College of Engineering

Catalog

His Majesty Sultan Qaboos Bin Said

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A Message from the Dean

The college of engineering at Sultan Qaboos University was established in 1986 and has celebrated its Silver Jubilee in 2011. Currently with more than 5,500 engineering alumni, the college of engineering has played a very important role in the human resources development of the Sultanate of Oman.

Thanks to its strong academic programs and dedicated staff and faculty, our students are receiving an outstanding educational opportunity to be prepared to successfully enter the Engineering Profession. The College is committed to maintaining and continuously improving its academic programs. Four programs have been accredited by ABET Inc. in 2007 and four others recognized as substantial equivalent programs in 2006. However, all the eight undergraduate programs offered by the College have been accredited by ABET Inc. in 2012 and the college will undergo a general review for the third time in November 2019.

Through its academic programs, scholarly activities and community outreach, the college is doing its best to respond to the different needs of Industry and all its different constituents. There are currently four departments in the College of Engineering, Civil and Architecture; Electrical and Computer; Mechanical and Industrial, and Petroleum and Chemical Engineering. The four departments offer eight Bachelor of Engineering programs, eleven Master of Science programs and six PhD programs.

I am very pleased to introduce our third course catalog, which contains brief information on the college and the academic undergraduate programs offered in the departments that includes description of the courses. I would like to thank the University Administration for its relentless support to the College and to the College Accreditation, Publication and Web Committees for their efforts in preparing this informative catalog.

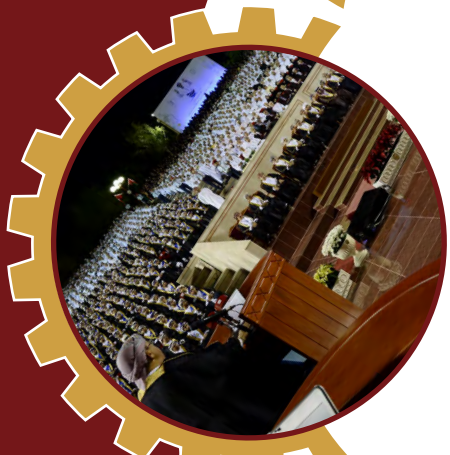
For all of you, I hope that you find reading this catalog useful and remember we are here to support you.

Prof. Hadj Bourdoucen

Dean College of Engineering


كلية الهندسة

College of Engineering



كلية الهندسة

COLLEGE OF ENGINEERING

Introduction

The College of Engineering(CoE) at Sultan Qaboos University started its academic programs in 1986 when Sultan Qaboos University accepted its first batch of students. It serves to provide an engineering education to the Omani youth that will enable them to participate in the development of Oman. The College has steadily increased its new student admission. The number of students admitted in the first batch in 1986 was 86 students, while about 448 students were admitted in 2017 with 20% females. The student population in the College is now near 3223 students in undergraduate programs and around 255 in Postgraduate programs.

The college has always strived to ensure and maintain quality engineering education. This started with inviting 'External Examiners' for every program offered by the college. This yearly critical review by 'External Examiners' has helped the college to maintain its standard.

The programs in the college underwent successful ABET accreditation starting in 2006, and all of our eight programs are currently ABET accredited. ABET accreditation is a significant achievement that requires comprehensive, periodic evaluations. ABET accreditation demonstrates our continuing commitment to the quality of our programs. This achievement made possible via continuous effort of our faculty, administration, students and Industrial advisory boards. The establishment of the Quality Assurance & Accreditation Unit will serve to enhance our effort as a college to maintain quality engineering education

Vision

To continue its leading role in engineering education, research and innovation, and community service in the region and beyond.

Mission

To excel in engineering education, research and innovation, and community service through creative thinking, promoting the principles of engineering analysis and design, and knowledge sharing with national and international communities.

Objectives

- To prepare highly qualified engineers who are capable of assuming professional careers and pursuing graduate studies.
- To conduct scientific research to expand knowledge in the scientific and engineering fields, and to find engineering solutions to problems faced by society.
- To provide continuing education and to disseminate engineering knowledge through conferences, short courses, workshops, consultation and seminars.
- To promote regional and international cooperation with reputable universities throughout the world.

Departments and Academic Programs

The College of Engineering has the following four Departments:

- Civil and Architectural Engineering
- Electrical and Computer Engineering
- Mechanical and Industrial Engineering
- Petroleum and Chemical Engineering

Successful students are awarded one of the following Bachelor of Engineering degrees on completion of study.

- Civil Engineering
- Architectural Engineering
- Electrical & Computer Engineering in the following specializations:

  Communications and Signal Processing (CSP)

  Computer Systems and Networks (CSN)

  Electronic Instrumentation and Control (EIC)

  Power Systems and Energy (PSE)
- Mechanical Engineering
- Industrial Engineering
- Petroleum & Natural Gas Engineering
- Chemical & Process Engineering
- Mechatronics Engineering

College of Engineering

The College offers Master programs in a number of specializations:

- Civil Engineering
- Civil Engineering (Water Resources)
- Civil Engineering (Environmental Engineering)
- Architectural Engineering
- Electrical & Computer Engineering in the following specializations:

  Power Systems & Energy

  Electronic Instrumentation & Control

  Communication & Signal Processing

  Computer System & Networks
- Mechanical Engineering
- Industrial Engineering
- Petroleum & Natural Gas Engineering
- Geomatics Engineering
- Chemical and Process Engineering

The College of Engineering offers doctoral programs in six disciplines:

- Civil Engineering
- Electrical and Computer Engineering
- Mechanical Engineering
- Industrial Engineering
- Petroleum Engineering
- Chemical and Process Engineering

Foundation Program

The Foundation Program started in 2010 with the main goals of:

- Improving English language proficiency of newly admitted undergraduate students, with some emphasis on technical and business applications in preparation for their undergraduate courses.

- Reinforcing the knowledge of basic mathematical and analytical techniques that is considered obligatory for enhancing undergraduate students problem solving skills.
- Consolidating the knowledge of basic applications of computer science as means for effective learning and interaction.
- Integrating the necessary study skills needed to effectively adopt, learn and thrive through the years of study.

All students admitted to the University are required to sit during the orientation period for the placement tests in English language, Mathematics and Information Technology, which evaluate their efficiency in the basics of these areas. Successful students will then sit for the exit tests. Students, who pass the exit test, are considered to have satisfied the Foundation Program requirement in that area.

The Foundation Program consists of courses in English language, Mathematics and Information Technology. The learning outcomes of the Study Skills are integrated within the courses of the three areas. The program courses have been designed according to Oman Academic Standards that were published by the Omani Authority for Academic Accreditation in the form of learning outcomes for English, Mathematics, and Information Technology. A student may fulfill the Foundation Program requirements by presenting an equivalent qualification, passing the exit test, or attending the foundation program courses and passing them.

For more information about the foundation program please visit SQU website at www.squ.edu.om/fp/

Total Credits required

The total number of credit hours required for a bachelor degree in engineering is 136 credit hours, except for the architectural engineering program, which is 156 credit hours. These hours consist of University Requirements (12 credits) and College Requirements (35 credits); that are common to all Departments and Department requirements (89 credits or 109 credits in the architectural engineering program) that are specific for each Department. Given normal scheduling patterns, the program can be completed within 5 years including the foundation year.

University Requirements (12 Credits)

Code	Title	Credits
ARAB1001	Arabic	3
HIST1010 Or ISLM1010	Oman & Islamic Civilization Islamic Culture	2
SOCY1001	Omani Contemporary Society	1
	General University Electives	6

College Requirements (35 Credits)

A total of 35 credit hours are required for all students in the College which must be successfully completed by all students as part of all degree plans for their College.

Code	Title	Credits
ENGR1501	Introduction to Engineering	1
ENGR1600	Workshop I	1
ENGR3006	Industrial Training I	0
ENGR4006	Industrial Training II	0
LANC2160	English for Engineering I	3
LANC2161	English for Engineering II	3
MATH2107	Calculus I	4
MATH2108	Calculus II	3
MATH3171	Linear Algebra & Multi. Var. Calculus for Engineers	3
MATH4174	Differential Equations for Engineers	3
PHYS2107	Physics for Engineering I	4
PHYS2108	Physics for Engineering II	4
CHEM1071	General Chemistry for Engineers	3
ENGR2216 Or COMP2002	Fortran Programming for Engineers Introduction to Computer Programming for Engineers	3

University Elective Courses (6 Credits)

University elective courses specified by the College, from which the student selects 6 credit hours.

Code	Title	Credits
ARAB1040	Literature and Sociology	2
ARAB1050	Language and Sociology	2
ARCH1170	Development Civilization in Oman	2
ARCH1180	Archaeology and Environment in Oman	2
ARCH1520	Arch in Ancient Oman	2
ARCH1525	Arch Style Arab Gulf	2
ARCH1526	Islamic Arch	2
ARCH1530	Oman Arch Through Ages	2
ARCH1531	History of Animals in Oman	2
ARCH1535	Oman Town Culture Rem	2
ARCH1536	Arch. Knowledge Arab Peninsula	2
ARCH1537	Cult. Development Arab Gulf	2
ARCH1538	Oral History Cult. Heritage	2
ARCH1539	Hist. Ethn. Jewelry Oman	2
ARCH1540	Natural Culture Heritage Oman	2
ARCH1541	Cult. Scent and Aromatics in Oman	2
ARCH1550	Development of Art Arch in Oman	2
ARCH1551	Admin. Arch. Heritage	2
ARCH5500	Sea Port and Mart. Arch	2
ARED1001	Contemporary Visual Arts	2
ARED1002	Appreciation of Islamic Arts and Arabic	2
BCOM1950	Varieties of Public and Professional Communication	3
BCOM1960	Cross-Cultural Communication	2
BIOL1003	Genetics in our Life	2
BIOL1004	Environment Issues	2
CUTM1002	Environmental Education	2
CUTM1003	Principles of Teaching	2
GEOG2021	Man and Natur. Env. In Oman	2
GEOG2031	Urbanization in the Arabian Gulf	2
GEOG2122	Man and Environment	2
GEOG2341	Development Problems in Developing Countries	2

Code	Title	Credits
HIST1030	History of the GCC Countries	2
HIST1040	Some Aspects of the History of Oman	2
INFO4100	Children's Literature	2
ISLM1020	Human Right in Islam	2
ISLM2010	Prophet Biography	2
ISLM2030	The Miracle of the Holy Quran	2
ISLM2040	Islamic Economy	2
ISLM2060	Family Systems in Islam	2
ISLM2070	Quranic Stories	2
ISLM2080	General Aims	2
ISLM2090	Islamic Ethics	2
ISLM2150	Islam and the Modern World	2
MASS1020	Arts of Media Edit	2
MASS1030	Public Opinion	2
MASS1060	Mass Media and Society	2
MASS1070	International Communication	2
MASS1080	Principles of Public Relations	2
NURS1004	First Aid	2
NURS1005	Physical & Psychological Child Health	2
PHED1000	Physical Fitness	2
PHIL2050	International Meth	2
PHIL2060	Ethics	2
PHIL2070	Trends of Contemporary Philosophical Thought	2
PHIL2213	Science in Arab Thought	2
PSYC1001	Human Behavior	2
PSYC1002	Psych/Human Problems	2
SOCI2151	Medical Sociology	2
SOCI2361	Introduction to Social Work	2
THAR1001	Theater Appreciation	2
THAR1003	Music Appreciation	2
THAR1012	Play Writing	2
THAR1013	Oratory/Presentation	2
THAR1014	Scholastic Theater	2

Code	Title	Credits
THAR1016	Child's Theater	2
THAR1017	Theater Scenography	2
TOUR1050	Tourism in Oman	2

For more information about the elective course description, please visit SQU website at http://sisinfo.squ.edu.om/cgi-bin/crs-en/allsub.cgi

Major (Specialization) Requirements

A total of 89 credit hours (or 109 credit hours for the architectural engineering) are required for the Major Specialization, and may fall into two categories:

1. Courses which must be completed by all students as part of the degree plan for their major.
2. Elective courses specified for the Major, from which students may make a selection in consultation with advisors.

It should be noted that the description of Department courses for each Department can be found in the section on Departments in this catalog.

Important units and links

College of Engineering Web Site

The College of Engineering has a website that can be accessed through Intranet and Internet. Each Department of the College of Engineering is contributing in developing and maintaining the website. Important information about each Department such as degree plans, faculty, and facilities can be obtained by browsing the website. Members of the College Web Committee are responsible for maintaining and updating the website. The College website can be accessed through the University Home Page

www.squ.edu.om or directly on www.squ.edu.om/eng/

Admissions and Registration Web Site

The Admission and Registration website provides information on matters related to the admission and registration for the students and members of the staff. Information on

admissions, academic regulations, university degree plans, Timetables, section counts, statistics, student status, and related matters are presented on the web site. The Admissions and Registration web site can be accessed through the link on the University Home Page or through the address https://www.squ.edu.om/ar/

Students are encouraged to browse these web sites on regular basis in order to update themselves with the academic regulation and matters concerning their academic affairs.

In addition to the Deanship of Admission and Registration and the Deanship of Student Affairs, there are other supporting units in the university such as:

- The Language Center
- Main Library & SQU Cultural Center
- Center for Information System
- Center for Education Technology
- Career Guidance Center
- Student Counseling Center
- SQU Hospital
- Center for Community Service & Continuing Education
- Deanship of Postgraduate Studies
- Deanship of Research

More information about these units can be found from the university web site at www.squ.edu.om

Course Description

ARAB1001 Arabic (3 credits)

This course is designed to study Arabic language through discussion of some verses from the Holy Quran , texts from the prophet's Hadeeth, and from ancient and modern literature. Much attention will be given to the application and language practice in class and through the assignments given to the students.

HIST1010 Oman and Islamic Civilization (2 credits)

This course is a comprehensive survey of the role of Oman in Islamic civilization including an historical and geographical introduction to Oman before Islam; the efforts of the Omanis in spreading Islam; study of aspects of Islamic civilization, and Oman's role.

ISLM1010 Islamic Culture (2 credits)

Concept of Islamic Culture, sources of Islamic Culture, characteristics of Islamic culture, constituents (components) of Islamic culture (God, Universe, human being, life, relation between these four elements).

SOCY1001 Omani Contemporary Society (1 credit)

This course aims to enlighten students with the reality contemporary Omani society focusing on the Renaissance and the path to modernization and comprehensive development, through descriptive and analytical study of the following: the general features of the Omani society; the administrative organization of the state; the Omani contemporary economy; the Oman village in the context of agricultural development; industrial development; education and human resource development; and social welfare policies and their evolution.

ENGR1501 Introduction to Engineers (1 credit)

This course is a summary of all the engineering disciplines in which undergraduate engineering degrees are offered at the Sultan Qaboos University (College of Engineering). Students will be familiarized not only with the fundamentals of each discipline, but will also be enlightened by the experiences of engineering professionals in the industry. This would enable students to get a glimpse of each engineering discipline and will also give an idea of what to expect as an engineer once they graduate.

ENGR1600 Workshop I (1 credit)

As well as giving an extensive grounding in theoretical aspects of engineering, the professional engineer needs to appreciate the methods by which things are made and to understand and respect the skills involved in these processes. An elementary

knowledge of manufacturing techniques is an essential for many undergraduate courses, so that some workshop experience is now regarded as necessary before starting an engineering course or in the initial year of that course This course includes the following main topics: Safety, the care and use of bench tools, measurement, materials, fitting, elementary forming, turning, milling, drilling, and finishing technique.

