COLLEGE OF ENGINEERING & DESIGN
SILLIMAN UNIVERSITY
Dumaguete City

MASTER OF ENGINEERING

EFFECTIVE SCHOOL YEAR 2009-2010

Majors: *Civil Engineering*
Computer Engineering
Electrical Engineering
Mechanical Engineering

FIRST YEAR

First Semester

MEP 200	Advanced Engineering Mathematics I		3-0-3
MEP 201	Probability and Statistics for Engineers		3-0-3
MEP 203	Environmental Engineering and Management		3-0-3
MEP 205	Computer Programming: Structured & OOP in C++		3-0-3
		Total	12 units

Second Semester

MEP 202	Advanced Engineering Mathematics II		3-0-3
MEP 204	Numerical Methods for Engineers		3-0-3
	(Discipline Related Course)		3-0-3
	(Discipline Related Course)		3-0-3
		Total	12 units

SECOND YEAR

First Semester

MEP 300	Special Problems		3-0-3
	(Discipline Related Course)		3-0-3
	(Elective Course)		3-0-3
	(Elective Course)		3-0-3
		Total	12 units

Second Semester

MEP 400	Project		3-0-3
	(Discipline Related Course)		3-0-3
	(Discipline Related Course)		3-0-3
	(Discipline Related Course)		3-0-3
		Total	12 units

GRAND TOTAL: **48 UNITS**

COLLEGE OF ENGINEERING & DESIGN
SILLIMAN UNIVERSITY
Dumaguete City

MASTER OF ENGINEERING

EFFECTIVE SCHOOL YEAR 2009-2010

I. Mathematics (Required 12.0 units)

MEP 200	Advanced Engineering Mathematics I	3-0-3
MEP 201	Probability and Statistics for Engineers	3-0-3
MEP 204	Numerical Methods for Engineers	3-0-3
MEP 202	Advanced Engineering Mathematics II	3-0-3
		12 units

II. Foundation Courses (Required 6.0 units)

MEP 205	Computer Programming: Structured and OOP in C++	3-0-3
MEP 203	Environmental Engineering and Management	3-0-3
		6 units

III. Project (Required 6.0 units)

MEP 300 Special Problems
MEP 400 Project

IV. SPECIALIZATION COURSES (24.0 units)

Area 1: CIVIL ENGINEERING

A. Core Courses (Required 12.0 units)

I. Structural/Geotechnical Engineering

MCE 211S Bridge Engineering
MCE 213S Matrix Structural Analysis
MCE 215S Pre-stressed Concrete
MCE 217S Dynamics of Structures
MCE 221S Advanced Soil Mechanics
MCE 222S Advanced Foundation Engineering
MCE 223S Advanced Design Concrete Structures
MEP 214 Finite Element Analysis

II. Water Resources and Environmental Engineering

MCE 212W Sanitary Engineering
MCE 214W Groundwater Hydrology
MCE 216W Surface Hydrology
MCE 222W Water Resources Development
MCE 224W Engineering Economic Analysis
MCE 222 Image Analysis and Remote Sensing

B. Electives (Required 12.0 units)

MCE 111 Geographic Information System

MCE 212W	Sanitary Engineering
MCE 213W	Irrigation, Drainage and Flood Control
MCE 214W	Groundwater Hydrology
MCE 216W	Surface Hydrology
MCE 221	Engineering Economic Analysis
MCE 221S	Advanced Design of Steel Structures
MCE 222	Image Analysis and Remote Sensing
MCE 222W	Water Resources Development
MCE 226	Engineering and Technology Management
MCE 230	Land Use Planning
MCE 230W	Open Channel Hydraulics
MCE 231S	Advanced Mechanics of Materials
MCE 222S	Advanced Foundation Engineering
MCE 232S	Rock Mechanics
MCE 233S	Subsurface Investigation and Soil Testing
MCE 235S	Soil Erosion and Sediment Transport
MCE 301	Project Planning and Management
MCE 303	Reliability Engineering
MCE 311	Advanced Hydrology
MCE 328	Advanced Water and Wastewater Treatment Processes
MCE 329	Solid Waste Management
MCE 413	River and Coastal Engineering
MCE 418	Hydrogeology
MCE 428	Environmental Impact Assessment
MCE 461	Quality and Quality Systems
MCE 467	Strategic Planning and Management in Engineering and Technology
MCE 468	Decision Analysis in Engineering
MCE 501	Special Topic in Civil Engineering
MCE 513	Design of Hydraulic Structures
MCE 610	Geotechnical Earthquake Engineering
MCE 612	Advanced Geotechnical Engineering
MCE 613	Soil Reinforcing Techniques and Modeling
MCE 614	Earthquake Engineering
MCE 615	Advanced Transportation Engineering
MCE 616	Transportation Systems and Analysis
MCE 617	Design and Management of Transportation Operations
MCE 618	Spatial Database Management

Area 2: COMPUTER ENGINEERING

DISCIPLINE RELATED COURSES (Required 15.0 units)

Control Systems Engineering:

MECE 211	Modern Control Systems
MECE 212	Linear Systems Theory
MECE 213	Digital Control Design
MECE 214	Signals and Systems
MECE 215	Digital Signal Processing I
MECE 216	Robotics
MECE 217	Advanced Feedback Systems

Computer and Communications Engineering:

MECE 212	Linear Systems Theory
MECE 214	Signals and Systems

MECE 215 Digital Signal Processing I
MECE 218 Mobile Computing
MECE 219 Digital Communications
MECE 220 Data Communications Network I

ELECTIVES (Required 9.0 units)

MEE 221 Power System Operation and Control
MEE 222 Renewable Energy
MEE 223 Special Topics in Electrical Engineering
MEE 224 Power System Economics
MEE 225 Power System Reliability
MECE 221 Digital Image Processing
MECE 222 Computer Architecture
MECE 223 Coding and Information Theory
MECE 224 Data Communications Network II
MECE 225 Digital Signal Processing II
MECE 226 Operating Systems Engineering
MECE 227 Mobile Robotics
MECE 228 Design with Microcontrollers

Area 3: ELECTRICAL ENGINEERING

DISCIPLINE RELATED COURSES (Required 15.0 units)

Control Systems Engineering:
MECE 211 Modern Control Systems
MECE 212 Linear Systems Theory
MECE 213 Digital Control Design
MECE 214 Signals and Systems
MECE 215 Advanced Feedback Systems
MECE 216 Robotics
MECE 217 Digital Signal Processing I

Energy Management:
MEE 212 Energy Management in Buildings
MEE 213 Energy Efficiency and Conservation
MEE 214 Demand Side Management
MEE 215 Electricity Economics and Planning

ELECTIVES (Required 9.0 units)

