

Master of Engineering in Mechanical Engineering

The Kate Gleason College of Engineering
Rochester Institute of Technology, New York, USA

PROGRAM OVERVIEW

The graduate degree in mechanical engineering combines theoretical fundamentals as well as practical aspects in this dynamic field, and educates students in the practices, methodologies, and techniques in the design of modern mechanical systems. The focus of this program is on alternative energy systems and control. Students will earn the same degree and be taught by the same faculty as if they enrolled in the master's degree program being taught on the RIT campus in Rochester, New York.

CURRICULUM AND PROGRAM SCHEDULE

The master of engineering degree in mechanical engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 48 credit hours. Each student is required to complete a graduate paper.

RIT faculty will offer the program entirely in Dubai. Students will be able to complete a master's degree in 18 months through a combination of traditional classroom lectures, lab experiences, online learning, and short courses. Class schedules will cater to working professionals, and classes will be offered in the evening and on weekends. Students will have the option of taking the summer quarter in the RIT campus in Rochester, New York.

ADMISSION REQUIREMENTS

Admission to the master's degree program in

mechanical engineering requires a bachelor's degree from an accredited mechanical engineering program.

Prerequisites for admission include a baccalaureate degree from an accredited college or university with an acceptable equivalent grade point average (GPA). In addition, all applicants are required to meet the English language requirement for graduate study at RIT by submitting either a TOEFL or IELTS score.

SAMPLE SCHEDULE

Fall Quarter (August – November)
Accounting for Decision Makers++
Stat. Analysis for Decision Makers++
Mathematics for Engineers I
Random Signals & Noise ##
Winter Quarter (November – February)
Economics for Managers++
Mathematics for Engineers II
Computer Implementation FEM
Spring Quarter (March – May)
Organizational Behavior & Leadership++
Numerical Analysis
Systems Modeling
Summer Quarter Rochester Campus (June – August)
Control Systems** ##
Refrigeration and Air Conditioning**
Fall Quarter (August – November)
Renewable Energy Systems
(Simulcast)**
Graduate Paper
Winter Quarter (November – February)
Global Business Environments++

CONCENTRATION OPTIONS

++ Business Concentration (Two required and two elective courses)

(Req'd) Accounting for Decision Makers
(Req'd) Org. Behavior and Leadership
(Elec) Financial Analysis for Managers
(Elec) Stat. Anal. for Decision Makers
(Elec) Economics for Managers
(Elec) Global Business Environments
(Elec) Financial Management II

Systems and Controls Concentration

Control Systems

Intermediate Control Systems
Advanced Control Systems
Random Signals and Noise

** Sustainable Energy Engineering Concentration (Select four)

Control Systems
Fuel Cell Technology
Renewable Energy Systems
Sustainable Energy Management

COURSE DESCRIPTIONS

Mathematics for Engineers I

A concise introduction to the concepts of matrix and linear algebra, including determinants, eigenvalues, systems of linear equations, vector spaces, linear transformations, diagonalization, orthogonal subspaces, and the Gram-Schmidt orthonormalizing procedures. The use of complex exponentials in differential equations is introduced. Fourier series, Laplace and Fourier transforms also are presented.

Mathematics for Engineers II

Topics covered are orthogonal functions including Fourier series, Fourier Integrals, Bessel functions, Legendre Polynomials, Sturm-Liouville problems, and eigenfunction expansions; an introduction to calculus of variation including problems with constraints; vector analysis including the directional derivative, the gradient, Green's Theorem, the Divergence Theorem and Stokes' Theorem; Laplace transform methods.

Numerical Analysis

This course emphasizes the development and implementation of methods available to solve engineering problems numerically. Specific topics include root finding for algebraic and transcendental equations, systems of linear and non-linear equations, interpolation of numerical data and curve fitting, numerical differentiation and integration, ordinary and partial differential equations, including initial and boundary value problems.

Systems Modeling

This course is designed to introduce the



Mechanical Engineering Degrees are Accredited by ABET

student to state-space modeling techniques and response characterization. Both lumped and distributed parameter systems will be considered. Bond-graph theory will be used extensively. System performance will be assessed through numerical solution using MATLAB/Simulink. Traditional closed form solution methods utilizing Laplace and Fourier transforms and transfer functions also are discussed.