ENGR3006 Industrial Training I (No credit)

Industrial training in the College of Engineering is compulsory for graduation. This course aims at preparing the students for training in professional environments. It exposes the students to "hands-on" training on tasks related to the student's specialization. The course addresses some key issues in industrial training such as safety procedures and professional work habits.

ENGR4006 Industrial Training II (No credit)

This training, within an industrial or professional environment related to the student's chosen field of study, provides him with valuable practical experience of the type of work with which a professional engineer is engaged.

LANC2160 English for Engineering I (3 credits)

The aim of upper intermediate course is to develop the study and language-related skills required by engineering students in order to deal with their academic studies. The course teaches the academic reading and writing skills associated with the most common language functions found in general scientific English, such as generalizing, describing, defining, classifying and hypothesizing.

LANC2161 English for Engineering II (3 credits)

(Prerequisite: LANC2160 English for Engineering I)

The aim of this advanced course is to further develop the study and language-related skills required by engineering students in order to deal with their academic studies. The course develops academic reading and writing skills at an intellectually challenging level. Class work, group projects, and self-access assignments are included.

MATH2107 Calculus I (4 credits)

This is the first standard Calculus course of three. It presents practical and theoretical aspects related to: Limits and continuity, derivatives, functions (logarithmic, exponential, trigonometric, hyperbolic) and integration. The course also introduces Computer Algebra Systems CAS and their uses to the students.

MATH2108 Calculus II (3 credits)

(Prerequisite: MATH2107)

This is a standard second calculus course from a sequence of three. It studies some applications of integration such as calculating areas, volumes, length of curves: the techniques of integration of different functions, proper, and improper integrals. The course also deals with Maclaurin & Taylor polynomial expansions, sequences, series and their convergences as well as differentiating and integrating power series. Some introduction to analytic geometry in calculus is also given.

MATH3171 Linear Algebra and Multi-Variable Calculus for Engineers (3 credits)

(Prerequisite: MATH2108)

Many physical quantities have a vectorial representation, and vector analysis often simplifies calculations considerably. The current course introduces the student to vector algebra, matrices and determinants, vector differential calculus, line and surface integrals, and divergence theorems.

MATH4174 Differential Equations for Engineers (3 credits)

(Prerequisites: MATH2108, LANC2161)

Differential Equations of the first order, linear Differential Equations, Laplace Transformation, Fourier Series, Fourier Transforms and partial Differential Equations.

PHYS2107 Physics for Engineering I (4 credits)

(Prerequisite: MATH2107)

An introductory course that develops a sound understanding of the basic physical principles underlying natural phenomena related to translational dynamics, rotational

dynamics, statics and fluids using elementary calculus and experimental techniques. The emphasis is on developing an intuition for the behavior of physical systems and problem solving.

PHYS2108 Physics for Engineering II (4 credits)

(Prerequisite: PHYS2107)

An introductory course that develops a sound understanding of the basic physical principles underlying natural phenomena related to electricity and magnetism and heat and thermodynamics using calculus and experimental techniques. The emphasis is on developing an intuition for the behavior of physical systems and problem solving.

CHEM1071 General Chemistry for Engineers (3 credits)

This is an introductory survey course designed to give engineers an appropriate background in chemistry. It includes topics such as atomic structure, bonding, states of matter, energy changes, reaction kinetics and equilibrations in solution, and the periodic table.

ENGR2216 FORTRAN Programming for Engineers (3 credits)

This course exposes the students to the concept of programming in Fortran-95. It is basically an introductory course that deals with the fundamental concepts of programming and problem solving procedures. At the end of the course the students will be able to become familiar with most of the data types, program statements, I/O techniques and program development..

COMP2002 Introduction to Computer Programming for Engineers (3 credits)

This course is intended to introduce the engineering students to software development using a high level programming language. Course contents include: problem solving methodology, program structure, language syntax, variables, data types, control flow, functions, data files, arrays, and variable scope.

Department of Civil and Architectural Engineering

كلية الهندسة

COLLEGE OF ENGINEERING

Introduction

The Department of Civil Engineering is one of the four engineering departments established with the opening of Sultan Qaboos University in 1986. The department was renamed to "Department of Civil and Architectural Engineering" with introduction of a new program in Architectural Engineering in May 2002. The two programs offered by the department namely, Civil Engineering and Architectural Engineering are ABET accredited. The undergraduate programs offered by the department cover planning, design and construction of buildings, hospitals, bridges, roads, pipelines, refineries, wastewater treatment plants, waste disposal facilities, and others. In addition to teaching and service duties, they are involved in research projects of great significance to Oman and the region.

Vision

The vision of the department is to become an outstanding Civil and Architectural Engineering Institute in the Gulf region and beyond.

Mission

Our mission is to provide high quality Civil and Architectural Engineering education through teaching, research, and development and to provide services to local community. This will be accomplished by:

- Providing high quality engineering education programs that encompass engineering knowledge, ethics, and values that should enable our graduates to become Professional Engineers.
- Offering services to the industry through cooperative programs in research, consultancy, and professional development.
- Promoting communication channels for collaboration with local and international communities to enhance public awareness and advancement of engineering knowledge.

Educational Objectives

The Department offers two Bachelor of Engineering (B.Eng.) degrees as follows:

- Bachelor of Engineering in Civil Engineering
- Bachelor of Engineering in Architectural Engineering

The educational objectives for Civil Engineering Program are to prepare Civil Engineering graduates who will:

- Design, construct, and maintain civil engineering systems using technical knowledge, design principles, and modern engineering tools.
- Use their communication, leadership, and team-work skills effectively, and deal responsibly with the ethical, professional and social issues.
- Stay current through self-learning experiences, professional development, or postgraduate studies.

The Program Educational Objectives for the Architectural Engineering Program are to prepare graduates who will:

- Design, construct and maintain built facilities using innovative engineering tools and methods.
- Work in teams and communicate effectively considering ethical, professional and social issues.
- Engage in self-development through life-long learning, professional practice, and graduate studies.

Degree Requirements

The total number of credit hours required for a bachelor degree in Civil Engineering is 136 hours. An Architectural Engineering student needs to complete 156 credit hours to graduate. These credit hours consist of University (12 credits), College (35 credits) requirements that are common to all departments in the college.

The department has further requirements (44 credits) for both programs. Given normal scheduling patterns, the program can be completed within 10 semesters (Civil Engineering) and 11 semesters (Architectural Engineering) including Foundation Program. A time limit of four additional semesters may be allowed.

Summary of Credits

University Requirements	12
College Requirements	32
College electives	3
Department Requirements	44
Major(Civil Engineering)	45
Major(Architectural Engineering)	65
TOTAL (Civil Engineering)	136
TOTAL (Architectural Engineering)	156

Department Requirements (44 Credits)

Code	Title	Credits
CIVL2401	Professional Practice & Ethics	2
CIVL3002	Drawing I	2
CIVL3036	Structures I	3
CIVL3056	Surveying	3
CIVL3086	Mechanics of Materials	3
CIVL3096	Construction Materials	3
CIVL3216	Basic Mechanics	4
CIVL4006	Prob. & Statistics for Engineers	3
CIVL4046	Fluid Mechanics	3
CIVL4206	Concrete Design	3
CIVL4216	Steelwork Design	3
CIVL5146	Numerical Methods	3
CIVL5204	Engineering Economics	3
CIVL5336	Construction Management	3
PETM3006	Engineering Geology	3
Major	Civil Engineering	45
	Requirements	30
	Technical Electives	15
Total (Civil Engineering)		136
Major	Architectural Engineering	65
	Requirements	59
	Technical Electives	6
Total (Architectural Engineering)		156

Major Requirements – Civil (30 Credits)

Code	Title	Credits
CIVL3046	Drawing II	2
CIVL3066	Engineering Hydrology	3
CIVL3076	Transportation Engineering	3
CIVL3106	Geotechnical Engineering I	3
CIVL4016	Structures II	3
CIVL4036	Highway Engineering	3
CIVL4136	Environmental Engineering I	3
CIVL4146	Hydraulics	3
CIVL4226	Foundation Engineering	3
CIVL5995	Project I	2
CIVL5996	Project II	2

Major Electives – Civil Engineering (15 Credits)

The student should select 5 courses (15 credit hours) or 3 courses (9 credit hours) and Research Project I and Research Project II. The electives can be taken from:

1. Civil Engineering optional technical electives; or
2. One course (max. 3 credits) offered in the M.Sc. Program in Civil Engineering after approval of advisor.

General		
Code	**Title**	**Credits**
CIVL5104	Special Topics in Civil Engineering	3
CIVL5150	Remote Sensing	3
CIVL5376	Conservation of Structures	3
CIVL5993	Research Project I	3
CIVL5994	Research Project II	3

Water Resources		
Code	**Title**	**Credits**
CIVL5076	Coastal Engineering	3
CIVL5142	Groundwater	3
CIVL5160	GIS in Water Resources Engineering	3
CIVL5246	Hydraulic Structures	3
CIVL5346	Water Resources Engineering	3
Geotechnical		
Code	**Title**	**Credits**
CIVL4106	Geotechnical Engineering II	3
CIVL5106	Slope Stability	3
CIVL5132	Environmental Geotechnics	3
CIVL5133	Soil Improvement	3
Transportation		
Code	**Title**	**Credits**
CIVL5122	Highway Materials	3
CIVL5206	Traffic Engineering	3
CIVL5216	Pavement Design and Maintenance	3
CIVL5226	Airport Design	3
Structures		
Code	**Title**	**Credits**
CIVL5096	Concrete Structures	3
CIVL5126	Concrete Materials and Technology	3
CIVL5214	Computer Applications in Structural Engineering	3
CIVL5236	Pre-stressed Concrete	3
CIVL5270	Fire Safety in Buildings	3
CIVL5296	Design of Masonry Structures	3
CIVL5462	Concrete Technology	3
CIVL5662	Building Materials	3

Construction		
Code	**Title**	**Credits**
CIVL5102	Construction Engineering	3
CIVL5156	Estimating Construction Cost	3
CIVL5306	Specifications and Contracts	3
CIVL5678	Administration of Contracts	3
Environment		
Code	**Title**	**Credits**
CIVL5151	Solid Waste Management	3
CIVL5152	Microbiology for Engineers	3
CIVL5153	Chemistry for Environmental Engineering	3
CIVL5186	Water and Wastewater Management	3
CIVL5254	Environmental Pollution	3
CIVL5255	Environmental Management Systems	3
CIVL5326	Environmental Engineering II	3
CIVL5154	Membrane Technology for water and wastewater	3
Geomatics		
Code	**Title**	**Credits**
CIVL5111	Global Positioning Systems and Its Applications in Civil Engineering	3
CIVL5311	Adjustment Computations	3
CIVL5600	Introduction to Photogrammetry	3

Major Requirements – Architectural Engineering (61 Credits)

Code	Title	Credits
AREN2111	Architectural Design I	3
AREN2312	Architectural Drawing	2
AREN2313	Architectural Graphics	3
AREN2411	History I: Modern & Contemporary	2
AREN3112	Architectural Design II	3
AREN3113	Architectural Design III	4

Code	Title	Credits
AREN3211	Architectural Design Theory	2
AREN3312	Introduction to CAAD	3
AREN3313	Architectural Working Drawing	3
AREN3412	History II: Islamic & Vernacular	2
AREN3811	Building Construction Methods	3
AREN3812	Architectural Acoustics	2
AREN3814	Climate-responsive Design	3
AREN3816	Building Mechanical Systems	3
AREN4114	Architectural Design IV	4
AREN4115	Graduation Project I	4
AREN4813	Building Illumination	2
AREN4817	Sanitary & Plumbing Design	2
AREN4818	Building Electrical Systems	3
AREN5116	Graduation Project II	3
AREN5819	Specifications and Quantities	2
MEIE3141	Thermodynamics I	3

Major Electives – Architectural Engineering (6 Credits)

The student should select 3 courses (6 credit hours) from the following architectural elective courses:

Code	Title	Credits
AREN3611	Principles of Settlement Planning	2
AREN3808	Computer Aided Lighting Design	2
AREN3809	Architectural Conservation Techniques	2
AREN3815	Sustainable Design in Hot climates	2
AREN4202	Architectural Professional Practice	2
AREN4203	Behavioral Factors in Housing Design	2
AREN4205	Residential Planning and Design	2
AREN4304	Special Topics in CAD	2
AREN4305	Introduction to Interior Design	2

Code	Title	Credits
AREN4306	Spatial Analysis Techniques	2
AREN5403	Omani Vernacular Architecture	2
AREN5801	Solar Energy in Buildings	2
AREN5802	Modern Building Construction Systems	2
AREN5805	Building Energy Conservation and Analysis	2
AREN4222	Fire and Smoke Control in Buildings	2
AREN4601	Landscape Design in Hot Regions	2
AREN4604	Concepts and Elements of Urban Design in Hot Regions	2
MEIE5228	Innovation and Entrepreneurship[1]	3

Course Description

CIVL2401 Professional Practice and Ethics (2 credits)

This course introduces students to the fundamental concepts necessary for an understanding of the ethical basis in the engineering work place, engineering professionalism, and the legal and social frameworks in which engineering is practiced. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers.

This course will give a student an idea of work on multidisciplinary teams. It will give them the broad education necessary to understand the impact of engineering solutions in a global/societal context and it will give them a knowledge of contemporary issues.

Topics covered will include ASCE code of practice; societal responsibilities of civil engineers; and consideration of economics, environmental, sustainability, business, public policy, professional licenses and social issues in engineering projects. The course will be supplemented by seminars offered by practicing engineers; case studies (locally and internationally); and site visits.

CIVL3000 Field Survey Training (0 credit)

(Prerequisites: CIVL3056)

This field training course is designed to expose the student to actual field survey conditions. The student will learn how to apply survey knowledge to comprehensive survey projects.

CIVL3002 Drawing I (2 credits)

This basic course is designed to develop student's drawing skills. The course includes all the techniques used in the graphic presentation of engineering problems. It includes lettering, dimensioning, and three-dimensional drawings. The course also includes drawing of reinforced concrete detailing, steel connections and other civil engineering applications such as bridges, dams and wadi Cross-Section. The students finishing this course will be able to read, understand and draw any general engineering drawings.

CIVL3036 Structures I (3 credits)

(Prerequisites: CIVL3086)

This intermediate course is designed to provide students with basic skills to carry out the analysis of statically determinate beams, frames and trusses; determine linear elastic deformations by geometric methods and work-energy methods; construct influence lines; analyze statically indeterminate beams and rigid frames using displacement methods (slope-deflection method and moment-distribution Method).

CIVL3046 Drawing II (2 credits)

(Prerequisites: CIVL3002)

An intermediate course designed to further develop the student's skills in, and understanding of, civil engineering drawing. The course introduces the student to computer graphics using AutoCAD. The student will be required to use AutoCAD for the drawing of steel frame sections and details; reinforced concrete members and details; highway horizontal, vertical alignment and sections; and hydraulics structures. A student completing this course will be able to prepare practical engineering drawing using AutoCAD. .

CIVL3056 Surveying (3 credits)

(Prerequisites: MATH2107)

This is an introductory course in surveying. The course provides the student with the necessary information and skills for surveying data collection and analysis for use in Civil Engineering. Basic concepts are explained combined with practical exercises on using surveying equipment. The course is supplemented by a field survey training course during the winter break (10 days).

CIVL3066 Engineering Hydrology (3 credits)

(Prerequisites: CIVL4046)

This course addresses principles and practical aspects of hydrology. Topics in engineering hydrology include: hydrologic processes, hydrologic cycle, precipitation, evaporation, infiltration, subsurface water, hydrologic measurements, unit hydrograph, frequency analysis, flood routing; rainfall-runoff analyses, watershed modeling, urban hydrology, and groundwater hydrology..