MEE 221 Power System Operation and Control
MEE 222 Renewable Energy
MEE 223 Special Topics in Electrical Engineering
MEE 224 Power System Economics
MEE 225 Power System Reliability
MECE 221 Digital Image Processing
MECE 222 Computer Architecture
MECE 223 Coding and Information Theory
MECE 224 Data Communications Network II
MECE 225 Digital Signal Processing II
MECE 226 Operating Systems Engineering
MECE 227 Mobile Robotics

MECE 228 Design with Microcontrollers

Area 4: MECHANICAL ENGINEERING

I. Core Courses (Required 15.0 units)

MME 211 Advanced Engineering Thermodynamics
MME 212 Advanced Material Science and Engineering
MME 213 Advanced Vibrations
MME 214 Combustion Engineering
MME 215 Advanced Conduction Heat Transfer
MME 216 Advanced Mechanics of Solids
MME 217 Mechatronics
MME 218 Advanced Radiation Heat Transfer
MME 219 Advanced Convection Heat Transfer

II. Electives (Required 9.0 units)

MME 230 Thermal Environmental Engineering
MME 233 Instrumentation and Control
MME 236 Finite Element Analysis
MME 237 Advanced Fracture Mechanics
MME 239 Thermal Engineering
MME 243 Advanced Energy Management
MME 244 Renewable Energy Sources
MEP 214 Industrial Pollution Control
MEP 330 Fluids Engineering
MEP 331 Biomass Energy Conversion Systems

MASTER OF ENGINEERING MAJOR IN CIVIL ENGINEERING
COURSE DESCRIPTION

I. Mathematics (Required 12.0 units)

MEP 200 ADVANCED ENGINEERING MATHEMATICS I
Vector spaces, linear independence, matrices, rank and inverse of a matrix, decomposition theorems, Eigenvalues and Eigenvectors, unitary and similarity transformations on matrices, initial and boundary value problems, power series solutions. Applications to engineering problems.

MEP 201 PROBABILITY AND STATISTICS FOR ENGINEERS
Basic probability and statistics with application and examples in engineering systems, elementary probability theory, random variables and their distributions, random processes, statistical inferences, curve fitting and prediction, correlation and application to quality assurance reliability life testing.

MEP 204 NUMERICAL METHODS FOR ENGINEERS
Error analysis, solution of nonlinear equations, direct and iterative methods of solving linear systems, approximations of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. With computer machine problems.

MEP 202 ADVANCED ENGINEERING MATHEMATICS II
Boundary value problems of differential equations. Sturm-Liouville theory, singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations, spherical harmonics.

II. Foundation Courses (Required 6.0 units)

MEP 205 COMPUTER PROGRAMMING: STRUCTURED AND OBJECT-ORIENTED PROGRAMMING IN C++
Elements of computer programming, structured computer programming, abstract data type, and object-oriented programming and design in C++.

MEP 203 ENVIRONMENTAL ENGINEERING & MANAGEMENT Pollution control laws; regulations and standards; types' sources and harmful effects of pollution, solid and liquid waste disposal and management, air pollution control

III. Core Courses (Required 12.0 units)

A. STRUCTURAL/GEOTECHNICAL ENGINEERING

MCE 211S BRIDGE ENGINEERING
This course deals with the structural analysis and design of modern bridge structures. The course covers the study of influence lines and their application to moving loads, applications of AASHTO and NSCP Volume 2 Specifications to bridge design especially steel, reinforced concrete and prestressed concrete bridges, aerodynamic performance of bridges under wind loads, earthquake response of bridges, maintenance and rehabilitation.

MCE 213S MATRIX STRUCTURAL ANALYSIS
Force and flexibility methods; displacement and stiffness method; displacement and rotation method using Matrix Structural analysis.

MCE 215S PRESTRESSED CONCRETE

This course is concerned with the elastic and ultimate strength analysis and design of prestressed concrete structures. The course covers the calculations of stresses due to bending, shear, torsion and anchorages, losses of prestresses and deflections. Behavior of statically indeterminate prestressed concrete beams is also studied.

MCE 217S DYNAMICS OF STRUCTURES

Kinetics and kinematics of structures; kinetics and kinematics of rigid bodies; work energy method; and impulse and momentum. Seismic and Wind Design of Concrete/Steel Structures

MCE 221S ADVANCED SOIL MECHANICS

This course presents the application of principles of soil mechanics. It considers the following topics: the origin and nature of soils; soil classification; the effective stress principle; hydraulic conductivity and seepage; stress-strain-strength behavior of cohesionless and cohesive soils and application to lateral earth stresses; bearing capacity and slope stability; consolidation theory and settlement analysis; and laboratory and field methods for evaluation of soil properties in design practice.

MCE 222S ADVANCED FOUNDATION ENGINEERING

The course covers various aspects of foundation engineering including soil exploration, details of shallow and deep foundations, and retaining walls. The soil-foundation interactions are discussed along with the numerical solution techniques of beams and plates resting on elastic foundation bed. The behavior and design methods of foundation on reinforced earth are discussed. Also covered are the advanced theories and design of various foundation components and earth pressure theories for designing the retaining walls. The codal provisions of the design of various types of foundation are dealt with.

MCE 223S ADVANCED DESIGN CONCRETE STRUCTURES

This course is concerned with the design, applications and code specifications used in structural reinforced concrete members subjected to flexure *(beams, girders, joists, lintels, girts, etc.),* tension, and compression members *(columns),* combined stressed members *(beam-columns),* the *Plastic Limit Method* or the Ultimate Strength Design (USD). Applications and specifications as applied to buildings, bridges, and other reinforced concrete structures are also given emphasis. A thorough knowledge and proficiency in Structural Theory is imperative.

MEP 214/MME 236 FINITE ELEMENT ANALYSIS

After the concepts of finite elements methods are presented, formulation for different engineering problems and their applications are studied. Topics include variational methods. The finite element concept and applications in stress analysis, dynamics, fluid mechanics, and heat transfer.

B. WATER RESOURCES AND ENVIRONMENTAL ENGINEERING

MCE 212W SANITARY ENGINEERING

This course deals with the principles and applications of sanitary engineering and
other related sanitary sciences to the control of man's environment, sources of infection; modes of transmission, diseases vectors, rural sanitation, control of animal and insects vectors of diseases, industrial hygiene, air pollution, radiological health and stream sanitation.

MCE 214W GROUNDWATER HYDROLOGY

Infiltration and Percolation: Processes and Measurements; Groundwater Storage and the Flow of Water Hydrologic Investigations in Determining Subsurface Resource. Hydraulics of Low of Groundwater. Groundwater Exploration and Exploitation in the Philippines.

