modelling.

10.3 Research Track

RESEARCH METHODOLOGY

Fundamentals of Research

This course provides basic foundation of research techniques. Topics includes: roles and responsibilities of scientists; data collection and analysis; theory and hypothesis; quantitative and qualitative methodologies; etc.

Quantitative Methods

This course deals with quantitative methodologies. These methodologies allow one to assign numbers to the data that is gathered. Topics include: statistical and correlational analysis; surveys; experimental; etc.

Qualitative Methods

This course deals with qualitative methodologies. These methodologies allow one to gather data that reflect the content and meaning of an event or the perspective of an individual. Topics include: interviews; participant observation; questionnaires; field research; etc.

Research Proposal

This course deals with conducting preliminary research in the disciplines offered by UMICPS and writing a proposal towards a research project. Students will work with qualified instructor(s) as advisor(s) in the area they are researching.

Research Project

This course deals with conducting research in the areas offered by UMICPS and writing a report. Students will work with qualified instructor(s) as advisor(s) in the area they are researching.

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