CIVL3076 Transportation Engineering (3 credits)

This intermediate-level course introduces the student to transport modes, geometric design, traffic-flow characteristics and highway capacity, and the technical implications of transport-related problems, methodologies and techniques. Lectures and problem-solving tutorials are used.

CIVL3086 Mechanics of Materials (3 credits)

(Prerequisites: CIVL3216)

This course will cover the fundamental concepts and calculation of stresses and strains in engineering materials. The behavior of members subjected to loads will be studied to develop a thorough understanding of the relations between loads and stresses developed in the material. This understanding is necessary to develop adequate procedure for design.

CIVL3096 Construction Materials (3 credits)

(Prerequisites: CIVL3216, CHEM1071)

This basic course integrates the study of materials science with the applications of materials in construction. The course enables the student to understand the relationships between the structure of a material, its environment and its physical and mechanical properties. Topics include structure of materials, defects and imperfections in materials, strengthening of materials, general properties of materials, use of metals and steel in construction, concrete and its components, fresh and hardened properties of concrete, and concrete mix design. Laboratory tests are conducted to determine different physical and mechanical properties of the material.

CIVL3106 Geotechnical Engineering I (3 credits)

(Prerequisites: PETM3006)

First course in geotechnical engineering, dealing with phase relations, soil classification, Atterberg limits, compaction, permeability, seepage, consolidation and shear strength. The lectures are supplemented with tutorials and laboratory sessions.

CIVL3216 Basic Mechanics (3 credits)

(Prerequisites: PHYS2107)

This basic course provides the student with an understanding of the fundamental principles of statistics and of the dynamics of rigid bodies. This will enable him to apply these principles to the more complex systems associated with mechanics of materials and the analysis of structures in subsequent courses.

CIVL4006 Probability and Statistics for Engineers (3 credits)

(Prerequisites: MATH 2107)

This intermediate course gives the necessary background in probability and statistics, with emphasis on inferences and regression analysis. The course, which is tailored to meet the needs of civil engineering students, is taught through lectures, examples and extensive tutorial sessions.

CIVL4016 Structures II (3 credits)

(Prerequisites: CIVL3036, MATH4174)

This intermediate course introduces the basic concepts of the moment- distribution method and its applications to structures. This is followed by the matrix-flexibility and matrix-stiffness methods for the analysis of structures. The plastic theory of structures including the concepts of collapse mechanisms and their applications is considered.

CIVL4036 Highway Engineering (3 credits)

(Prerequisites: CIVL3106, CIVL3076)

This advanced course provides information relevant to the materials used for highway construction. Topics include unbound materials (soils and aggregates), bituminous binders and mixtures, production of hot-mix asphalt concrete, road construction and basic earthwork operations, and an overview of thickness design of asphalt concrete pavements. The course consists of lectures and extensive laboratory work.

CIVL4046 Fluid Mechanics (3 credits)

(Prerequisites: CIVL3216)

This basic course provides the student with a working knowledge of the fundamental principles governing fluid mechanics and fluid flow. Lectures covering the properties of fluids, fluid statics, fluids in motion, momentum and energy principles, similitude, dimensional analysis, flow in conduits, and fluid measurements. These lectures are supplemented by laboratory experiments.

CIVL4106 Geotechnical Engineering II (3 credits)

(Prerequisites: CIVL3106)

This specialization course deals with in depth coverage of fundamental topics in geotechnical engineering. It covers compaction, compressibility, shear strength, unsaturated soil behavior, seepage and flow nets, earth pressure theories, and stability of slopes. The lectures are supplemented with handouts, laboratory sessions, tutorials and assignments.

CIVL4136 Environmental Engineering I (3 credits)

(Prerequisites: CIVL4046, CHEM1071)

This intermediate course introduces the basic concepts of environmental engineering. Topics include environment and ecological balance, impacts on environment, environmental sustainability, sustainable development, water quality (physical - solid contents, color, turbidity; chemical - pH, electro-neutrality., ionic strength, ionic activity, hardness, alkalinity, carbonate system, COD; and biological - BOD, DO, TOC, microbial count, Streeter-Phelps DO modeling); chemical and biological kinetics modeling (zero, first and second order kinetics) and application for environment, bio-chemical reactor modeling and analysis, basic theory of water treatment, and sanitation in developing countries.

CIVL4146 Hydraulics (3 credits)

(Prerequisites: CIVL4046)

This intermediate course aims to teach the design principles for engineering water works such as pipelines, open channels and turbomachinery. Lectures are supplemented by class tutorials and laboratory work.

CIVL4206 Concrete Design (3 credits)

(Prerequisites: CIVL3036, CIVL3096, (CIVL3046 OR AREN3312))

This intermediate course develops the student's skill in designing of reinforced-concrete structures. Flexural analysis and design of beams, singly reinforced rectangular beams, doubly reinforced rectangular beams, T-beams. Shear and diagonal tension design, bond, anchorage and development length. Analysis and design of edge supported slabs. Analysis and design of axial compression plus bending members. Detailing of reinforced concrete members.

CIVL4216 Steelwork Design (3 credits)

(Prerequisites: CIVL3036, (CIVL3046 OR AREN3312),),PHYS2108)

This intermediate course provides the student with an understanding of the behavior of structural steelwork and with the ability to design steel beams, columns, frames and connections such as those encountered in steel framed

buildings and industrial complexes. Lectures are supplemented with Tutorials and team projects.

CIVL4226 Foundation Engineering (3 credits)

(Prerequisites: CIVL3106, CIVL4206)

This course deals with site investigation; stress distribution; settlements analysis, bearing capacity and design of shallow foundations; mat foundations; earth pressure theory; retaining walls; sheet piles; braced excavations; and pile foundations. The lectures are supplemented with handouts, tutorials and assignments.

CIVL4400 Professional Practice and Ethics (2 credits)

This course introduces students to the fundamental concepts necessary for an understanding of the ethical basis in the engineering work place, engineering professionalism, and the legal and social frameworks in which engineering is practiced. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers.

This course will give a student an idea of work on multidisciplinary teams. It will give them the broad education necessary to understand the impact of engineering solutions in a global/societal context and it will give them a knowledge of contemporary issues. Topics covered will include ASCE code of practice; societal responsibilities of civil engineers; and consideration of economics, environmental, sustainability, business, public policy, professional licenses and social issues in engineering projects. The course will be supplemented by seminars offered by practicing engineers; case studies (locally and internationally); and site visits.

CIVL5076 Coastal Engineering (3 credits)

(Prerequisites: CIVL4146)

An advanced course in the concepts of harbor design: fundamental wave properties, wave transformations, tides, storm surges, tsunamis, wave-structure interaction, sediment transport and the general concepts of breakwater design. Design criteria including wave run-up and overtopping, wave forces and impact loading are reviewed.

CIVL5096 Concrete Structures (3 credits)

(Prerequisites: CIVL4016,CIVL4206)

This advanced course gives the student deeper insight into the problems of designing concrete structures, through an intensive study of advanced theory for both reinforced and prestressed concrete members. Theory lectures are supplemented by tutorials and design/drawing office.

CIVL5102 Construction Engineering (3 credits)

Introduction to construction engineering, planning, methods and specifications. Production estimates; equipment selection; Heavy construction equipment. Equipment specifications, selection, performance and economics of equipment, estimating productivity of construction equipment.

CIVL5104 Special Topics in Civil Engineering

(Prerequisites: Department Council approval)

Contemporary topics in selected areas of study within civil engineering. Course content is chosen by the instructor to meet the interests of the students..

CIVL5106 Slope Stability (3 credits)

(Prerequisites: CIVL3106)

This elective course provides the students with an understanding of slope stability and land slides. The course covers an introduction to slope stability, principles and techniques used in stability analysis, remedial and corrective measures for slope stabilization. The course also covers examples of landslides from Oman.

CIVL5111 Global Positioning Systems and Its Applications in Civil Engineering (3 credits)

(Prerequisites: CIVL3056)

Fundamental concept of satellite positioning, the GPS components (satellite, ground and user segments), field planning and office procedures for GPS surveying,

GPS instrumentation, GPS observables and modeling, data processing for single point positioning, differential positioning and precise relative positioning. Introduction to modern GPS surveying techniques, real-time and post processed baseline solutions, adjustment of baselines within networks. Applications of GPS in civil and site construction and engineering, building design and construction & operation.

CIVL5122 Highway Materials (3 credits)

(Prerequisites: CIVL4036)

This course will cover the following topics: basic properties of aggregates; road subbases; road bases; asphalt production, chemistry, and rheology; asphalt binders and modifiers; asphalt specifications; asphalt concrete mix design; asphalt concrete special mixes (Superpave, stone mastic, large stone mixes, etc.); hot mix asphalt concrete plants; road construction; recycling; pavement distresses and their relation to material properties; and quality assurance/quality control (QA/QC). Laboratory sessions will be part of this course..

CIVL5126 Concrete Materials & Technology (3 credits)

(Prerequisites: CIVL3096, CIVL3036, CIVL3086)

Concrete and its constituents. Properties & specification of cement and aggregates. Concrete mixing, placing, compacting & curving. Concrete mixes. Admixtures. Concrete in hot weather. Strength & durability. Deterioration, maintenance and repairing. Production & quality control. Sulphate attack. Corrosion and alkali-Silica reaction. Fiber reinforced concrete.

CIVL5132 Environmental Geotechnics (3 credits)

(Prerequisites: CIVL3106)

This course covers the nature of soil and environment, chemical composition of soils, clay mineralogy and structure, characterization of contaminated soils, soil hydraulic conductivity, contaminant transport in porous media, landfills, compacted clay liners, geosynthetics clay liners, engineering properties of municipal solid waste, settlement and stability of landfills, and construction of landfills.

CIVL5133 Soil Improvement (3 credits)

(Prerequisites: CIVL3106)

This specialized course deals with review of problematic soils such as soft and loose soils, expansive soils and collapsible soils; soil compaction, preloading; dewatering and sand drains; soil stabilization using cement, lime, fly ash and cement by pass dust; vibrofoltation; stone columns; deep compaction; geotextile; geogrids; geomembrane; grouting ; and mechanically stabilized walls.

CIVL5142 Groundwater (3 credits)

(Prerequisites: CIVL3066)

The course is designed to introduce groundwater in more details than hydraulics. Students will be dealing with Darcy's law to measure groundwater flow. Aquifer stress, groundwater storage and pumping tests are issues to be covered in this course. Environmental issues such as groundwater quality, contaminant transport processes and groundwater protection, are also included in this course.

CIVL5146 Numerical Methods in Engineering (3 credits)

(Prerequisites: (ENGR2217 or COMP2002) and MATH3171)

This intermediate course introduces numerical techniques used for solving typical engineering problems. Related structural programming is the objective of computer labs. Selected case studies of Civil engineering problems are solved using these techniques.

CIVL5150 Remote Sensing (3 credits)

The course is designed to introduce the basic principles of remote sensing and applications to Civil and Geomatics Engineering. This is a computer oriented course. This course covers elements of remote sensing, electromagnetic spectrum, radiation interaction with the earth and atmosphere, spectral signatures of environment, remote sensing sensors and their application, digital image processing, satellite imagery correction and enhancement techniques, data questions, remote sensing platforms, real applications and some case studies.

CIVL5151 Solid Waste Management (3 credits)

(Prerequisites: CIVL5326)

The course is introduced to focus on some ways of controlling municipal solid waste. Several ways of sorting solid wastes from the source will be explained. This course will discuss different ways of handling wastes paring in mind economic and esthetical factors. Some alternatives to landfill of the wastes will be introduced.

CIVL5152 Microbiology for Engineers (3 credits)

(Prerequisites: CIVL4136)

This course provides an introduction to microbiology relevant to environmental and sanitary engineering and assumes little prior knowledge of the subject. The morphology and biochemistry of some microorganisms such as bacteria, fungi, protozoa, viruses and helminthes will be discussed in some details. The microbiology of drinking water, wastewater (including industrial effluent) and sewage sludge are considered in relation to stabilization processes, nutrient removal and the provision of barriers to the transmission of disease causing organisms..

CIVL5153 Chemistry for Environmental Engineering (3 credits)

(Prerequisites: CIVL4136)

This course provides an introduction to water and organic chemistry and assumes that students have taken a basic course in general chemistry. It explains in some details the interaction of solids with water. Large organic molecules such as carbohydrates, proteins, nucleic acids and lipids will be explained. The course will also provide some information about atmospheric chemistry and electrochemistry. A discussion of the chemistry and environmental effects of some chemicals such as pesticides, detergents, waste incineration and landfill is also included in this course.

CIVL5154 Membrane Technology for Water and Wastewater (3 credits)

(Prerequisites: CIVL4136)

This course introduces the basic principles of membrane technology as well as its applications. Topics covered include membrane materials and their properties, preparation and characterization of synthetic membranes, transport phenomena

through membranes, as well as polarization and fouling. The different types of membrane processes for water treatment as well as their applications, including pressure driven reverse osmosis, concentration driven forward osmosis, thermally driven membrane distillation, membrane contactors, electrically driven membrane dialysis, and membrane bioreactors will also be discussed.

CIVL5156 Estimating Construction Cost (3 credits)

(Prerequisites: CIVL3046 and 4206)

This final year course provides the student with an understanding of the approximate and detailed estimating of materials and cost of Civil Engineering Projects. Emphasis is directed towards concrete structures, including earth work and excavation, construction, labour, equipment etc. The course, also, covers handling, storing and transporting cost of material.

CIVL5160 GIS in Water Resources (3 credits)

(Prerequisites: CIVL3066)

This course focuses on application of Geographic Information Systems (GIS) in Water Resources management. Spatial coordinate systems, terrain analysis using digital elevation models (DEM), digital mapping of water resources information (e.g. precipitation, evapotranspiration, infiltration, soil, and land use). Wadi and watershed networks, Wadi flow modeling, flood plain mapping, and integration of time series and geospatial data.

CIVL5186 Water and Wastewater Management (3 credits)

(Prerequisites: CIVL4136)

This senior level course is oriented towards providing an understanding of (1) estimating the water demand and wastewater quantity from different sources, (2) methods of supplying water to the consumers, (3) sewer systems (4) the use of water and wastewater quantity and quality data for treatment process design, (5) the design of unit processes, and (6) the combination of unit processes to produce a total treatment system. The practice in design for the basic elements of conventional biological and physical processes are applied.

CIVL5204 Engineering Economics (3 credits)

(Prerequisites: MATH2107)

This course is an introductory course in engineering economy. The course covers cost concepts and design economics, money-time relationships and equivalence, comparing alternatives, depreciation, cost estimating techniques, price changes an exchange rates, replacement analysis and dealing with uncertainty. The course also introduces economics contemporary issues, business fundamentals such as revenues, and present some aspects of public policy.

CIVL5206 Traffic Engineering (3 credits)

(Prerequisites: CIVL3076)

In this course, the student learns to conduct traffic engineering studies and accident investigation and analysis, through the study of traffic elements and measurements, statistical methods, capacity of intersections and roundabouts, delays, signal design, traffic control and management, queuing, and traffic flow theory.

CIVL5214 Computer Application in Structural Engineering (3 credits)

(Prerequisites: CIVL4016, CIVL4206)

Extension of the matrix stiffness method for the analysis of grids, three dimensional trusses and three dimensional frames. Efficient use of computers by senior students to solve structural engineering problems is emphasized. Structural analysis and design of steel and concrete are carried out using computer packages such as STAADPro, SAP2000 and others. The skills learned are helpful in understanding the use of commercial software in the structural engineering practice.