MCE 216W SURFACE HYDROLOGY

This course is concerned with the discussion of Hydrologic cycle; occurrence and analysis of components of hydrologic cycle such as precipitation, evapo - transpiration, infiltration, stream flow and ground water; river and reservoir sedimentation; flood routing techniques; probability analysis for hydrologic design; computer modeling for hydrologic systems.

MCE 222W WATER RESOURCES DEVELOPMENT
This course deals with the principles and analysis of water resources systems such as multi-purpose reservoir, water supply distribution system and storm water drainage; irrigation system and agricultural drainage system; special topics

MCE 224W ENGINEERING ECONOMIC ANALYSIS
This course is designed to introduce the upper level graduate students to the concepts and practices of entrepreneurial thinking. Using a combination of lectures, case studies, student led discussions, team business plans, and investor presentation formats, the course teaches life skills in entrepreneurial thought and action that students can utilize in careers ranging from starting companies to instigating cutting edge R&D projects in large company entrepreneurial endeavors. Major course themes include: Introduction to Entrepreneurship, Idea Generation and Feasibility Analysis, and Business Planning.

MCE 222 IMAGE ANALYSIS AND REMOTE SENSING
Satellite imagery and aerial photography are vital tools for GIS developers, analysts, and users. Students will first be introduced to the concepts and methods of imaging, remote sensing, and image analysis. The main focus of this course will then be the manipulation and analysis of images within a GIS.

IV. Electives (Required 12.0 units)

MCE 111 GEOGRAPHIC INFORMATION SYSTEM
Provides hands-on introduction to a dynamic desktop GIS (Geographic Information System). Introduces the components of a desktop GIS and their functionality. Emphasizes manipulation of data for the purpose of analysis, presentation, and decision-making.

MCE 212W SANITARY ENGINEERING
This course deals with the principles and applications of sanitary engineering and other related sanitary sciences to the control of man's environment, sources of infection; modes of transmission, diseases vectors, rural sanitation, control of animal and insects vectors of diseases, industrial hygiene, air pollution, radiological health and stream sanitation.

MCE 213W IRRIGATION, DRAINAGE AND FLOOD CONTROL
This course deals with the planning and design of structures for irrigation, flood control and drainage, reservoir storage, flood routing, urban run off, drainage, water flow and similar control structures.

MCE 214W GROUNDWATER HYDROLOGY
Infiltration and Percolation: Processes and Measurements; Groundwater Storage and the Flow of Water Hydrologic Investigations in Determining Subsurface Resource. Hydraulics of Low of Groundwater. Groundwater Exploration and Exploitation in the Philippines.

MCE 216W SURFACE HYDROLOGY
This course is concerned with the discussion of Hydrologic cycle; occurrence and analysis of components of hydrologic cycle such as precipitation, evapo- transpiration, infiltration, stream flow and ground water; river and reservoir sedimentation; flood routing techniques; probability analysis for hydrologic design; computer modeling for hydrologic systems.

MCE 221 ENGINEERING ECONOMIC ANALYSIS
This course is designed to introduce the upper level graduate students to the concepts and practices of entrepreneurial thinking. Using a combination of lectures, case studies, student led discussions, team business plans, and investor presentation formats, the course teaches life skills in entrepreneurial thought and action that

students can utilize in careers ranging from starting companies to instigating cutting edge R&D projects in large company intrepreneurial endeavors. Major course themes include: Introduction to Entrepreneurship, Idea Generation and Feasibility Analysis, and Business Planning.

MCE 221S ADVANCED DESIGN OF STEEL STRUCTURES
This course is also concerned with the design of structural steel members subjected to flexure *(beams, girders, joists, lintels, girts, etc.),* tension, and compression members *(columns),* combined stressed members *(beam-columns),* riveted, welded, and bolted connections using the *Elastic Limit Method*, also known as the Allowable Stress Design (ASD), and the *Plastic Limit Method*. The course also deals with an introduction to *the Load Resistance Factor Design Method* (LRFD) in designing structural steel. Applications and specifications as applied to buildings, bridges, and other steel structures are also given emphasis. A thorough knowledge and proficiency in Structural Theory is imperative.

MCE 222 IMAGE ANALYSIS AND REMOTE SENSING
Satellite imagery and aerial photography are vital tools for GIS developers, analysts, and users. Students will first be introduced to the concepts and methods of imaging, remote sensing, and image analysis. The main focus of this course will then be the manipulation and analysis of images within a GIS.

MCE 222W WATER RESOURCES DEVELOPMENT
This course deals with the principles and analysis of water resources systems such as multi-purpose reservoir, water supply distribution system and stormwater drainage; irrigation system and agricultural drainage system; special topics include river, flood control, drought mitigation and water resource planning management.

MCE 226 ENGINEERING AND TECHNOLOGY MANAGEMENT
Design and Technology In Society; Material Properties and Testing; Materials Processing and Process Selection

MCE 230 LAND USE PLANNING
The integration of Earth Science and Planning, Methods of Land use control, sources of geologic data; New approaches to environmental planning

MCE 230W OPEN CHANNEL HYDRAULICS
Analysis and characteristics of flow in open channels (natural and artificial); channel design considerations including uniform flow (rivers, sewers), flow measuring devices (weirs, flumes), gradually varied flow (backwater and other flow profiles, flood routing), rapidly varied flow (hydraulic jump, spillways), and channel design problems (geometric considerations, scour, channel stabilization, sediment transport)**.**

MCE 231S ADVANCED MECHANICS OF MATERIALS
Axial stress and strain; stresses for torsion and bending; combined stresses; beam deflections; indeterminate beams; and elastic instability.

MCE 222S ADVANCED FOUNDATION ENGINEERING
This course deals with the design of reinforced concrete footings such as wall footing, square isolated footing (subject to axial load, and to axial load and bending moment), rectangular footing (isolated and combined), trapezoid footing, footing on piles, and strap footing.

MCE 232S ROCK MECHANICS
This course provides basic knowledge of Rock Mechanics and helps understand the design aspects of various structures in/on rock like tunnels and other underground openings, slopes etc. The aim is to provide a comprehensive understanding of the rock engineering subject, including determination of physicomechanical properties of intact rock and rock mass, rock discontinuities, stresses and deformations around the excavation, stresses and failure mechanisms in rocks.

MCE 233S SUBSURFACE INVESTIGATION AND SOIL TESTING
This course presents the latest methods and procedures in the planning, execution, and interpretation of the various subsurface investigation methods and the development of appropriate soil and rock design and construction parameters for engineering applications. Topics include the geotechnical specialist's role in subsurface investigations; exploration methodologies; exploratory equipment types and their suitability for various subsurface conditions; the use of in-situ testing and geophysical surveys for subsurface characterization; the handling, transportation, and storage of soil and rock samples; and laboratory testing techniques and interpretation of data. Contracting for soil and rock investigations, correlation of soil and rock properties, and preparation of clear and concise geotechnical reports are also covered.