Computer Implementation of FEM

This course emphasizes the application of the finite element method to problems in the area of static and dynamic structural analysis, heat transfer, and analogous solution. A standard commercial software package is used for these applications where the general structure, operating characteristics, and use of a complex program are presented. Topics include the finite element method; shape factors, element formulation, and the element library; program sequencing; general modeling methods (loads, constraints, material factors, mesh generation, interactive graphics, model conditioning); convergence, error analysis and the "patch" test, vibration and heat transfer analysis, and analogous analysis such as acoustics, illumination.

Fuel Cell Technology

Fuel cell technology is an emerging technology for electric power on demand, and can be used for stationary power generation or for driving vehicles. Fuel cell, the heart of this technology, is an electrochemical device that produces electricity via cell reactions from useful chemical energy stored in fuel. After learning fuel cell basics and operating principles, fuel cell performance will be considered from energy and thermodynamic viewpoints. Types discussed are polymer electrolyte membrane fuel cell (PEMFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC), and solid oxide fuel cell (SOFC). Modelling of one fuel cell type will demonstrate design and analysis of systems and the information and components needed to make the system successful. Also discussed: thermal system design and analysis issues, limitations, cost effectiveness, and efficiency.

Renewable Energy Systems

This course provides an overview of renewable energy system design. Energy resource assessment, system components, and feasibility analysis will be covered. Possible topics to be covered include photovoltaics, wind

turbines, solar thermal, and hydropower. Students will be responsible for a final design project.

Sustainable Energy Management

This course, Sustainable Energy Management and the Built Environment, provides an overview of mechanical and associated control systems within buildings with an emphasis on sub-systems that possess the most visible energy signature in terms of energy usage, energy inefficiency, and societal/global impact. Fundamentals of system operation are explored as well as energy management techniques. Using domestic and international case studies that highlight energy management within the built environment, students will explore methods by which engineers have achieved solutions aligned with sustainability.

Refrigeration and Air Conditioning

This is a basic course in the principles and applications of refrigeration and air conditioning involving mechanical vapor compression and absorption refrigeration cycles, associated hardware, psychometrics, heat transmission in buildings, and thermodynamic design of air conditioning systems. Students are expected to do a design project.

Control Systems

This course introduces the student to the study of linear control systems, their physical behavior, design, and use in augmenting engineering system performance. Topics include control system behavior characterization in time and frequency domains, stability, error, and design. This is accomplished through classical methods that employ the use of Laplace transforms, block diagrams, feedback control, root locus, and Bode diagrams. Several laboratory assignments will provide students with significant "hands-on" experience.

Intermediate Control Systems

Characterization of discrete-time systems; analysis of discrete-control systems by time-domain and transform techniques; discrete-state variable techniques; synthesis of discrete systems; engineering consideration of computer-controlled systems.

Advanced Control Systems

Introduction to advanced control systems, including elements of continuous, digital, and nonlinear control systems theory. Topics include continuous to digital control conversion using finite difference solutions;

continuous to digital control conversions using state equation approach; stability of discrete systems; PID control design for digital systems; frequency domain control system design methods (PID, lead, lag, lead-lag compensation design) for continuous systems, and for digital systems using phase loss methods and bilinear transformations; z-transforms for discrete systems; digital control system design using root locus; deadbeat control design; nonlinear control design using feedback linearization; sliding control method; adaptive control methods; and time permitting eigen-structure assignment methods; fuzzy-logic; neural-net; and introduction to H-infinity control.

Graduate Paper

This course is used by students in the master of engineering degree program for conducting an independent project. The student must demonstrate an acquired competence in an appropriate topic within mechanical engineering. The topic is chosen in conference with a faculty adviser. The work may involve an independent research and/or a design project and/or literature search with a demonstration of acquired skill. A written paper, approved by the advisor and the department, and an oral presentation of the work are required.

APPLICATION & ADMISSION

RIT Dubai
Dubai Silicon Oasis
P.O. 341055
Dubai
United Arab Emirates
Tel: +971 4 501 5566
Fax: +971 4 372 4285
Email: dubai@rit.edu
Web: www.dubai.rit.edu