CIVL5216 Pavement Design and Maintenance (3 credits)

(Prerequisites: CIVL4036)

This pavement design course introduces the design concepts in designing pavements. The courses describes historical development in pavement design, stress computation in flexible pavement, load, and traffic and material characteristics for design. It covers

several flexible pavement design methods including the current method of design in Oman Highway Design Manual (2010). Computer software applications are used for stress analysis and pavement design.

CIVL5217 Steel Structures (3 credits)

(Prerequisites: CIVL4216)

This advance course further develop students' knowledge in design of steel structures. It will build on the basic design principles covered in CIVL4216: Steelwork Design and cover advance topics in the structural steel design such as: simple and moment resisting connections, plate girders, frames in simple construction and torsion.

CIVL5226 Airport Design (3 credits)

(Prerequisites: CIVL4036)

This is an introductory course on airport design. The course provides students with information on: airport components; aircraft characteristics related to airport design; geometric design of the airfield runways, taxiways and aprons; airside capacity and delay; structural design of pavements; and lighting, signing and marking. A site visit is planned to Muscat International Airport.

CIVL5235 Structural Stability and Dynamics (3 credits)

(Prerequisites: CIVL3036)

This is course provides students with basic knowledge of structural stability and dynamics for the analysis of civil engineering structures. The topics covered include general principles of stability and dynamics; buckling of beam, columns and frames; design against local and overall stability. Dynamics analysis will cover single-degree-of-freedom systems, multi-degree-of-freedom systems and continuous systems. Students are taught to deal with general stability and vibration problems of frames. The course of specialized context targets at undergraduate students in research or engineering practices relating to structural engineering applications.

CIVL5236 Prestressed Concrete (3 credits)

(Prerequisites: CIVL4206)

This course introduces the student to the analysis and design of prestressed concrete structures. Topics covered include flexure, shear, torsion and deflection of prestressed concrete beams and slabs, and time-dependent effects such as creep and shrinkage.

CIVL5246 Hydraulic Structures (3 credits)

(Prerequisites: CIVL4146)

This is an advanced course covering the design of hydraulic structures like dams, weirs and culverts. The course develops the student's design skills through integrative practical problems.

CIVL5254 Environmental Pollution (3 credits)

(Prerequisites: CIVL5326)

The course provides knowledge about the fate of contaminants in the environment within a single medium and between media. The course will emphasize on contaminant dispersion within air, soil, and water (surface water, and groundwater). For some applications, students will be taught to identify the dominant transport mechanisms, develop the appropriate equations that quantify the mechanisms, and simplify the system to arrive at solutions that are appropriate. The course will cover contaminant fate and transport topics such as advection, diffusion, dispersion, chemical decay, soil adsorption. Contaminant Plume characterization and identification will also be covered. Air pollution, soil contamination and groundwater contamination and remediation technologies will be covered.

CIVL5255 Environmental Management Systems (3 credits)

(Prerequisites: CIVL5326)

A course that describes popular environmental management systems and international standards. The course stresses on environmental auditing types, procedures and report writing. It also involves a practical application of the environmental auditing process.

CIVL5270 Introduction to Fire Safety Design in Buildings (3 credits)

(Prerequisites: CIVL4216)

This is an introductory course to the fire safety design in buildings. This course is an elective course offered for senior civil engineering students. This course provides students with basic skills to carry out fire safety design in buildings with particular emphasis on the following topics: introduction to principles of fire and compartment fires, means of escape, human behavior in fire, detection and warning systems, smoke and heat exhaust ventilation, emergency lighting, alarm systems and sound level calculations, automatic sprinklers protection systems, and aspects of passive fire protection in buildings. The course is covered through lectures and tutorials.

CIVL5296 Design of Masonry Structures (3 credits)

(Prerequisites: CIVL3086)

This basic course is aimed at giving the student a thorough understanding of design of masonry structural elements. This lecture course is supplemented by practical design exercises.

CIVL5306 Specification and Contracts (3 credits)

(Prerequisites: CIVL4206)

Job specification writing. Bidding documents. Overview of the construction management process in relation to each phase of a project from the inception of the need by the client to the completion of the work in the field.

CIVL5311 Adjustment Computations (3 credits)

(Prerequisites: CIVL3056)

Basic definitions. The Gaussian curve and the random error; The variance, covariance and weight of a measured quantity; Principles of correlation; Least squares method; Adjustment of simple surveying network by parametric method.

CIVL5326 Environmental Engineering II (3 credits)

(Prerequisites: CIVL4136)

This is an advanced level course introduces the basic concepts of air pollution control, solid and hazardous waste management, and noise and light pollution control. The course provide a detail understanding of atmospheric physical composition, types and sources of air pollutants, the transport and fate of atmospheric pollutants, Gaussian plume model for air pollutant dispersion, different controlling mechanisms of air pollutants in stationary and moving sources; the solid and hazardous waste types, collection systems, treatment and disposal by composting, anaerobic digestion, incineration, recycling, landfilling, deep well injections and bio-remediation; the source of noise and light pollution and mitigation measures.

CIVL5336 Construction Management (3 credits)

(Prerequisites: CIVL5204)

This course is aimed to provide a comprehensive introduction about construction project management. This course presents principles and techniques in the management of construction projects and present some aspects of public policy. Upon completion of this course, students should have knowledge on the following aspects of construction management: elements of project management, role of leadership in management, construction contracts, project planning and scheduling, project cost estimation, resources allocation and levelling, project cost and time control, and earned value analysis.

CIVL5346 Water Resources Engineering (3 credits)

(Prerequisites: CIVL3066,CIVL4046)

This advanced course is designed to provide the essential information required for planning, design, construction, and operation of facilities to control and utilize water. Theoretical aspects are reinforced with practical applications.

CIVL5376 Conservation of Structures (3 credits)

History of architecture and development in past. Conservation, restoration, preservation & revitalization of monuments. Process of decay and deterioration. Causes

of deterioration. Classification of monuments and materials of construction. Engineering aspects of restoration. Case studies in Oman and outside of Oman. Visits and practical exercises in documentation, identification, morphology, repair methodology etc.

CIVL5462 Cementitious Materials and Concrete Technology (3 credits)

(Prerequisites: CIVL3096)

This course provide a comprehensive understanding on some major topics related to concrete technology: Portland cement manufacturing, cement hydration, microstructure, properties and types of cement. Fresh concrete and hardened Properties of concrete, dimensional stability of cement-based materials, durability of concrete (corrosion, sulfate, ASR, Acids, etc), some advanced laboratory techniques for concrete, special types of concretes (high strength/performance concrete, Self-compacting concrete, fiber-reinforced concrete, lightweight concrete). Chemical and mineral additives in concrete are also covered.

CIVL5600 Introduction to Photogrammetry (3 credits)

(Prerequisites: CIVL3056)

This course conveys the fundamentals of photogrammetry. The objective is to supply students with the principles and applications in photogrammetry through image acquisition and measurements. Topics cover in course involve cameras' basics, mathematical models relate the image and object space, collinearity and coplanarity conditions, orientation parameters(interior, exterior) and various mathematical and geometric models in photogrammetric operations. .

CIVL5662 Building Materials (3 credits)

(Prerequisites: CIVL3086,CIVL3096)

This is an introductory course to the most used and contemporary building materials other than concrete and steel. It is an elective course targeting senior Civil and Architectural engineering students. The course provides students with basic skills and knowledge on the following topics: Masonry: stones, clay bricks and concrete blocks, physical and chemical properties, structural and non-structural behaviour of masonry, thermal properties of masonry products, uses and application of different masonry products, deterioration and conservation

of masonry; Masonry mortar: design, properties and uses; Lime, Gypsum and Plaster: properties, design, performance and rehabilitation; Wood and Timber: structure, composition, mechanical properties, defects, deformation, durability and failure in timbers; Other building materials: paint, tiles, coatings, adhesives etc. might also be discussed.

CIVL5678 Administration of Contracts (3 credits)

(Prerequisites: CIVL4206)

This final year course provides knowledge about the types of projects constructed in Oman and administration of construction projects based on the contracts used. The course will concentrate on discussions of implementing the construction contracts using the Omani Unified contract for Civil Engineering Works "Standard Documents for Building and Civil Engineering Works" Third Edition, 1999 and FIDIC. Case studies using some projects executed in Oman will be discussed. For some applications, students will be required to study real construction cases and present findings in front of complete class. Also, Consultancy Services Contracts "Standard Form of Agreement and Conditions of Engagement for Consultancy Services for Building and Civil Engineering Works, Second Edition, March 1987" will be studied given at the beginning of the course including all pre-contract services.

CIVL5680 Construction Planning & Scheduling (Computer application) (3 credits)

(Prerequisites: CIVL4206)

This course gives students hand-on experience of the different aspects related to the planning and scheduling of construction projects using the commercial software available in the market. The scheduling skills acquired through this course enables students to devise project schedules and monitor the progress which are the two components of project time management.

CIVL5993 Research Project I (3 credits)

(Prerequisites: Department Approval)

This first phase of the research project aims to develop the student's initiative and awareness of independent engineering thought process. Each student is assigned a

topic and is required, under the guidance of the project supervisor, to plan and carry out associated research which may be both experimental and analytical over a total period of one semester. The student will be required to submit a report on his work at the end of the semester.

CIVL5994 Research Project II (3 credits)

(Prerequisites: CIVL5993)

This second phase of the research project aims to develop the student's initiative and awareness of independent engineering thought process. Each student is assigned a topic and is required, under the guidance of the project supervisor, to plan and carry out associated research which may be both experimental and analytical over a total period of one semester. The student will be required to submit a report on his work at the end of the semester.

CIVL5995 Project I (2 credits)

(Prerequisites: CIVL4206 and (CIVL4036 or CIVL4136 or CIVL4146))

This is the first course of two design project courses which challenges the student to synthesize various subject areas in order to produce an engineering solution for a practical design problem. The students will design a system, component, process in at least two civil engineering contexts, including principles of sustainability in design. The aim is to prepare the student for professional work in a design office situation. The course involves team work, design calculations, production drawings and presentation.

CIVL5996 Project II (2 credits)

(Prerequisites: CIVL5995)

This is the second course of two design project courses which challenges the student to synthesize various subject areas in order to produce an engineering solution for a practical design problem. The students will design a system, component, process in at least two civil engineering contexts, including principles of sustainability in design. In addition, the student will be exposed to different aspects of construction management to be integrated with parts of the project.

The aim is to prepare the student for professional work in a design office situation and construction industry. The course involves team work, design calculations, production drawings and presentation.

AREN2111 Architectural Design (1): Basic Design (3credits)

(Prerequisites: AREN2312, AREN3211)

Foundation studio aimed at developing critical and conceptual design skills. Students develop understanding of design through exploring 2 & 3D pattern making, form and space compositions, exploration of design domain, design analysis and simple design problems. Small projects are used to explore the domain of architectural design and enhance communication skills.

AREN2312 Architectural Drawing (2credits)

The aim of this basic course is to develop student's knowledge, understanding and communication skills required for producing general architectural engineering drawings. The course covers the following topics: drawing tools and materials, principles of orthographic representation (plan, elevation, section), and three dimensional drawings (isometric, axonometric), and architectural standards. By the end of this course students should be able to read, understand, and draw general architectural engineering drawings.

AREN2313 Architectural Graphics (3credits)

(Prerequisites: AREN2312)

The aim of this course is to enhance knowledge and understanding of the relation of perception and representation through free-hand drawing and graphical communication. The course covers the following topics: drawing and observation: line and shape, contour, tone and texture, light and color, form and structure, space and depth; principles of shade and shadow, and perspective drawing.

AREN2411 History of Architecture (1): Modern and Contemporary (2credits)

Course examines historical development in western art and architecture from the industrial revolution to the present. Focus is on understanding how cultural settings

shaped the direction of artistic thinking and built form in each period. Emphasis is on technical developments, artistic movements, institutions (such as Bauhaus) and important personalities.

AREN3112 Architectural Design (2): Simple Function (3 credits)

(Prerequisites: AREN2111)

This course aims at understanding the generic design process with emphasis on conceptualization, order, function, and form and space relationship. Structure and environment are also introduced as design issues. Design focus is on simple buildings with limited functional and technical complexity for different sites, situations, and programs, and design ideas are developed through analytical and compositional studies.

AREN3211 Architectural Design Theory (2 Credit)

Course examines design theory as a means to develop cognitive and problem-solving skills. Difference between theory and design theory of architecture is explored. Also explored are issues of order and organization, phenomena of perception, elements and organizing principles of form and space, ordering principles, design typology, designers and design thinking, and design process.

AREN3312 Introduction to Computer Aided Architectural Design (3 Credits)

(Prerequisites: AREN2312)

The course introduces students to digital media and its application in architecture. Focus is on enabling skill acquisition in the use of 2D drafting, 3D modelling, and Rendering software. Image processing and post production programs may also be explored.

AREN3113 Architectural Design (3): Complex Multi-Function (4 Credits)

(Prerequisites: AREN3112)

The course will address, through methodical design process, complex architectural organization in terms of function, context, structure, formal expression and

environmental considerations. Also, the course will address technical aspects such as choice of materials and the design of architectural details. Human needs and values, visual and physical qualities of the designed environment are expected to be addressed.

AREN3313 Architectural Working Drawing (3 Credits)

(Prerequisites: AREN3312, AREN3811)

Introduce methods of preparing working drawing as part of building construction documents and provides a hands-on experience in preparing such documents. The course will emphasize the use of computer in generating such drawings. Topics to be covered include: working drawing conventions, drawing organization, working drawing of plans, sections, elevations, and details.

AREN3412 History of Architecture (2): Islamic and Vernacular (2Credits)

This course concentrates on Islamic architecture in different regions and times. It searches for the forms while examining the embedded meanings and symbolic appearances. It examines the design principles of different styles in Islamic architecture. A field trip to observe and document a selected traditional Omani architecture is undertaken as part of the course.

AREN3611 Principles of Settlement Planning (2 Credits)

Overview of the historical development of human settlements. Examination of different types, morphology, structure and growth of settlements. Overview of factors influencing settlement form and growth. Contemporary urban form with emphasis on the influence of rapid urbanization. Examination of settlement form in Oman in the context of global practices. Sustainability issues in settlement planning.

AREN3808 Computer Aided Lighting Design (2 Credits)

The course will give a review in lighting design (daylighting and artificial lighting). Introducing overview of modeling of the building and simulation of lighting. Concepts relating to the simulation of daylight, sunlight and artificial lighting in buildings. Use of on-market simulation tools such as: Ecotect and Radiance software.

AREN3809 Architectural Conservation Techniques (2 Credits)

The course will cover: evolution of historical conservation, historic buildings and architectural cultural heritage, conservation decisions, ethics, and values, conservation team, causes of decay in historic buildings. The course will introduce different methods of intervention and techniques, and examples from different geo-climatic regions and periods.

AREN3811 Building Construction Methods and Details (3 Credits)

(Prerequisites: CIVL3096)

(Co-requisites: AREN2312)

Types of structures and their construction methods and techniques. Foundation, floor, wall and roof systems. Moisture and thermal protection. Doors and windows. Building details. Pre-fabrication techniques of building components. Construction techniques of special form: dome, vault, shell, space frame and metal structure. Local materials and construction systems. Building joints and movements. Finishing and cladding.

AREN3812 Architectural Acoustics (2 Credits)

(Co-requisites: PHYS2108)

The course introduces theoretical foundations, computational approaches, and design methods in architectural acoustics (room acoustics, building acoustics, noise control). Topics include: review of physical properties of sound, fundamentals of sound perception, prediction of air-borne and structure-borne sound propagation, noise control, and relevant design methods.