MCE 235S SOIL EROSION AND SEDIMANT TRANSPORT
Landslides and Mass movement; Principal type of mass movements; factors producing landslides and mass movement; recognition and mapping; landslides and urban development; landslide prevention or stabilization.

MCE 301 PROJECT PLANNING AND MANAGEMENT
The course deals with the principles of construction methods and equipment, management and their applications. It covers project planning, scheduling, monitoring and control. It also includes concepts on organization, safety, information systems and computer applications. Students are given opportunities to visit actual project sites and observe the application of these theories in construction projects.

MCE 303 RELIABILITY ENGINEERING
Probability overview; statistics overview; system reliability modeling and prediction-static methods; system reliability modeling and prediction-dynamic methods; maintainability and availability; reliability optimization; and risk analysis.

MCE 311 ADVANCED HYDROLOGY
Development, calibration, and application of rainfall-runoff models. Submodels available to simulate abstractions, hydrograph generation, and flow routing discussed in detail. Design storm and continuous simulation approaches described and compared.

MCE 328 ADVANCED WATER/WASTEWATER TREATMENT PROCESSES
Wastewater characteristics; stream pollution load; sewerage systems; physical and other waste water treatment methods.

MCE 329 SOLID WASTE MANAGEMENT
Composition and quantity of solid wastes generated by residential, commercial
and industrial establishments, disposal methods and management

MCE 413 RIVER AND COASTAL ENGINEERING
River and Coastal Processes; Beaches and Beach Processes; River and Coastal Erosion; Stabilization and Control of River and Coastlines. An investigation into multi-purpose river usage. Sediment erosion, transportation and deposition in rivers and reservoirs. An overview course on coastal engineering including Great Lake applications. Fundamentals of water wave motion including wave generation, propagation, and breaking.

MCE 418 HYDROGEOLOGY
Groundwater with particular emphasis given to its chemistry, mode of migration and relation to geologic environment. Theory and applications of groundwater flow; exploration for groundwater; and groundwater in igneous and metamorphic rocks, sedimentary rocks, nonindurated sediments and in region of climatic extremes.

MEP 428 ENVIRONMENTAL IMPACT ASSESSMENT
Framework and methodology of environmental impact assessment; prediction and assessment of impacts on the physical and biological environment, assessment of environmental resources in terms of their potential for utilization and corresponding impact to human activities

MCE 461 WATER QUALITY MANAGEMENT
Methods and economics of water quality control; river and estuary models for water.

MCE 467 STRATEGIC PLANNING AND MANAGEMENT IN ENGINEERING AND TECHNOLOGY
The course covers Civil Engineering Information Systems, information Engineering and Architectures, Information Strategy, Enterprise-wide Information Strategy planning, Case tools, Relational Database, Modeling and Normalization, Zachman's Framework, Object Oriented Modeling and Design, Data Warehousing and Data Mining.

MCE 468 DECISION ANALYSIS IN ENGINEERING
Overview of modeling techniques and mehtods used in decision analysis, including multiattribute utility models, decision trees, and Bayesian models. Psychological components of decision making are discussed. Elicitation techniques for model building are emphasized.

MCE 501 SPECIAL TOPIC IN CIVIL ENGINEERING
Topic or topics of current interest in the field of civil engineering. Course content subject to change each time the course is offered.

MCE 513 DESIGN OF HYDRAULIC STRUCTURES
This course deals with the analysis and hydraulic design of by systems such as reservoirs dams, spillways, gates, open channels, pipe networks, pumps and turbines; sediment transport in rivers and reservoir; computer hydraulic modeling.

MCE 610 GEOTECHNICAL EARTHQUAKE ENGINEERING
This course concerns plate tectonics and elastic rebound theory of earthquakes and faults; characterization of ground motions; seismicity; deterministic and probabilistic seismic hazard analyses; effects of local soil conditions on ground response; development of design ground motions; liquefaction; dynamic lateral earth pressures; seismic slope stability

MCE 612 ADVANCED GEOTECHNICAL ENGINEERING
The course deals with the some fundamentals of geotechnical engineering that includes compressibility of soil, shear strength of soils, triaxial tests of soils, settlement, lateral earth pressure, soil bearing capacity, slope stability, and earth retaining structures.

MCE 613 SOIL REINFORCING TECHNIQUES AND MODELING
This course involves the design techniques and applications for geotextiles, geosynthetics, geogrids, geonets, geomembranes and geocomposites as they are used in environmental, geotechnical, and other construction engineering projects. The course first studies natural slopes and embankments for their stability and seepage problems. The proceeding sessions deal with applications of geosynthetic construction materials to designs of those earth structures. In the recent years, geosynthetics became very practical and economical materials to be used in earth reinforcement, filtration, pond liner, landfill liner, and many other subsurface constructions and earth structures. The class reviews different types of available geosynthetic materials, those applications, and design techniques

MCE 614 EARTHQUAKE ENGINEERING
This course deals with the fundamentals and basic concepts of seismic design as well as the minimum standards for the analysis, design, and construction of earthquake resistive structures. The course covers the introduction to seismology and seismic analysis of buildings and structures, effects of earthquake on bearing capacity, procedure for the design of earthquake resistant structures, calculation of seismic forces, and dynamic analysis of structures. It also deals with the determination of loads of structures due to motions, methods of analysis or lateral forces, approximate dynamic analysis, time history analysis, concepts of mass, damping, stiffness of structures, design for inelastic behavior and retrofitting of existing building. Critical

building configurations and appropriate methods of analysis are also given emphasis. Applications and specifications as applied to vertical and horizontal structures are also given importance.

MCE 615 ADVANCED TRANSPORTATION ENGINEERING

Design and construction aspects of Highway Surfaces and Railways' Guideways; Capacity and Level of Service of Air, Rail, and highways. Environmental impacts and their mitigation of transportation system; Traffic-Analysis Techniques; Traffic Flow and Control.

MCE 616 TRANSPORTATION SYSTEMS AND ANALYSIS

Urban transportation planning process, design of urban transportation models including trip generation; urban transit planning and Operations; Transportation Demand Analysis; Transportation Project Evaluation

MCE 617 DESIGN AND MANAGEMENT OF TRANSPORTATION OPERATION

The course includes highway administration; traffic, driver, pedestrian and vehicle characteristics; geometric design, roadside design, highway and related structures; intersection, interchanges, terminals; drainage structures; traffic engineering

This course is intended to provide the fundamentals of highway design and operation, human factors and vehicular characteristics and how they interact with the roadway, and highway safety analysis and different statistical techniques employed in the analysis.