AREN3814 Climate Responsive Design (3 Credits)

This course addresses the impact of hot climate on architectural design. Topics covered are: Climatic elements and site microclimate, Human comfort, Solar control, Shading systems, Wind movements and ventilation, Urban environment and dynamics of external space, Built environment and effects of the building envelop.

AREN3815 Sustainable Design in Hot Climates (2 Credits)

This course addresses the issues of sustainable architectural design in hot climates. The course covers: global issues of sustainability and green architecture, environmental constraints on future sustainability, problems of non-sustainable cities, future sustainable urban patterns in Oman, bases and application of sustainability rating systems of LEED - LEED/N- Estidama, study and analyses of examples of sustainable building projects in the world.

AREN3816 Building Mechanical Systems (3 Credits)

(Prerequisites: MEIE3141)

Psychometrics, human thermal comfort in the internal environment, basic heat transfer in buildings, heating and cooling load calculation, introduction to computerized cooling load calculation, air-conditioning systems and equipment, air duct design, air distribution systems design, fan design, vertical transportation systems design.

AREN4114 Architectural Design (4): Design in an Urban Context (4 Credits)

(Prerequisites: AREN3113)

Studio explores design at the scale of the urban context. Focus is on designing a new housing neighborhood or intervention aimed at neighborhood/district regeneration. Scope covers design of architectural elements and their situation in the urban context. Attention is paid to contextual issues, such as site, location, and climate. Social, cultural and behavioral issues are also addressed.

AREN4115 Graduation Project (1) (4 Credits)

(Prerequisites: AREN4114, CIVL4206)

(Co-requisites: CIVL4216)

First part of the graduation project aimed at developing a comprehensive architectural solution that serves the society. Starting with selecting a project, programming studies, site selection, and compiling a technical report. This part will consider general requirements for structural, environmental, and building services. Focus in assessment is on the architectural solution.

AREN4202 Architectural Professional Practice (2 Credits)

Issues affecting current architectural theory and practice. Legal framework of practice and the role of the architect in building industry and process. The regulatory system: planning and urban design controls, building code and approval process. Management principles and practices for the range of architectural practice. The selection process and the conditions of the design market. Responsibilities and liabilities of different building professionals in all sectors of practice as the outcome of their relationship to local authorities and current building legislation.

AREN4203 Behavioral Factors in Housing Design (2 Credits)

Introduction to the science of spatial behavior. Perceptual learning and way finding. adaptation. motivation. emotion development and cultural and personal context, and the process of feedback. Human Senses (vision; olfactory, auditory, touch) and Sensory process. Perception cognition. Social influence on behavior and space syntax. Personal space and territoriality.

AREN4205 Residential Planning and Design (2 Credits)

Course examines housing planning, design and financing issues with a focus on urban areas. Issues covered include housing problems, housing market and planning, family cycle and housing demand, delivery systems, types of housing, housing design, criteria for housing location, and neighborhood planning. Concepts such as territoriality, sense of place and defensible space are also examined.

AREN4222 Fire and Smoke Control in Buildings (2 Credits)

This is an introductory course to the fire and smoke control in buildings. This course is an elective course offered for senior architectural engineering students. This course provide students with basic skills to carry our fire safety design in buildings with particular emphasis on the following topics: introduction to Principles of fire and compartment fires, means of escape, human behavior in fire, detection and warning systems, smoke and heat exhaust ventilation, emergency lighting, alarm systems and sound level calculations, automatic sprinklers protection systems, and aspects of passive fire protection in buildings. The course is covered through lectures and tutorials.

AREN4304 Special Topics in Computer Aided Design (2 Credits)

Course explores emerging ideas and applications of information technology in architecture. It provides a forum for faculty to share research findings and or experience in the use of Computer Aided Design, or to explore the use of particular computer programs. The course also serves to cater for the CAD interest of students.

AREN4305 Introduction to Interior Design (2 Credits)

This course introduces students to principals of interior design. The course explores the historical background of the interior design, space planning and spatial arrangements, furniture, style, materials and finishes, illumination, psychological and functional effects of colors, and human factors through assignments and projects. Several design communication means might be used (free hand drawing, manual drafting, CAD and models).

AREN4306 Spatial Analysis Techniques (2 Credits)

This course introduces students to principles of spatial analysis techniques, namely space syntax theory and the associated methods. The course explores the role of space design -at micro (building) and macro (city) levels- on the socio- cultural, behavioral and economic activities. After the theoretical background and basic knowledge of the analytical techniques are established through lectures and assignments, students will learn to use the related software to perform the analysis. All knowledge gained during the course will be used in a research project.

AREN4601 Landscape Design in Hot Regions (2 Credits)

Comprehensive application of landscape design skills. Landscape-design applications involving site inventory and analysis, functional and planting diagrams, preliminary and master planning. Theories & concepts for creating exterior spaces with plant materials; and the principles, concepts, and techniques used by landscape architects in the design of a variety of landscape types, including soft-and-hard-scape that will be applied on real projects in Oman.

AREN4604 Concepts and Elements of Urban Design in Hot Regions (2 Credits)

This course will discuss and present terms, concepts, fundamentals, principles and the criteria of urban design. The urban design criteria in addition to social and cultural factors that influence the urban context will be discussed with particular emphasis on formal aspects of urban design and applied on real design project of Omani-built-up environment.

AREN4813 Building Illumination (2 Credits)

(Co-requisites: PHYS2108)

The course introduces theoretical foundations, computational approaches, and design methods in building illumination (daylighting, electrical lighting). Topics include: Review of visual performance criteria and lighting psychology, analytical and numeric methods for the prediction of lighting conditions in interior spaces, lighting engineering and design methods.

AREN4817 Sanitary and Plumbing Design (2 Credits)

(Prerequisites: CIVL4046)

Basic elements, organization, design and layout of plumbing, sanitation and fire safety systems in buildings; plumbing systems including water sources, water requirements, water supply and distribution in buildings; sanitary systems including drainage, venting, storm water, waste disposal and recycling; fire safety systems.

AREN4818 Building Electrical Systems (3 Credits)

(Prerequisites: AREN4813)

Introduction, electrical safety, DC circuits, AC circuits, polyphase, transformers, electrical systems, electrical wiring for various types of buildings, electrical distribution and circuit design, and electrical drawing

AREN5116 Graduation Project (2) (3 Credits)

(Prerequisites: AREN4115, AREN3816, AREN4818, AREN4817)

The second part of the graduation project course is focusing on integrating the structural and building system designs with the previously accomplished architectural design in part one. The first phase of the course is devoted to design structural and services systems and preparation of related working drawing. Then, architectural solution revision and preparation of final presentation to be addressed.

AREN5403 Omani Vernacular Architecture (2 Credits)

Introduction to Omani cities, villages, desert settlements, and landscape. Urban settlement and architecture in Different regions in Oman. Religious Architecture: traditional & contemporary mosques, memorial buildings. Defense architecture. Urban and architectural elements. Building materials, light and climatic considerations. Decorative interior elements. Cultural spatial presentation, space syntax, form, style and outside influence.

AREN5801 Solar Energy in Buildings (2 Credits)

Available solar radiation, radiation on opaque and transparent materials, theory, types, and performance of solar collectors, energy storage in solar systems, solar water heating in buildings, passive and active solar heating, design of solar heating systems, solar cooling in buildings, desiccant cooling systems, economics of solar systems, computer applications.

AREN5802 Modern Building Construction Systems (2 Credits)

Advanced aspects of building construction and green building solutions, new technological aspects of building structure and material: reinforced concrete, prefabrication, pre-cast concrete, steel framing systems; innovative building envelope systems: curtain walls, window walls, glazing and roofing systems; new industrialized methods of designing and assembling buildings.

AREN5805 Building Energy Conservation and Analysis (2 Credits)

Energy conservation as a design determinant, energy use in buildings in Oman, design techniques to minimize energy consumption in building, mechanical and electrical systems, energy conservation standards & codes, computer models for estimating building energy consumption, computer-aided energy analysis and evaluation of alternative building energy conservation measures (ECMs).

AREN5819 Specifications and Quantities (2 Credits)

(Prerequisites: AREN3313)

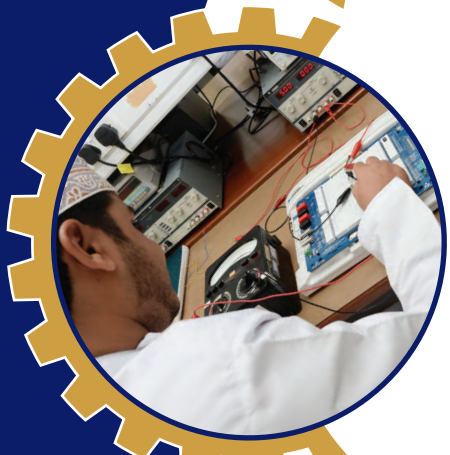
The course focuses on the principles underlying specification writing and material selections and the preparation of project tender documents. Understanding various types of materials according to international and local standards. Bill of quantities calculations and ways of integrating drawings with quantities.

MEIE5288 Innovation and Entrepreneurship (3 Credits)

Innovation at its simple definition is the process of turning ideas into reality and capturing a value from them. In this course the student will learn how to innovate, create value which will eventually lead to start-up company. Finally, the student will learn how to manage resources i.e. money, people and equipments.


V1
V2
V3

Department of Electrical and Computer Engineering



كلية الهندسة

COLLEGE OF ENGINEERING

Introduction

The Department of Electrical and Computer Engineering (ECE) is the largest department in the College of Engineering and offers both undergraduate and graduate degrees in electrical and computer engineering. The department also collaborates with the Mechanical and Industrial Engineering Department in offering undergraduate degree in Mechatronics Engineering. The ECE program is accredited by ABET.

Vision

The vision of the ECE Department is to be among the leading and well known departments of Electrical and Computer Engineering in the Gulf region and beyond.

Mission

Our mission is to provide an outstanding education in electrical and computer engineering with a rich diversity of skills, to contribute to the community prosperity through professional services and research, and to prepare graduates capable of engaging in life-long learning for engineering practice with competence.

Educational Objectives

Our program educational objectives stipulate that the graduates of the Electrical and Computer Engineering program, within a few years of graduation, will:

- Practice engineering in diverse work environments with an integrative approach and entrepreneurial mindset in undertaking tasks and providing effective solutions to problems.
- Continue professional development and/or postgraduate studies throughout their careers.
- Serve the profession and the community at large with integrity and objectivity

The Department offers two Bachelor of Engineering (B.Eng.) degrees:

- B. Eng. in Electrical & Computer Engineering
- B. Eng. in Mechatronics (offered jointly with the Department of Mechanical & Industrial Engineering)

The Bachelor Degree in Electrical and Computer Engineering is designed to provide a sound education with solid foundation in basic sciences and electrical engineering. The program also imparts a broad awareness of social, cultural, and ethical issues together with a good understanding of the role of engineers in the community, leading to an internationally recognized degree.

Four tracks are available in the ECE undergraduate program: Communication and Signal Processing, Computer Systems and Networks, Electronic Instrumentation and Control, and Power Systems and Energy.

Degree Requirements

To graduate, a student is required to complete a total of 136 credit hours resulting in the award of a Bachelor Degree in Electrical and Computer Engineering. The credit hours are allocated to University, College and Department requirements/electives as summarized below:

Summary of Credits

University Requirements	12
College Requirements	35
Department Requirements	56
Track Requirements	24
Track Electives	9
TOTAL	136

Department Requirements (56 credits)

Students from all tracks within the Department have to take the following courses:

Code	Title	Credits
ECCE2016	Circuit Analysis I	3
ECCE3016	Circuit Analysis II	3
ECCE3022	Electromagnetics I	3
ECCE3038	Elect. Measurements & Instrumentation	2
ECCE3142	Signals & Systems	3
ECCE3152	Electronics I	3
ECCE3206	Digital Logic Design	3
ECCE3258	Applied Engineering Programming	1
ECCE3352	Electrical Technology	3
ECCE4010	Engineering Design and Professional Ethics	2
ECCE4082	Professional Skills	1
ECCE4122	Principles of Analog & Digital Comm.	3
ECCE4158	Electronics II	3
ECCE4227	Embedded Systems	3
ECCE4416	Linear Control Systems	3
ECCE5004	Eng. Management & Economics I	3
ECCE5009	Project (Part I)	2
ECCE5099	Project (Part II)	3
MATH4151	Discrete Mathematics and Complex Analysis	3
MATH4176	Numerical Analysis for Engineers	3
STAT2103	Probability for Engineers	3

Track Requirements (24 credits)

Communications and Signal Processing

Code	Title	Credit
ECCE4022	Electromagnetic II	3
ECCE4142	Digital Signal Processing	3
ECCE4126	Principles Digital Communications	3
ECCE4242	Introduction to Computer Networks	3
ECCE5112	Antennas & Wave Propagation	3
ECCE5123	Optical Communications	3
ECCE5124	Wireless Communications	3
ECCE5143	Advanced Digital Signal Processing	3

Computer Systems and Network

Code	Title	Credits
ECCE4242	Introduction to Computer Networks	3
ECCE4254	Operating Systems	3
ECCE4257	Applied Algorithm	3
ECCE5214	Adv. Logic & Computer Interfacing	3
ECCE5215	Computing Systems for Engineering Applications	3
ECCE5223	Advanced Embedded Systems Design	3
ECCE5232	Computer Architecture & Organ.	3
ECCE5242	Advanced Computer Networks	3

Electronic Instrumentation and Control

Code	Title	Credits
ECCE4142	Digital Signal Processing	3
ECCE4358	Electrical Machines	3
ECCE4436	Industrial Control Systems Design	3
ECCE4455	Sensors and Actuators	3
ECCE4467	Power Electronics & Drives	3
ECCE5445	Control System Design	3
ECCE5452	Computer-Aided Instrumentation	3
ECCE5231	Industrial Networks and Operating Systems	3

Power Systems and Energy

Code	Title	Credits
ECCE4022	Electromagnetic II	3
ECCE4312	Power System Analysis I	3
ECCE4316	Power System Analysis II	3
ECCE4358	Electrical Machines	3
ECCE4467	Power Electronics & Drives	3
ECCE5302	Power Systems Protection	3
ECCE5303	Power Distribution System Engineering	3
ECCE5332	High Voltage Engineering	3

Track Electives (9 credits)

Code	Title	Credits
ECCE4005	Numerical Methods for Engineers	3
ECCE4022	Electromagnetics II	3
ECCE4126	Principles of Digital Communications	3
ECCE4142	Digital Signal Processing	3
ECCE4203	Advanced Logic Design	3
ECCE4213	Digital Electronics – Reliability and Testing	3
ECCE4232	Introduction to Distributed & Parallel Systems	3
ECCE4242	Introduction to Computer Networks	3
ECCE4252	Data Structure & Algorithms	3
ECCE4253	Object Oriented Programming	3
ECCE4254	Operating Systems	3
ECCE4255	Applied Programming & Algorithms for Eng.	3
ECCE4256	Engineering Design Issues and Professional Practices	3
ECCE4263	Data Base Systems	3
ECCE4272	Artificial Intelligence	3
ECCE4282	Coding and Data Encryption	3
ECCE4312	Power System Analysis I	3
ECCE4316	Power System Analysis II	3
ECCE4358	Electrical Machines	3
ECCE4422	Digital Control Systems	3
ECCE4436	Industrial Control Systems Design	3
ECCE4455	Sensors and Actuators	3
ECCE4467	Power Electronics & Drives	3
ECCE5008	Project Management	3
ECCE5112	Antennas & Wave Propagation	3
ECCE5122	Communications Systems	3
ECCE5123	Optical Communications	3
ECCE5124	Wireless Communications	3
ECCE5134	Selected Topics in Communications	3
ECCE5142	Image and Video Processing	3
ECCE5143	Advanced Digital Signal Processing	3
ECCE5152	Electronic Communication Circuits	3
ECCE5162	Microwave Engineering	3
ECCE5164	RF Communication Circuits	3