MCE 618 SPATIAL DATABASE MANAGEMENT

The course covers Civil Engineering Information Systems, information Engineering and Architectures, Information Strategy, Enterprise-wide Information Strategy planning, Case tools, Relational Database, Modeling and Normalization, Zachman's Framework, Object Oriented Modeling and Design, Data Warehousing and Data Mining.

MASTER OF ENGINEERING MAJOR IN COMPUTER ENGINEERING
COURSE DESCRIPTION

I. Mathematics (Required 12.0 units)

MEP 200 ADVANCED ENGINEERING MATHEMATICS I
Vector spaces, linear independence, matrices, rank and inverse of a matrix, decomposition theorems, Eigenvalues and Eigenvectors, unitary and similarity transformations on matrices, initial and boundary value problems, power series solutions. Applications to engineering problems.

MEP 201 PROBABILITY AND STATISTICS FOR ENGINEERS
Basic probability and statistics with application and examples in engineering systems, elementary probability theory, random variables and their distributions, random processes, statistical inferences, curve fitting and prediction, correlation and application to quality assurance reliability life testing.

MEP 204 NUMERICAL METHODS FOR ENGINEERS
Error analysis, solution of nonlinear equations, direct and iterative methods of solving linear systems, approximations of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. With computer machine problems.

MEP 202 ADVANCED ENGINEERING MATHEMATICS II
Boundary value problems of differential equations. Sturm-Liouville theory, singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations, spherical harmonics.

II. Foundation Courses (Required 6.0 units)

MEP 205 COMPUTER PROGRAMMING: STRUCTURED AND OBJECT-ORIENTED PROGRAMMING IN C++
Elements of computer programming, structured computer programming, abstract data type, and object-oriented programming and design in C++.

MEP 203 ENVIRONMENTAL ENGINEERING & MANAGEMENT
Pollution control laws; regulations and standards; types' sources and harmful effects of pollution, solid and liquid waste disposal and management, air pollution control

III. PROJECTS

MEP 300 SPECIAL PROBLEMS
Credit: 3 units (3 hrs lec)
Prerequisite(s): none

MEP 400 PROJECT
Credit: 3 units (3 hrs lec)
Prerequisite(s): none

IV. DISCIPLINE RELATED COURSES

Control Systems Engineering Track

MECE 211- MODERN CONTROL SYSTEMS
Organized around the concept of control systems theory. Classical control, root locus design, frequency and response design using Bode and Nyquist plots. Also covers modern control methods based on state variable models including pole placement design techniques with full-state feedback controllers and full-state observers.

MECE 212 - LINEAR SYSTEMS THEORY
Functions of matrices. State-space descriptions, canonical realizations, observability and controllability. Linear state-variable feedback, quadratic regulator theory. Asymptotic observers, direct transfer function design procedures. Synthesis of multivariable transfer functions.

MECE 213 - DIGITAL CONTROL DESIGN
Analysis and design of digital control systems. Review of z-transforms; root-locus and frequency response methods; state-space analysis and design techniques; controllability, observability, and estimation. Examination of digital control algorithms.

MECE 214 - SIGNALS AND SYSTEMS
Analysis techniques for signals and systems in both continuous and discrete time, signal representation, including Fourier and Laplace Transforms, system definitions and properties.

MECE 215 - DIGITAL SIGNAL PROCESSING I
Conventional optimization techniques, including linear programming and dynamic programming; searching techniques including steepest descent. Basic optimization techniques as applied to dynamical systems control. Popular and emerging optimal control techniques.

MECE 216 - ROBOTICS
Overview of robotics: control, AI, and computer vision. Components and structure of robots. Homogeneous transformation. Forward kinematics of robot arms. Denavit-Hartenberg representation. Inverse kinematics. Velocity kinematics. Manipulator Jacobian. Singular configurations. EulerLagrange equations. Dynamic equations of motion of manipulators. Task planning, path planning, and trajectory planning in the motion control problem of robots.

MECE 217 - ADVANCED FEEDBACK SYSTEMS
Systems employing electronic, magnetic, hydraulic, pneumatic & mechanical devices. Analysis& design. Transducers.

Computer and Communications Engineering Track

MECE 212 - LINEAR SYSTEMS THEORY
Functions of matrices. State-space descriptions, canonical realizations, observability and controllability. Linear state-variable feedback, quadratic regulator theory. Asymptotic observers, direct transfer function design procedures. Synthesis of multivariable transfer functions.

MECE 214 - SIGNALS AND SYSTEMS
Analysis techniques for signals and systems in both continuous and discrete time, signal representation, including Fourier and Laplace Transforms, system definitions and properties.

MECE 215 - DIGITAL SIGNAL PROCESSING I
Conventional optimization techniques, including linear programming and dynamic programming; searching techniques including steepest descent. Basic optimization techniques as applied to dynamical systems control. Popular and emerging optimal control techniques.

MECE 218 – MOBILE COMPUTING
Mobile computing systems; data management; packet transmission; mobile IP; routing protocols; reliability and issues in mobile wireless networks.

MECE 219 - DIGITAL COMMUNICATIONS
Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal band width requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication system is discussed.

MECE 220 – DATA COMMUNICATIONS NETWORK I
Principles of data communications. Design issues and protocols in the layers of data network. Networks for various applications.

V. ELECTIVES:

MEE 221 - POWER SYSTEM OPERATION & CONTROLS
Synchronous machines and their control systems. Excitation and speed governing systems. Prime movers. Load-frequency control. System voltage control.

MEE 222 - RENEWABLE ENERGY
Overview of renewable energy resources with emphasis on solar, wind, and geothermal technologies. Renewable energy systems and their underlying physical and technological principles, economics, and environmental impact. How these technologies can be integrated into an overall system.

MEE 223 – SPECIAL TOPICS IN ELECTRICAL ENGINEERING
Special topics in Electrical Engineering. Can be any area in Electrical Engineering not included in the listed courses for the program.

MEE 224 - POWER SYSTEM ECONOMICS
Economics of energy generation and operation. Optimization methods. Mixed- generation dispatch. Optimal load flow. Recent developments.

MEE 225 – POWER SYSTEM RELIABILITY
Basic concepts. Measures and models. Reliability of generation, transmission, distribution and composite systems.

MECE 221- DIGITAL IMAGE PROCESSING
Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis, 2-D signals and systems; sampling and scanning; random fields; discrete cosine transform; discrete Karhunen-Loeve transform; grayscale transformations; linear, ranked order, and morphological filters; human vision, printing, and display of images, entropy-based compression; vector quantization; block truncation coding; transform coding; predictive coding; image degradation models; Wiener filter; constrained deconvolution, computed tomography; edge detection; shape representation; and segmentation.

MECE 222 - COMPUTER ARCHITECTURE
An introduction to the problems involved in designing and analyzing current machine architectures. Included are stack, SIMD, and MIMD machines, and the use of overlap, pipeline, parallel, and associative processing. Advanced I/O systems and memory organizations are examined. Evaluation methods for the performance of computer systems to enable the architect to determine the relation between a computer design and the design goals are explored. Some programming experience is assumed.

MECE 223 - CODING AND INFORMATION THEORY
Basic concepts of information theory--entropy, mutual information, channel capacity, information rate, Shannon's noiseless coding theorem and Shannon's fundamental coding theorem; Modeling of information sources--zero-memory and Markov models; Modeling of information channels; Construction of compact source codes--Kraft inequality, compact codes, Huffman and LZW compression codes; and analysis and design of error-control channel codes.

MECE 224 - DATA COMMUNICATIONS NETWORK II
Mathematical analysis of communication networks. Queuing theory and its applications, including M/M/1 systems, M/G/1 systems, Burke's theorem, and Jackson's theorem. Multiaccess communication. Network routing and optimal routing.

MECE 225 - DIGITAL SIGNAL PROCESSING II
Continuation of Digital Signal Processing I. Discrete Fourier transform. Digital filter design techniques. Fast Fourier transform. Quantization effects. Estimation.

MECE 226 - OPERATING SYSTEMS ENGINEERING
The design and construction of modern operating systems. Basic process concepts in multiprogrammed computer systems including concurrency, scheduling, resource sharing, synchronization, deadlock, mutual exclusion and protection. The engineering of operating systems involving detailed examination and modification of an existing operating system, Unix. Presentation of analytic modeling and performance evaluation techniques. Case studies of existing operating systems.

MECE 227 - MOBILE ROBOTICS
Introduction to Mobile Robotics and their applications, forward and inverse kinematics, vision and different sensor systems, applications of AI in Robotics and project.

MECE 228 - DESIGN WITH MICROCONTROLLERS
Design of controllers that incorporate microcontrollers as an embedded component in a larger system. Topics to be studied will include architecture, software, programming and interfaces.

MASTER OF ENGINEERING MAJOR IN ELECTRICAL ENGINEERING
COURSE DESCRIPTION

I. Mathematics (Required 12.0 units)

MEP 200 ADVANCED ENGINEERING MATHEMATICS I
Vector spaces, linear independence, matrices, rank and inverse of a matrix, decomposition theorems, Eigenvalues and Eigenvectors, unitary and similarity transformations on matrices, initial and boundary value problems, power series solutions. Applications to engineering problems.

MEP 201 PROBABILITY AND STATISTICS FOR ENGINEERS
Basic probability and statistics with application and examples in engineering systems, elementary probability theory, random variables and their distributions, random processes, statistical inferences, curve fitting and prediction, correlation and application to quality assurance reliability life testing.

MEP 204 NUMERICAL METHODS FOR ENGINEERS
Error analysis, solution of nonlinear equations, direct and iterative methods of solving linear systems, approximations of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. With computer machine problems.

MEP 202 ADVANCED ENGINEERING MATHEMATICS II
Boundary value problems of differential equations. Sturm-Liouville theory, singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations, spherical harmonics.

II. Foundation Courses (Required 6.0 units)

MEP 205 COMPUTER PROGRAMMING: STRUCTURED AND OBJECT-ORIENTED PROGRAMMING IN C++
Elements of computer programming, structured computer programming, abstract data type, and object-oriented programming and design in C++.

MEP 203 ENVIRONMENTAL ENGINEERING & MANAGEMENT
Pollution control laws; regulations and standards; types' sources and harmful effects of pollution, solid and liquid waste disposal and management, air pollution control

III. PROJECTS

MEP 300 SPECIAL PROBLEMS
Credit: 3 units (3 hrs lec)
Prerequisite(s): none

MEP 400 PROJECT
Credit: 3 units (3 hrs lec)
Prerequisite(s): none

IV. DISCIPLINE RELATED COURSES

Control Systems Engineering Track

MECE 211- MODERN CONTROL SYSTEMS
Organized around the concept of control systems theory. Classical control, root locus design, frequency and response design using Bode and Nyquist plots. Also covers modern control methods based on state variable models including pole placement design techniques with full-state feedback controllers and full-state observers.

MECE 212 - LINEAR SYSTEMS THEORY
Functions of matrices. State-space descriptions, canonical realizations, observability and controllability. Linear state-variable feedback, quadratic regulator theory. Asymptotic observers, direct transfer function design procedures. Synthesis of multivariable transfer functions.

MECE 213 - DIGITAL CONTROL DESIGN
Analysis and design of digital control systems. Review of z-transforms; root-locus and frequency response methods; state-space analysis and design techniques; controllability, observability, and estimation. Examination of digital control algorithms.

MECE 214 - SIGNALS AND SYSTEMS
Analysis techniques for signals and systems in both continuous and discrete time, signal representation, including Fourier and Laplace Transforms, system definitions and properties.

MECE 215 - DIGITAL SIGNAL PROCESSING I
Conventional optimization techniques, including linear programming and dynamic programming; searching techniques including steepest descent. Basic optimization techniques as applied to dynamical systems control. Popular and emerging optimal control techniques.

MECE 216 - ROBOTICS
Overview of robotics: control, AI, and computer vision. Components and structure of robots. Homogeneous transformation. Forward kinematics of robot arms. Denavit-Hartenberg representation. Inverse kinematics. Velocity kinematics. Manipulator Jacobian. Singular configurations. EulerLagrange equations. Dynamic equations of motion of manipulators. Task planning, path planning, and trajectory planning in the motion control problem of robots.

MECE 217 - ADVANCED FEEDBACK SYSTEMS
Systems employing electronic, magnetic, hydraulic, pneumatic & mechanical devices. Analysis& design. Transducers.

Energy Management Track

MEE 212 – ENERGY MANAGEMENT IN BUILDINGS
Energy consumption issues and methods of assessing energy performance in buildings. Energy auditing, and current energy conservation techniques. Management and control of electrical power delivered via the grid. Active energy systems and their fundamentals: lighting, air conditioning, hot water, ventilation, vertical transportation, and machinery.

MEE 213 – ENERGY EFFICIENCY AND CONSERVATION
Energy efficiency and conservation methods. Analysis of energy-consuming facilities, both domestic and commercial, for energy efficiency opportunities. Energy savings and environmental impacts for most energy efficiency methods. Energy monitoring and measuring equipment commonly used by energy specialists and energy auditors.

MEE 214 – DEMAND SIDE MANAGEMENT
The traditional monopoly model of regulation and evolving competitive alternatives. Energy resource planning, pollution management, rate design, green markets, energy efficiency, demand side management, renewable energy portfolios, climate change, and carbon management. Introduction to practice issues in the field.