Code	Title	Credits
ECCE5212	VLSI Design	3
ECCE5213	Fault-Tolerant Computing Systems	3
ECCE5214	Advanced Logic & Computer Interfacing	3
ECCE5215	Computing Systems for Engineering Applications	3
ECCE5222	Microprocessor Interfacing	3
ECCE5223	Adv. Embedded Systems Design	3
ECCE5224	Microprocessor Based Control Design	3
ECCE5231	Industrial Networks and Operating Systems	3
ECCE5233	Computer Architecture and Organization II	3
ECCE5242	Advanced Computer Networks	3
ECCE5243	Network Software Design & Programming	3
ECCE5252	Software Engineering	3
ECCE5282	Computer Network Security	3
ECCE5283	Cryptography, Security & e-Commerce	3
ECCE5292	Selected Topics in Computer Engineering	3
ECCE5302	Power Systems Protection	3
ECCE5303	Power Distribution System Engineering	3
ECCE5304	Power Stations	3
ECCE5312	Power System Control and Stability	3
ECCE5314	Selected Topics in Power	3
ECCE5322	Electrical Power Systems Quality	3
ECCE5323	Power System Operation	3
ECCE5324	Power System Reliability and Planning	3
ECCE5332	High Voltage Engineering	3
ECCE5333	Power System Economics	3
ECCE5352	Generalized Machine Theory	3
ECCE5422	Selected Topics in Control Systems	3
ECCE5432	Programmable Logic Control Systems	3
ECCE5433	Modern Control Systems	3
ECCE5445	Control System Design	3
ECCE5452	Computer-Aided Instrumentation	3
ECCE5443	Optimization Techniques in Engineering	3
ECCE5462	Electric Drives	3

Course Description

ECCE2016 Circuit Analysis I (3 Credits)

(Prerequisite: MATH2107)

Electrical quantities and terminology used in electrical engineering. Methods and theorems used in DC analysis. DC and transient analysis of R, RC and RL circuits both manually and with SPICE simulator.

ECCE3016 Circuit Analysis II (3 Credits)

(Prerequisite: ECCE2016)

This is the second part of a two-semester course in circuit analysis. The topics covered in this course deal with sinusoids, phasor concept, steady-state response, average power and RMS values, magnetically coupled circuits, three-phase circuits, complex frequency, resonance, and two-port networks.

ECCE3022 Electromagnetics I (3 Credits)

(Prerequisites: MATH3171, PHYS2108)

This is the first part of a two-semester course in engineering electromagnetics that deals with static fields. Topics cover: Review of vector algebra, coordinate systems and transformation, vector calculus. Electrostatic Fields: Characteristics and Laws. Electric Fields in Materials, Electric Boundary Conditions, Magnetostatic Fields: Characteristics and Governing Laws, and Electrical Classification of Materials, Maxwell's Equations for Static Fields.

ECCE3038 Electrical Measurements and Instrumentation (2 Credits)

(Prerequisites: ECCE3016, ECCE3152)

This course, designed for the students of Electrical & Computer Engineering, covers instrument static and dynamic characteristics, measurement errors. Analog and digital Instruments. DC and AC bridges. Introduction to sensors.

ECCE3142 Signals & Systems (3 Credits)

(Prerequisite: ECCE3016)

ECCE3142 is an introductory course on signals and systems. It covers the following topics: Fundamental concepts of signals and systems, System modeling, Convolution, Fourier series and Fourier transform, Frequency domain analysis, Laplace transform and continuous-time linear system analysis - z transform and discrete-time linear systems analysis, MATLAB for modeling, analysis, and design.

ECCE3152 Electronics I (3 Credits)

(Prerequisite: ECCE2016)

E lectronic devices (Diodes, bipolar junction transistors, metal-oxide semiconductor field-effect transistors and Op amps). Techniques used for analyzing electronic devices and circuits both manually and with CAD tools like PSPICE simulator. Basic circuits design and applications.

ECCE3206 Digital Logic Design (3 Credits)

This is an introductory course in logic and digital design. The topics covered within this course are number systems, Boolean algebra, logic gates, simplification of Boolean functions, combinational logic design, MSI and PLD components, sequential logic design, registers, counters, and the memory unit

ECCE3258 Applied Engineering Programming (1 Credit)

(Prerequisite: COMP2002 or ENG2217)

This course aims to reinforce the programming and algorithmic concepts learned in COMP 2002/ENGR 2217. The course is mainly practical based and run in labs. Students will learn to design flow charts and basic algorithms for engineering problems that involve, e.g., finding roots, solving linear equations, and curve fitting. The students will then translate their solutions into correctly running programs using any appropriate programming tool in C, C++, MATLAB, or Java.

ECCE3352 Electrical Technology (3 Credits)

(Prerequisite: ECCE3016)

This course covers fundamentals of Electric Energy Systems, Electric Energy Conversion, Transformer, Fundamentals of AD & DC Machines, electric safety, Power Electronics and introduction to illumination.

ECCE4005 Numerical Methods for Engineers (3 Credits)

(Prerequisites: (ENGR2216, MATH3171) or (COMP2002, MATH3171) or (COMP2216, MATH3171))

This course covers the basics of numerical methods for the solution of applied problems in engineering. It concentrates on the mathematical analysis and implementation of basic numerical techniques. Topics relate to various numerical methods developed for solving linear/non-linear equations, curve fitting and interpolation. This course also introduces students to numerical differentiation, integration and an introduction to solve first order ordinary and partial differential equations. The applications related to each topic in electrical engineering are also covered.

ECCE4009 Engineering Design and Professional Skills (2 Credits)

(Prerequisite: ECCE4227)

In this, course students learn essential engineering skills that help them identify and effectively solve engineering design problems. Topics covered includes engineering design process, problem formulation, system requirements specification, system design and testing, engineering project management and economics issues and effective teamwork practices. In addition, ethical, safety, environmental, societal and global implications of engineering solutions as well as professional engineering practice will be addressed.

ECCE4010 Engineering Design and Professional Ethics (2 Credits)

(Prerequisite: ECCE3142, ECCE3152, ECCE3206, ECCE3352)

This course introduces students to the theory, concepts and practice of engineering

design. It focuses on engineering design process, design tools, professional skills, and ethical issues. Problem identification, research, requirements specification, concept generation, design, prototyping, system integration and testing phases are covered in the engineering design process part. In design tools, important technical tools that are used in the design and implementation phases as well as engineering project management are considered. Essential professional skills as teamwork, communication and management skills are reinforced through team-based projects. Ethical issues and realistic constraints that impact engineering design projects realization are also covered.

ECCE4022 Electromagnetic II (3 Credits)

(Prerequisite: ECCE3022)

This is the second part of two-semester course in engineering electromagnetic. Topics cover: Poisson's and Laplace equations, resistance and capacitance. Time varying fields and electromagnetic induction, Maxwell's equations. Electromagnetic wave propagation: Plane waves in conductors and in dielectrics; Power and the Pointing Vector; Wave polarization. Transmission lines.

ECCE4080 Seminars and Field-Work (No Credits)

The goal of this course is to provide the students with general knowledge and skills encompassing a wide area, and also to present them with topics in the engineering field and business that might not be addressed in their degree plans and that can broaden their thinking skills. An example of the topics that might be covered are: ethics, safety, life-long learning, functioning in business organizations, CV preparation and interviews, communication and presentation skills, design issues, time management planning, privatization of electricity in Oman, E-government, creative enterprises (incubators), and global issues.

ECCE4082 Professional Skills (1 Credit)

(Prerequisite: LANC2161)

The goal of this course is to provide the students with general knowledge and skills encompassing a wide area, and also to present them with topics in the engineering

field and business that might not be addressed in their degree plans and that can broaden their thinking skills. The skills related to communication, professional and ethical responsibility, engineering within global, economic, environmental and societal context and knowledge of contemporary issues are presented in this course. An example of the topics that might be covered are: ethics, safety, life-long learning, functioning in business organizations, CV preparation and interviews, communication and presentation skills, time management planning, privatization of electricity in Oman, E-government, creative enterprises (incubator)

ECCE4122 Principles of Analog & Digital Communication (3 Credits)

(Prerequisite: ECCE3142, STAT2103)

This course provides an introduction to the basic principles of analogue and digital communications. Topics covered include generic communication system

components, review of Fourier representation of signals and systems, amplitude modulation (AM) and demodulation, frequency division multiplexing (FDM), angle modulation (FM and PM) and demodulation, sampling theorem, pulse

code modulation (PAM, PWM, PPM, PCM), time division multiplexing (TDM), digital binary carrier modulation techniques (amplitude-shift keying: ASK, phase-shift keying: PSK, frequency-shift keying: FSK), M-ary digital carrier modulation, design of analogue and digital communications systems

ECCE4126 Principles Digital Communications (3 Credits)

(Prerequisite: ECCE4122)

Introduction to Digital Communications. Review of Probability Theory and Random Processes. Baseband Data Transmission: Baseband Signaling Schemes, Spectrum, and Error Performance. Intersymbol Interference and Signaling Over Band-limited Channels. Optimal Receivers for Binary Data Transmission. Digital Modulation: ASK, PSK, FSK, QPSK, OQPSK, and MSK Signaling. M-ary Signaling Techniques. Introduction to Channel coding and Information theory.

ECCE4142 Digital Signal Processing (3 Credits)

(Prerequisite: ECCE3142)

This is an introductory course in digital signal processing. It covers discrete- time signals and systems, convolution, linear-time invariant systems. Sampling, Discrete-Time Transforms: Discrete-Time Fourier Transform DFT and Fast Fourier Transform FFT, Z-Transform. Digital filters, structures for discrete-time systems, digital filter design, FIR filter design, IIR filter design. DSP applications: Simulation with DSP Board, Matlab Simulink, and Matlab software programming.

ECCE4158 Electronics II (3 Credits)

(Prerequisite: ECCE3152)

This is an advanced course in electronics which deals with concept, analysis and design of electronic circuits using discrete and integrated devices. Digital logic circuits. Switching response times of discrete devices and basic logic gates used in integrated digital circuits. Bode Plots. Feedbacks and Oscillators. Output Stages and Power amplifiers. Electronic Circuit Design and Applications. Labs on electronic circuits based on Diodes, Transistors, and Op Amps. CAD tools are used to analyze circuits.

ECCE4203 Advanced Logic Design (3 Credits)

(Prerequisite: ECCE3206)

Design of synchronous asynchronous sequential circuits: Flow tables, races, and hazards. Algorithmic state machines. Combinational programmable logic devices. Programmable logic arrays. Sequential programmable logic devices. Design for testability.

ECCE4213 Digital Electronics – Reliability and Testing (3 Credits)

(Prerequisite: ECCE3152)

Testing diodes and transistor logic circuits. Noise margins and fanout. MOS and CMOS devices. Applications in the design of combinational circuits and sequential circuits. Semiconductor memories. Fault models in digital circuits. Testing of digital circuits and memories.

ECCE4227 Embedded Systems (3 Credits)

(Prerequisites: COMP2002 or ENGR2217 + ECCE3206 + ECCE3152 or MCTE3110)

This is an introductory course about microcontroller and its use in the design of embedded systems. Topics covered include hardware and software architectures of a microcontroller, assembly language programming for the microcontroller, and its application for a wide range of real-world applications.

ECCE4232 Introduction to Distributed & Parallel Systems (3 Credits)

(Prerequisite: ECCE4227)

Introduction to distributed and parallel systems: Parallel processing mechanisms. Architectural classification schemes. Parallel computer structures. Principles of pipelining. Structures and algorithms for array processors. Multiprocessor architecture. Interconnection networks. Dataflow computers.

ECCE4242 Introduction to Computer Networks (3 Credits)

(Prerequisite: ECCE4227 or COMP3518 or COMP3501)

Local Area Network (Ethernet, Token Ring, FDDI): Transmission Medium, Medium Access Control, Repeaters, Bridges and Routers. Internet Protocols (TCP/IP, ICMP, etc...). Client Server Architecture. Internet Applications (DNS, DHCP, FTP, etc...).

ECCE4252 Data Structures and Algorithms (3 Credits)

(Prerequisite: COMP2002)

This course covers fundamental concepts in data structure and algorithms. Topics covered include: lists, stacks, queues, heaps, trees, various searching and sorting algorithms. The performance of the various sorting methods are compared and analyzed.

ECCE4253 Object Oriented Programming (3 Credits)

(Prerequisite: COMP2002)

This course provides necessary high-level skills and knowledge to develop

modern Windows-based applications using object-oriented concept of programming. At the end of the course, students will be aware of software development tools and technologies, be able to write solid event-driven code using Visual Basic; create stand-alone, multiform applications and create effective interfaces.

ECCE4254 Operating Systems (3 Credits)

(Prerequisite: COMP2002 or ENGR2217)

This course covers the principles of operating systems. The topics discussed in class are processes, threads, concurrency and synchronization, scheduling, deadlocks, memory management, and virtual memory. The course is accompanied with labs involving aspects of the Windows and Linux operating systems and the C programming language.

ECCE4255 Applied Programming& Algorithms for Engineers (3 Credits)

(Prerequisite: COMP2002)

Fundamental concepts in data structure and algorithms applied to engineering problem solving. The course covers some essential data structure topics such as lists, stack and trees as well as basic algorithms such as sorting, searching, matching and few graph algorithms (e.g. shortest path). In lab sessions, the above topics are deployed in solving engineering problems for efficient implementation in C, C++ or JAVA.

ECCE4256 Engineering Design Issues and Professional Practices (3 Credits)

(Prerequisite: ECCE4227)

In this course students will learn essential engineering skills that will help them identify and effectively solve engineering design problems. Topics covered includes engineering design process, engineering project management and economics issues, effective teamwork, effective report writing and effective project presentation skills. In addition, ethical, safety, environmental, societal and political issues related to engineering as well as professional engineering practice will be addressed. Students will apply the skills learned in this course to their Final Year Project to improve it.

ECCE4263 Database Systems (3 Credits)

(Prerequisite: COMP2002)

Concepts and principles of database management systems. Basic concepts. System structures. Data models, Database languages (SQL in particular). Relational database normalization. File systems. Indexing. Query processing. Concurrency control. Recovery schemes.

ECCE4272 Artificial Intelligence (3 Credits)

Fundamentals of automated reasoning in expert systems: Semantics and satisfaction, inference procedures, logical implication, proofs, unification, resolution, soundness and completeness. Searching strategies and problem solving. Limits of monotonic logic: forms of non-monotonic reasoning. The course includes a term project that consists of writing a small inference engine in Lisp.

ECCE4282 Coding and Data Encryption (3 Credits)

(Prerequisite: ECCE3122 or ECCE4122)

This course covers modern cryptography and data security. The basic information theoretic and computational properties of classical and modern cryptographic systems are presented, followed by a cryptanalytic examination of several important systems. Application of cryptography to the security of electronic mail, timesharing systems, computer networks and data bases are studied.

ECCE4312 Power System Analysis I (3 Credits)

(Prerequisite: ECCE3352)

This course is designed to give the students an ability to model electric power system components and to analyze power system under steady-state conditions. The course contents include the following topics:

Power system components. Transmission line parameters: Resistance, Inductance and capacitance. Model for short, medium, and long lines. Steady-state operation of transmission lines. Shunt and series compensation. Per unit systems. Bus admittance and impedance matrices. Symmetrical faults.

ECCE4316 Power System Analysis II (3 Credits)

(Prerequisite: ECCE4312)

This course covers the following main topics in power system analysis: Power-flow studies. Network calculations: node elimination, building and modifying bus impedance matrix. Symmetrical components. Unsymmetrical

faults. Economic dispatch. Transient stability: swing equation, equal-area criterion, time-domain simulation.

ECCE4358 Electrical Machines (3 Credits)

(Prerequisite: ECCE3352)

The course cover the following topics in electrical machines: Energy Conversion principle, Three-phase power transformers, special types of transformers, vector groups, multi-phase induction motors, single-phase induction motor, synchronous generators and motor.

ECCE4416 Linear Control Systems (3 Credits)

(Prerequisite: ECCE3142)

Introduction to control systems. Mathematical representation of dynamical systems. Time domain analysis of control systems. Stability of control systems. Control system analysis and design using Root Locus techniques.

ECCE4422 Digital Control Systems (3 Credits)

(Prerequisite: ECCE4416 or MCTE4250)

Control loops with samplers. Discrete control loop analysis. Stability analysis of digital control systems. Controller design for SISO systems. State space analysis and design of digital control systems. Implementation issues and Case studies.

ECCE4436 Industrial Control Systems Design (3 Credits)

(Prerequisite: ECCE4416 or MCTE4250 or MCTE4450)

This course is intended to put into practice the theoretical knowledge of the mathematical aspects of process control by converting this knowledge into practical understanding of industrial control aspects and problems. This course provides a graduate-level emphasis on the control system components and its corresponding process diagrams, it also provides a degree of emphasis on internal calculation of control algorithms in digital computers including techniques for controller tuning and implementation, designing various control structures most often employed in industry (i.e., feedforward, cascade control, ratio control technique and Dead time Compensation). The course carries out by providing introduction to fundamental aspects of system identification, i.e., estimating dynamic models from sampled (experimental/operating) data. The principles learned in this course can also provide a foundation for the general understanding of how traditional control algorithm can be programmed in an industrial Programmable Logic Controller (PLC) software using the IEC 1131.3 programming standard.

ECCE4455 Sensors and Actuators (3 Credits)

(Prerequisite: ECCE3036 or ECCE3038)

This course introduces the fundamentals of sensors and actuator, their working principles, and how to select them for a given application. The course is divided into two parts. The first part deals with sensors and covers: measurement system behavior, analog and digital signal conditioning, and sensors and transducers selection for system design. The second part concentrates on actuators and covers: electrical, hydraulic, and pneumatic actuators, the advantages and limitations, the selection and integration procedures. Learning activities include lectures, assignments, labs, and a design project.

ECCE4467 Power Electronics & Drives (3 Credits)

(Prerequisites: (ECCE3152 or MCTE3110), (ECCE3352 or MCTE3210))

This is a basic course in power electronics and electrical drives. It covers, introduction about power electronics and drives, Power semiconductor devices, Single-phase Rectifiers, Three-phase Rectifiers, Choppers (class A, B), Single-phase Inverters, PWM techniques, Single-phase ac voltage controllers, DC motor drives.

ECCE5004 Eng. Management & Economics I (3 Credits)

(Prerequisite: STAT2103 or MEIE4281)

This course focuses on introducing to the engineering students a variety of tools and techniques in management & economics that can be used to facilitate the optimum utilization of manpower, materials, machines, money, and other resources.

ECCE5008 Project Management (3 Credits)

(Prerequisite: ECCE5004)

Management methods and techniques of projects in Government and private sector organizations. Introduction to project development. Phases of project planning and management. Budgeting and cost estimation. Resource allocation. Organizing, staffing and directing, Project management techniques. Project controlling and monitoring. Cost management. Risk analysis. Quality management.

ECCE5009 Final Year Project (Part I) (2 Credits)

(Prerequisites: ECCE4009 or ECCE4010)

The final year project extends over two semesters, i.e., Part-I and Part-II. The tasks of the project are split in a way that the students could be evaluated in both the terms. The final year projects are normally design projects and should include standards and realistic constraints in their designs. These realistic constraints include economical, environmental, political, social, health, safty, manufacturability and sustainability etc. The standards are normally IEEE or IEC standards or even Omani standards, if they exist. Students are required to give a seminar to discuss the preliminary project results obtained in Part-I and submit a Part-I report as minimum.

ECCE5099 Final Year Project (Part II) (3 Credits)

(Prerequisite: ECCE 5009)

Part II of the final year project, which extends over two semesters. This part is a continuation of part I and it may include implementation of a prototype. Environmental impact of the project (if any) is addressed along with the cost analysis. Students

are required to submit a final report and to give a presentation to discuss the outcomes of the project.

ECCE5112 Antennas & Wave Propagation (3 Credits)

(Prerequisite: ECCE4022)

Fundamental antenna parameters. Radiation pattern. Far-field, directivity. Radiation efficiency. Gain impedance. Bandwidth. Polarization. Antenna noise temperature. Friis power transmission formula. Basic types of antenna. Dipoles, arrays and long-wire antennas. Aperture-type antennas. Reflector antennas. Printed antennas. Propagation: electromagnetic wave propagation of various frequency ranges. Design of radio links.

ECCE5122 Communication Systems (3 Credits)

(Prerequisite: ECCE4124 or ECCE4126)

This course deals with communication systems. Topics covered include the communication channel; digital signals and digital communication telephony: telex, facsimile, teletext; local area networks (LAN); integrated services digital network (ISDN); satellite communications.

ECCE5123 Optical Communications (3 Credits)

(Prerequisite: ECCE4122)

This course is a comprehensive and in-depth introduction to the basics of optical communications with fiber transmission lines. The topics to be covered include the light wave fundamentals, optical waveguides and fibers, dispersion, distortion and attenuation in optical communication systems, different optical sources, transmitters, detectors and receivers, passive couplers, connectors, modulators, amplifiers, filters and system design parameters.

ECCE5124 Wireless Communications (3 Credits)

(Prerequisite: ECCE4122)

This course addresses the following topics: overview of existing mobile communication standards, cellular telephony concept, inter-symbol interference, multiple-access techniques, multi-path channels, flat-fading and frequency-selective channels, Rayleigh and Ricean channels, bit error probability over AWGN and slow, flat fading Rayleigh channels, diversity, channel coding, and Rake receiver structure.

ECCE5134 Selected Topics in Communication (3 Credits)

(Prerequisite: ECCE4124 or ECCE4126)

This course covers the current state of the art in some of the hot areas of interest to student in the field of communication engineering.

ECCE5142 Image and Video Processing (3 Credits)

(Prerequisite: ECCE4142)

Introduction to digital image processing, Digital image fundamentals, Image transforms, image enhancement, image restoration, image compression, color image processing, video coding, motion estimation.

ECCE5143 Advanced Digital Signal Processing (3 Credits)

(Prerequisite: ECCE4142 + ECCE4227)

This is an advanced course in Digital Signal Processing. It covers, Multirate DSP: Decimation and Interpolation, sampling rate conversion, applications. Adaptive filtering algorithms (LMS, RLS). Image Processing Basics: 2D-DFT, 2D-FFT, Image filtering, Image Analysis, Image compression techniques and basics of video signals.

ECCE5152 Electronic Communication Circuits (3 Credits)

(Prerequisite: ECCE4157 or ECCE4158)

This course deals with theoretical analysis, practical issues and simulation of communication circuits. Small signal amplifiers. Audio and video amplifiers. Oscillators. Resonant circuits; coupling tuned circuits; IF and RF amplifiers. Mixers; frequency conversion; modulators and detectors. Phase Locked Loops (PLL). Network noise and intermodulation distortion.

ECCE5162 Microwave Engineering (3 Credits)

(Prerequisite: ECCE4022)

Microwave components, devices, techniques and systems. Fundamental concepts of Maxwell's equations. Wave propagation. Network analysis and design principles. Applications of microwave engineering. Transmission line theory. Transmission lines and waveguides. Microwave network analysis. Impedance matching and tuning. Microwave resonators. Power dividers and directional couplers. Microwave systems.

ECCE5164 RF Communications Circuits (3 Credits)

(Prerequisite: ECCE4158)

This course aims to provide students with the introduction of RF communications circuits design. The course covers the issues of RF circuit analysis & design; micro strip transmission line designing and analysis; S- parameters; Couplers and filter design (Interdigital OCTL/SCTL type); oscillators; Modulators, Low-noise and switching mode high efficient class-E Power Amplifiers (PA) design, CMOS Power amplifiers design issues, RFs safety in designing and international standards, overview of state of the art fabrication techniques and applications, Computer aided design and simulation of RF circuits using ADS.

ECCE5212 VLSI Design (3 Credits)

(Prerequisite: ECCE4227)

Very Large Scale integrated (VLSI) circuit design. Provides a review of FET basics with Functional module design including combinational memory, combinational logic, programmable logic arrays and finite-state machines. Computer-aided VLSI fabrication techniques, layout strategies, scalable design rules, design-rule-checking and guidelines for testing and testability are covered along with. Survey of VLSI applications.

ECCE5213 Fault-Tolerant Computing Systems (3 Credits)

(Prerequisite: ECCE4227)

This course addresses design, modeling, analysis, and integration of hardware and software issues to achieve dependable computing systems employing on-line fault-tolerance. The course centers mainly around the concepts of Fault-Tolerant System Design based on: Redundancy, Reliability and Testing. It includes and covers the concepts of Dependability, Maintainability, Error Detection, Voting and Fault Diagnosis and their related models.

ECCE5214 Advanced Logic and Computer Interfacing (3 Credits)

(Prerequisite: ECCE4227)

This course is designed to introduce the design of complex logic systems underlying or supporting the operation of computer systems and interfaces. Students will learn how to use advanced computer-aided design tools to develop and simulate logic systems consisting of MSI components such as adders, multiplexers, latches, and counters. The concept of synchronous logic is introduced through the design and implementation of Mealy and Moore machines. Hardware description languages are introduced and used to describe and implement combinational circuits. Students will also learn how to use programmable logic devices to implement customized designs.

ECCE5215 Computing Systems for Engineering Applications (3 Credits)

(Prerequisites: ECCE4242)

This is an advanced course where real-world examples and case studies from industry are covered to demonstrate to students the important up-to-date applications of computing systems in various engineering fields. Examples of applications are: consumer electronics, robotics, smart oil fields, networking and telecommunication.

ECCE5222 Microprocessor Interfacing (3 Credits)

(Prerequisite: ECCE4227)

This is a senior level course, which covers various aspects of interfacing microprocessors with peripheral and memory devices. Topics include general structures of advanced microprocessors; static and dynamic memory interfaces; DMA controllers; interrupt controllers; memory management units interfaces to keyboard, disk and CRT, data communications interfaces.

ECCE5223 Advanced Embedded Systems Design (3 Credits)

(Prerequisite: ECCE4227)

This is an advanced course on the design of embedded systems. We will use the LPC-P2148 Arm7 development board, an integrated C development environment, and a real-time operating system (RTOS) to study and develop the major elements of an embedded system. Applications include digital signal processing, industrial automation and control, computer networking, and consumer devices.

ECCE5224 Microprocessor Based Control Design (3 Credits)

(Prerequisite: ECCE4227)

The course treats the basic aspects of choice of architecture, technology - microprocessors; operations and timing diagrams; microprocessor simulator; designing and debugging of microprocessor based systems; required electronic circuits for building microprocessor based control systems; case studies.

ECCE5231 Industrial Networks and Operating Systems (3 Credits)

(Prerequisite: COMP2002 or ENGR2217 + ECCE4227)

The first part of the course provides an introduction to operating system functions, Processes, CPU scheduling, single/multiuser OS, networking OS, and aspects of Linux OS as a case study. The course introduces fundamental concepts in the design and implementation of computer and industrial communication networks and their protocols. This includes introduction to OSI reference model, TCP/IP network protocol suite, HTTP, SMTP, FTP, DNS, TCP, UDP, IP, industrial network architecture, physical and logical characteristics of industrial networks, Ethernet and fieldbus technologies, common industrial protocol, and precision time protocol.

ECCE5232 Computer Architecture & Organization (3 Credits)

(Prerequisite: ECCE4227)

This course teaches the fundamentals of modern computer systems with detailed emphasis on the internal working of various processor's components.

Topics covered include central processing unit (control unit, arithmetic and logic unit, registers), memory (internal, external, cache), input/output and interfaces, RISC/CISC, pipelining, and introduction to parallel processing.

ECCE5233 Computer Architecture and Organization II (3 Credits)

(Prerequisite: ECCE5232)

This is the second part of a two-semester course in computer architecture. Course topics include high speed arithmetic algorithms. Pipeline computers, multiprocessor systems, array and data flow computers, vector processors. Memory hierarchies, virtual memory, cache memory, input-output systems, DMA and interrupts.

ECCE5242 Advanced Computer Networks (3 Credits)

(Prerequisite: ECCE4242)

This is an advanced course on computer networks. The course emphasis is on topics related to routing and switching. These include: autonomous system, classification of routing protocols, popular routing protocols (e.g. RIP, OSPF, BGP), VLAN, STP, etc... In addition, it introduces students to recent and emerging networking technologies.

ECCE5243 Network Software Design and Programming (3 Credits)

(Prerequisite: ECCE4242)

The course is aimed at exposing students to general aspects of network software design and programming. Related architectures and communication protocols including medium access, routing, congestion control, internetworking, connection issues and overview of Internet application protocols will be dealt with appropriate concepts of design the necessary software.

ECCE5252 Software Engineering (3 Credits)

(Prerequisite: ECCE4252 or ECCE4255)

Designing, development and commissioning of large software systems. Software life cycle. Requirements specification. Module decomposition. Module specification.

Implementation and test planning. Software reliability and security. Multi-user environments. Project management issues. The course involves a group project.

ECCE5282 Computer Network Security (3 Credits)

(Prerequisite: ECCE4242)

This course introduces basic computer network security concepts. Topics include: network security objectives and mechanisms, basic cryptography, attacks and countermeasures at various layers of networking protocol stack, and networking devices.

ECCE5283 Cryptography, Security, and e-Commerce (3 Credits)

(Prerequisite: ECCE4242)

This course is serves as a broad introduction to cryptography and its application to computer-network security services and mechanisms, such as confidentiality, digital signature, access control, and electronic payments.

Analysis of software and hardware implementations of cryptographic algorithms and network-security protocols are covered. Topics also include techniques for authentication, privacy, denial of service, and non- repudiation. Current Internet distributed security models and protocols are discussed in the context of these techniques. Of special importance are the application to Internet infrastructure protocols, such as Internet routing and transport protocols, as well as secure mail, directory and multimedia multicast services.

ECCE5292 Selected Topics in Computer Engineering (3 Credits)

(Prerequisites: ECCE4227, (ECCE4242 or ECCE5231))

This course covers the current state of the art in some of the hot areas of interest to student in the field of computer engineering.

ECCE5302 Power Systems Protection (3 Credits)

(Prerequisite: ECCE4316)

This course provides students with a background on protection of electric power systems. It presents different components of protection systems, different types of relays and how these relays can be set to protect the different parts of a power system. It also introduces new protection techniques such as the use of microprocessor-based relays and substation automation. Different protection techniques dedicated to protect feeders, transformers, generators and motors are discussed.