MEE 215 – ELECTRICITY ECONOMICS AND PLANNING
Planning in the electricity sector and the hierarchy of electricity planning models, economic operation of power system, economics of power system reliability, conventional and modern system planning models, electricity pricing theory and approaches, buyback rates of independently produced power, demand-side management, electricity deregulation issues and approaches.

V. ELECTIVES:

MEE 221 - POWER SYSTEM OPERATION & CONTROLS
Synchronous machines and their control systems. Excitation and speed governing systems. Prime movers. Load-frequency control. System voltage control.

MEE 222 - RENEWABLE ENERGY
Overview of renewable energy resources with emphasis on solar, wind, and geothermal technologies. Renewable energy systems and their underlying physical and technological principles, economics, and environmental impact. How these technologies can be integrated into an overall system.

MEE 223 – SPECIAL TOPICS IN ELECTRICAL ENGINEERING
Special topics in Electrical Engineering. Can be any area in Electrical Engineering not included in the listed courses for the program.

MEE 224 - POWER SYSTEM ECONOMICS
Economics of energy generation and operation. Optimization methods. Mixed- generation dispatch. Optimal load flow. Recent developments.

MEE 225 – POWER SYSTEM RELIABILITY
Basic concepts. Measures and models. Reliability of generation, transmission, distribution and composite systems.

MECE 221- DIGITAL IMAGE PROCESSING
Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis, 2-D signals and systems; sampling and scanning; random fields; discrete cosine transform; discrete Karhunen-Loeve transform; grayscale transformations; linear, ranked order, and morphological filters; human vision, printing, and display of images, entropy-based compression; vector quantization; block truncation coding; transform coding; predictive coding; image degradation models; Wiener filter; constrained deconvolution, computed tomography; edge detection; shape representation; and segmentation.

MECE 222 - COMPUTER ARCHITECTURE
An introduction to the problems involved in designing and analyzing current machine architectures. Included are stack, SIMD, and MIMD machines, and the use of overlap, pipeline, parallel, and associative processing. Advanced I/O systems and memory organizations are examined. Evaluation methods for the performance of computer systems to enable the architect to determine the relation between a computer design and the design goals are explored. Some programming experience is assumed.

MECE 223 - CODING AND INFORMATION THEORY
Basic concepts of information theory--entropy, mutual information, channel capacity, information rate, Shannon's noiseless coding theorem and Shannon's fundamental coding theorem; Modeling of information sources--zero-memory and Markov models; Modeling of information channels; Construction of compact source codes--Kraft inequality, compact codes, Huffman and LZW compression codes; and analysis and design of error-control channel codes.

MECE 224 - DATA COMMUNICATIONS NETWORK II

Mathematical analysis of communication networks. Queuing theory and its applications, including M/M/1 systems, M/G/1 systems, Burke's theorem, and Jackson's theorem. Multiaccess communication. Network routing and optimal routing.

MECE 225 - DIGITAL SIGNAL PROCESSING II
Continuation of Digital Signal Processing I. Discrete Fourier transform. Digital filter design techniques. Fast Fourier transform. Quantization effects. Estimation.

MECE 226 - OPERATING SYSTEMS ENGINEERING
The design and construction of modern operating systems. Basic process concepts in multiprogrammed computer systems including concurrency, scheduling, resource sharing, synchronization, deadlock, mutual exclusion and protection. The engineering of operating systems involving detailed examination and modification of an existing operating system, Unix. Presentation of analytic modeling and performance evaluation techniques. Case studies of existing operating systems.

MECE 227 - MOBILE ROBOTICS
Introduction to Mobile Robotics and their applications, forward and inverse kinematics, vision and different sensor systems, applications of AI in Robotics and project.

MECE 228 - DESIGN WITH MICROCONTROLLERS
Design of controllers that incorporate microcontrollers as an embedded component in a larger system. Topics to be studied will include architecture, software, programming and interfaces.

MASTER OF ENGINEERING MAJOR IN MECHANICAL ENGINEERING
COURSE DESCRIPTION

I. Mathematics (Required 12.0 units)

MEP 200 ADVANCED ENGINEERING MATHEMATICS I
Vector spaces, linear independence, matrices, rank and inverse of a matrix, decomposition theorems, Eigenvalues and Eigenvectors, unitary and similarity transformations on matrices, initial and boundary value problems, power series solutions. Applications to engineering problems.

MEP 201 PROBABILITY AND STATISTICS FOR ENGINEERS
Basic probability and statistics with application and examples in engineering systems, elementary probability theory, random variables and their distributions, random processes, statistical inferences, curve fitting and prediction, correlation and application to quality assurance reliability life testing.

MEP 204 NUMERICAL METHODS FOR ENGINEERS
Error analysis, solution of nonlinear equations, direct and iterative methods of solving linear systems, approximations of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. With computer machine problems.

MEP 202 ADVANCED ENGINEERING MATHEMATICS II
Boundary value problems of differential equations. Sturm-Liouville theory, singular boundary conditions, orthogonal expansions, separation of variables in partial differential equations, spherical harmonics.

II. Foundation Courses (Required 6.0 units)

MEP 205 COMPUTER PROGRAMMING: STRUCTURED AND OBJECT-ORIENTED PROGRAMMING IN C++
Elements of computer programming, structured computer programming, abstract data type, and object-oriented programming and design in C++.

MEP 203 ENVIRONMENTAL ENGINEERING & MANAGEMENT
Pollution control laws; regulations and standards; types' sources and harmful effects of pollution, solid and liquid waste disposal and management, air pollution control

III. CORE COURSES (Required 15.0 units)

MME 211 ADVANCED ENGINEERING THERMODYNAMICS
An extended treatment of the fundamentals of classical thermodynamics, including availability and reversibility, the chemical potential, properties of matter, thermochemistry, chemical equilibrium of real gases and gas mixtures.

MME 212 ADVANCED MATERIAL SCIENCE AND ENGINEERING
Crystal binding and structure; energetics and structure of lattice defects; elasticity, plasticity, and fracture; phase equilibria and transformations; relations of structure and treatment to properties; structures of inorganic and organic polymers; and electronic and magnetic properties; study of the micromechanical and

thermomechanical response of composite materials. Execution and assessment of experiments conducted to investigate strength and stiffness characteristics of composite materials.

MME 213 ADVANCED VIBRATIONS
Response of single and two-degrees-of-freedom systems to initial, periodic, nonperiodic excitations. Reviewing the elements of analytical dynamics, including the principle of virtual work, the Hamilton's principle and Lagrange's equations. Response of multidegree-of-freedom systems. Modeling and dynamic response of discrete vibrating elastic bodies. Analytical techniques for solving dynamic and vibration problems.

MME 214 COMBUSTION ENGINEERING
Physical and chemical aspects of basic combustion phenomena. Classification of flames. Measurement of laminar flame speeds. Factors influencing burning velocity. Theory of flame propagation. Flammability, chemical aspects, chemical equilibrium, chain reactions. Calculation and measurement of flame temperature. Diffusion flames. Fuels-atomization and evaporation of liquid fuels. Theories of ignition, stability, and combustion efficiency. Theory of combustion processes. Reaction kinetics, flame propagation theories. Emphasis on factors influencing pollution

MME 215 ADVANCED CONDUCTION HEAT TRANSFER
Steady and transient heat conduction. Stationary and moving sources. Numerical and graphical methods. Porous systems.

MME 216 ADVANCED MECHANICS OF SOLIDS
Introduction to Cartesian tensor. Basic principles of continuum mechanics; concepts of deformation, motion, stress, and strain; conservation of mass, balance of momenta, continuum thermodynamics, and constitutive equations. Illustrative applications in elasticity, fluid dynamics, and viscoelasticity.

MME 217 MECHATRONICS
Theory of operation, analysis, and implementation of fundamental physical and electrical device components: basic circuit elements, transistors, op-amps, sensors, electromechanical actuators. Application to the development of simple devices.

MME 218 ADVANCED RADIATION HEAT TRANSFER
Introduction to concepts of quantum mechanics, black body behavior, and radiant heat exchange between bodies Treatment of gaseous radiation in enclosures. Solutions of transfer equation in various limits and for different molecular radiation models. Gray and nongray applications. Mathematical techniques of solutions.

MME 219 ADVANCED CONVECTION HEAT TRANSFER
Mechanism of fluid flow, energy relationship of flowing fluid. Convection heat transfer. Momentum, heat and mass transfer analogies. Boiling and condensing heat transfer.

IV. ELECTIVES (Required 9.0 units)

MME 230 THERMAL ENVIRONMENTAL ENGINEERING
Power system thermodynamics. Power plant cycles; processes; and components, combustion equipment, heat exchangers, turbines, and pumps. Water supply and treatment systems. Air circulating and heating systems. Operation, efficiency and energy balance calculations of power stations. Economics and management of power production. Environmental impacts of thermal plants.

MME 231 ADVANCED MECHANICAL DESIGN
The course includes a broad range of mechanical engineering topics including mechanical engineering design. It provides students with a knowledge and understanding of advanced aspects of mechanical engineering combined with numerical analysis, reliability and management.

MME 233 INSTRUMENTATION AND CONTROL
Laplace transforms, block diagrams, modeling of control system components and kinematics and dynamics of control systems, and compensation. Frequency domain techniques, such as root-locus, gain-phase, Nyquist and Nichols diagrams used to analyze control systems applications.

MME 234 DESIGN AND OPTIMIZATION OF THERMAL SYSTEMS
Design, analysis and optimization of thermal systems. Systems analysis applied to heat exchanger, power conversion, air conditioning, refrigeration, and heat recovery systems. Economics, equation fitting, and thermal property evaluation are integrated into the simulation and optimization of thermal system designs.

MME 235 ROBOTICS AND AUTOMATION
This program will cover all the possibilities offered by robotics and automation, from the most current industrial robots that have to be pre-programmed in their task execution, to the intelligent robots that can be characterized by the ability to autonomously plan and execute motion sequences and to achieve a goal specified by a human user without detailed instructions. The program will also examine the different computational and technological architectures proposed for the implementation and evolution of robotic behavior.

MME 236/MEP 214 FINITE ELEMENT ANALYSIS
After the concepts of finite elements methods are presented, formulation for different engineering problems and their applications are studied. Topics include variational methods. The finite element concept, and applications in stress analysis, dynamics, fluid mechanics, and heat transfer.

MME 237 ADVANCED FRACTURE MECHANICS AND FATIGUE
Fracture mechanics evaluation of structures containing defects. Theoretical development of stress intensity factors. Fracture toughness testing. Relationships among stress, flaw size, and material toughness. Emphasis on design applications with examples from aerospace, nuclear, and structural components.

MME 239 THERMAL ENGINEERING
Characteristics of gaseous, liquid and solid fuels. Local materials. Efficient burning of fuels in furnaces, kilns, gas producers, engine and other heat engine. Performance calculations. Treatment of fuel to improve its suitability for a given heat equipment.

MME 243 ADVANCED ENERGY MANAGEMENT
The course emphasizes both field and analytical techniques for accessing energy use in buildings and industrial applications. The course suggests many methods of conserving energy, including low/no cost operational and maintenance procedures as well as more capital intensive energy conservation measures. Methods of applying these measures as well as estimating the cost and energy savings associated with each measure are covered. Life cycle costing principles are presented as a method for determining the cost effectiveness of selected energy conservation measures.

MME 244 RENEWABLE ENERGY SOURCES
National and global resources and consumption. Future requirements of energy and the role of renewable sources of energy. Environmental and ecological impacts of the present and assumed future uses of energy.

Renewable energy sources and technologies. Solar for thermal applications for heating, cooking, drying, refrigeration and power generation. Photovoltaic application for rural power.

Wind energy: wind mapping and selection of location, wind power generation systems, power plant design, operation, maintenance and economic.

Biomass: agricultural waste and other sources. Energy through fermentation, pyrolysis, gasification and combustion. Aerobic and anaerobic bioconversion. Liquid fuels from organic wastes. OTEC, wave, tidal and geothermal energy. Scope fed, availability, system development, economic and limitations.

MEP 330 FLUIDS ENGINEERING (COMPUTATIONAL FLUID DYNAMICS)
Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solutions of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Graphical methods for problem solving. Emphasis is placed on development and use of graphical tools for various display devices.

MEP 214 INDUSTRIAL POLLUTION CONTROL
This course covers the general activities and processes used in industry, the ways in which wastes are produced, pollution control and waste minimization. It also deals with hazardous waste disposal and problems of occupational health. It aims to look at the types of process that take place in industry and review the types of emission that can occur. Two approaches will then be taken to controlling these. Firstly, the use of control technologies to remove pollutants from the waste stream (end of pipe technologies) and secondly, to see how the processes themselves may be controlled and made more efficient so as to minimize waste pollution.

MEP 331 BIOMASS ENERGY CONVERSION SYSTEMS
The course is focused on using biomass as fuel. Primary emphasis is combustion of wood waste and agricultural feedstocks in boilers and furnaces to produce steam or hot oil, or hot gas for dryers. The knowledge gained in the course will allow attendees to evaluate system economics, procure hardware, and avoid mistakes in specification and operation. Part of the value of this course in the practical experience of the presenter and his knowledge of what works best for a particular application. Case studies are used for illustration purposes, with many photos used of actual industrial equipment and projects.