ECCE5303 Power Distribution System Eng. (3 Credits)

(Prerequisite: ECCE4312)

Load characteristics and its applications. Load forecasting. Types of distribution networks. Selection of distribution transformers. Voltage drop and voltage regulation. Voltage dip due to motor starting. Design of distribution feeders. Power-factor correction, Power Quality.

ECCE5304 Power Stations (3 Credits)

(Prerequisite: ECCE4312)

Conventional and non-conventional power generation. Sources of energy. Types of power plants. Major equipment installed and layouts of different types of power stations. Environmental performance of power plants and the equipment installed to mitigate the environmental effects. Power plant costs, factors and definitions. Economic evaluation of power projects. Electricity trading and evolvement of electricity sector.

ECCE5312 Power System Control and Stability (3 Credits)

(Prerequisite: ECCE4316)

This is an advanced course on power systems control and stability. The course covers mathematical models and state-space representation of synchronous machine, power system stability studies and calculations; excitation control systems and their effect on dynamic and transient stability; turbine-governor control; load frequency control of single area and multi area power system.

ECCE5314 Selected Topics in Power (3 Credits)

(Prerequisite: ECCE4312)

Special topics in the field of electrical power system engineering.

ECCE5322 Electrical Power Systems Quality (3 Credits)

(Prerequisite: ECCE4312)

Introduction to power quality, Terms and definitions, Power quality problems, Voltage sage and interruptions, Transient overvoltage, Harmonics, Source of harmonics, Harmonics Mitigation, Harmonics filter design, Monitoring power quality, Improving power quality.

ECCE5323 Power System Operation (3 Credits)

(Prerequisite: ECCE4316)

Economic dispatch of power generation units. Load frequency control. Interchange of power and energy. Power system security. Optimal power flow. An introduction to state estimation in power system.

ECCE5324 Power System Reliability and Planning (3 Credits)

(Prerequisite: ECCE4312)

Introduction to reliability engineering, basic concepts and power plant reliability. Generation and transmission system reliability. Reliability worth evaluation. Energy production simulation. Generation planning methodologies. Demand-side management. Integrated demand-supply planning including externalities. Transmission planning. Electricity tariffs.

ECCE5332 High Voltage Engineering (3 Credits)

(Prerequisite: ECCE4312)

This is an introductory course in High Voltage Engineering, which is aimed the students specialized in Energy and Power Systems. This course covers a wide spectrum of High Voltage Engineering topic and introduces the students to the

importance of using high voltage, circuit interruption and circuit breakers, types of overvoltage and surge arresters, insulation coordination, high voltage generation and measurement, and dielectric breakdown of different states of matter and protective grounding.

ECCE5333 Power System Economics (3 Credits)

(Prerequisite: ECCE4312)

The goal of this course is provide the students with knowledge on the issues of electricity privatization and open market competition in electricity sector. The course also provides students with knowledge on the fundamentals of economics and gives awareness on the Current arrangement of electricity market in Sultanate of Oman.

ECCE5352 Generalized Machine Theory (3 Credits)

(Prerequisite: ECCE4358)

This course covers: Application of matrix algebra to static electric networks, matrix equations of transformers, matrix equations of basic rotating machines, commutator machines, linear transformation in electrical machines, polyphase machines.

MATH4151 Discrete Mathematics and Complex Analysis (3 Credits)

This course has two parts: Complex Analysis and Discrete Math, and each part has its own textbook. Topics of Complex Analysis are complex numbers, functions of a complex variable, limits and continuity, analyticity, Cauchy-Riemann equations, harmonic functions, integration, Cauchy's theorem and its consequences. Topics of Discrete Math are logic, proofs, mathematical induction, divisibility, the greatest common divisor, Euclid's algorithm, prime numbers, Boolean functions and applications, counting, introduction to graph theory.

MATH4176 Numerical Analysis for Engineers (3 Credits)

This course introduces basic numerical toolsets needed for Electrical and Computer Engineering (ECE) students to solve problems arising in different areas of ECE including

signal processing and linear system theory. The concepts and techniques are explained through the introduction of ECE- based applications via modem software. The course coverage includes propagation of errors and stability of algorithms, solving systems of linear and non-linear equations, least square regression and curve fitting, numerical integration, differentiation and approximation, numerical solution for ordinary and partial differential equations.

ECCE5422 Selected Topics in Control Systems (3 Credits)

(Prerequisite: ECCE4416 or MCTE4250)

A seminar-type course which covers topics of current interest in control systems design and analysis. the subject matter of this course will vary from year to year.

ECCE5432 Programmable Logic Control Systems

(Prerequisite: ECCE3206 and ECCE4416)

Control system components modeling and design of sequential controls, Review of sensors and actuators of interest, Programmable controllers (PLCs): principles, interfaces and programming. Programmable controller's communications and networking, User interfaces, Process monitoring and visualization, Supervisory control and data acquisition systems (SCADA).

ECCE5433 Modern Control Systems (3 Credits)

(Prerequisite: ECCE4416)

State space representation of dynamic system. Linearization of nonlinear systems. Solutions f state space equations. Controllability and observability. Pole placement design technique. Design of observers. Introduction to the optimal design in control. Review of frequency domain analysis. Nyquist criteria for Stability and relative stability. Design of compensators is the frequency domain. case studies

ECCE5443 Optimization Techniques in Engineering (3 Credits)

(Prerequisite: MATH3171)

Linear programming. Simplex method. Duality theory. Network flow problems. Elements of integer programming. Nonlinear programming. A brief overview of interior point methods and global optimization techniques.

ECCE5445 Control Systems Design (3 Credits)

(Prerequisite: ECCE4416 or MCTE4250 or MCTE4450)

State space representation of dynamic system. Linearization of nonlinear systems. Solutions of state space equations. Controllability and observability. Pole placement design technique. Design of observers. Introduction to the optimal design in control. Review of frequency domain analysis. Nyquist criteria for Stability and relative stability. Design of compensators is the frequency domain. Case studies.

ECCE5452 Computer-Aided Instrumentation (3 Credits)

(Prerequisites: (ECCE4456 or ECCE4455), ECCE4227)

Introduction to fundamentals of measurement and Instrumentation systems with hardware and software components, Principles and implementation of interfacing the computer and stand-alone instruments with real world signals, Fundamentals of data acquisition with focus on PC-based operation of data acquisition systems, Enable design, Installation, Configuration, and Programming of data acquisition systems effectively, Design and implementation of Virtual Instruments.

ECCE5462 Electric Drives

(Prerequisite: ECCE4466 or ECCE4467)

Electrical drives as key to industrialization, along with dc and ac machines modeling. DQ modeling of ac motors. Analogue control of dc motors and classical techniques. Digital control of dc motors and modern techniques. Voltage source and current source inverter fed induction motor drives. PWM techniques and speed control of electrical drives.

Department of Mechanical and Industrial Engineering

كلية الهندسة

COLLEGE OF ENGINEERING

Introduction

The Department of Mechanical Engineering is one of the four engineering departments established with the opening of Sultan Qaboos University in 1986. The department was renamed to "Department of Mechanical and Industrial Engineering" with the introduction of a new program in the department "Industrial Engineering" in 1999. Started in 2002, the department collaborates with the Electrical and Computer Engineering Department in offering undergraduate degree in Mechatronics Engineering. The department offers both undergraduate and graduate degrees in Mechanical and Industrial engineering. The Mechanical Engineering program is accredited by ABET since 2012. The Industrial Engineering program is accredited by ABET since 2007.

Vision

The vision is to be a leading Mechanical and Industrial Engineering (MIE) Department for the quality of its graduates, research and innovation, in the region and beyond.

Mission

The mission of the MIE Department is to provide an intellectual environment for learning, research and innovation, and to serve the community better. This is accomplished by:

1. Providing a comprehensive engineering education with life-long learning skills that encompass innovation, entrepreneurship, ethics and values;
2. Serving local, regional and global industries via effective academia-industry linkage;
3. Promoting collaborations with local and international communities in order to enhance public awareness, advancement of engineering knowledge, and department visibility.

Educational Objectives

The department offers three bachelors of engineering degrees

- Mechanical Engineering
- Industrial Engineering
- Mechatronics Engineering (offered jointly with the Department of Electrical and Computer Engineering)

In alignment with the University, College and Department missions, the Mechanical Engineering Program, with active involvements of all constituencies, has established Program Educational Objectives (PEO). These objectives are to produce graduates who:

- Serve as innovative solution providers and contribute effectively to the welfare of the society and are able to work globally;
- Work independently as well as in a team and are able to communicate effectively;
- Understand emerging technologies and implement them for personal and/or employer success;
- Conduct themselves in a responsible, professional and ethical manner; and
- Pursue advanced education or continue developing professionally with an entrepreneurial mind set to assume positions of technical and management leadership.

The Industrial Engineering Program has established five Program Educational Objectives (PEO). These objectives are to produce graduates who:

- Practice industrial engineering in industries, government sectors and service organizations, both nationally and globally, or pursue higher studies or business entrepreneurships.
- Apply knowledge and skills to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy.
- Apply analytical, computational and modern engineering tools and technologies to accomplish system integration.
- Undertake direct, effective and leadership role in the development of Oman by contributing to the development of its capabilities and the best use of its resources.
- Are knowledgeable in ethical issues, maintain high standards of health, safety and environment, communicate well and function individually and in multidisciplinary teams.

Degrees Requirement

To graduate, a student is required to complete a total of 136 credit hours resulting in the award of a Bachelor Degree in Engineering. The credit hours are allocated to University, College and Program requirements.

Summary of Credits

University Requirements	12
College Requirements	35
Mechanical Department Requirements	25
Industrial Department Requirements	24
Mechanical Major Requirements	52
Industrial Major Requirements	53
Major Electives	12
TOTAL	**136**

The core courses for students in the **Mechanical Engineering Program** include the following courses.

Code	Title	Credits
MEIE2102	Statics	3
MEIE2181	Workshop II	1
MEIE3102	Solid Mechanics	3
MEIE3107	Engineering Drawing and Graphics	3
MEIE3109	Product Design	3
MEIE3121	Dynamics	3
MEIE3122	Machine Dynamics	3
MEIE3141	Thermodynamics I	3
MEIE3142	Thermodynamics II	3
MEIE3161	Materials Science	3
MEIE3181	Electromechanical system	3
MEIE3281	Probability & Statistics for Engineers	3
MEIE4102	Machine Design I	3
MEIE4122	Engineering Systems and Control	3
MEIE4125	Instrumentation and Measurements	4

Code	Title	Credits
MEIE4141	Fluid Mechanics	3
MEIE4144	Heat Transfer	3
MEIE4161	Engineering Materials	3
MEIE4183	Numerical Methods for Engineers	3
MEIE4191	Seminar	1
MEIE4262	Manufacturing Processes	3
MEIE4285	Engineering Economics	3
MEIE5145	Design of Thermal System	3
MEIE5149	Capstone Design	3
MEIE5193	Final Year Project I	2
MEIE5194	Final Year Project II	3
MEIE5288	Innovation and Entrepreneurship	3

The elective courses in the **Mechanical Engineering Program** include the following courses:

Code	Title	Credits
MEIE5013	Refrigeration & Air Conditioning	3
MEIE5019	Internal Combustion Engines & Control of Exhaust Emissions	3
MEIE5101	Engineering Vibration	3
MEIE5106	Pressure Vessel & Piping System Design	3
MEIE5110	Applied Finite Element Methods	3
MEIE5121	Model. & Simul. of Eng. Systems	3
MEIE5122	Applied Multibody Dynamics	3
MEIE5124	Condition Monitoring and Diagnosis	3
MEIE5127	Analysis and Design of Control Systems	3
MEIE5128	Theory & Practice of Rotor Dynamics	3
MEIE5130	Mechatronics Systems and Applications	3
MEIE5131	Legged Locomotion of Robots and Animals	3
MEIE5132	Smart Materials and Structures	3
MEIE5141	Solar Energy Systems	3
MEIE5142	Solar Thermal Processes	3
MEIE5146	Renewable Energy	3
MEIE5147	Energy Conservation and Management	3
MEIE5148	Desalination	3

MEIE5151	Fundamentals of Turbomachinery	3
MEIE5152	Fundamental of Thermal Energy Storage Systems	3

Code	Title	Credits
MEIE5162	Corrosion Engineering	3
MEIE5165	Introduction to Fracture Mechanics	3
MEIE5166	Introduction to Nanotechnology Engineering	3
MEIE5167	Mechanics of Composite Materials	3
MEIE5182	Fundamentals Of Biomechanics	3
MEIE5190	Special Topics	3
MEIE5264	CAD/CAM	3

The core courses for students in the **Industrial Engineering Program** include the following courses:

Code	Title	Credits
MEIE2129	Basic Mechanics	3
MEIE3107	Engineering Drawing & Graphics	3
MEIE3269	Mathematics of Linear Programming	3
MEIE3181	Electromechanical Systems	3
MEIE3102	Solid Mechanics	3
MEIE3159	Thermofluids	3
MEIE3262	Materials Science and Engineering	3
MEIE3271	Methods of Operations Research	3
MEIE3284	Industrial Information System	3
MEIE3292	Work system Analysis and Design	3
MEIE3281	Probability & Statistics for Engineers	3
MEIE4224	Quality Engineering and Six Sigma	3
MEIE4222	Production Planning and Control	3
MEIE4265	Stochastic Optimization	3
MEIE4285	Engineering Economics	3
MEIE4218	Advanced Probability & Statistics	3
MEIE4272	Simulation Models	3
MEIE4262	Manufacturing Processes	3
MEIE5273	Product Design and Manufacturing	3

MEIE5275	Automated Industrial Systems	3
MEIE4201	Ergonomics and Safety	3
MEIE5291	Project I	2

Code	Title	Credits
MEIE5262	Industrial Systems Design	3
MEIE4275	Facilities Design and Logistics	3
MEIE5288	Innovation and Entrepreneurship	3
MEIE5295	Seminar	0
MEIE5292	Project II	3

The elective courses for the **Industrial Engineering program** include the following courses:

Code	Title	Credits
MEIE4125	Instrumentation & Measurement	3
MEIE4286	Management for Engineers	3
MEIE5202	Industrial Safety	3
MEIE5222	Introduction to Healthcare Engineering	3
MEIE5224	Six Sigma Methodology	3
MEIE5263	Design for Manufacturing	3
MEIE5271	Decision Analysis Models and Applications	3
MEIE5233	Maintenance and Reliability Engineering	3
MEIE5265	Computer Integrated Manufacturing	3
MEIE5280	Sustainable Manufacturing Process	3
MEIE5285	Technology Transfer	3
MEIE5287	Project Management	3
MEIE5286	Supply Chain Management	3
MEIE5290	Data Mining	3
MEIE5297	Special Topics	3

Course Description

MEIE2102 Statics (3 Credits)

(Prerequisites: PHYS2107)

Statics is a fundamental course for engineering students. The objective of the course is to introduce the Mechanical Engineering Students to the basics of equilibrium conditions of particles and rigid bodies. The course will integrate the knowledge of the students in the fields of mathematics and physics to understand nature of forces and moments; friction and structural mechanics; center of gravity and moment of inertia. The course will cover basic force and moment vectors, equilibrium of particles and rigid bodies, structural analysis, center of mass and moment of inertia.

MEIE2129 Basic Mechanics (3 Credits)

(Prerequisites: PHYS2107)

This course introduces students to the basic mechanics of particles and rigid bodies. The course consists of two parts, statics and dynamics. In the statics part, the students are introduced to the concept of force, moment, resultant, free body diagram, equilibrium state and friction. In the dynamics part, the students are introduced to the concept of velocity, acceleration, inertia forces, centrifugal forces, particle and rigid body dynamics.

MEIE2181 Workshop II (1 Credits)

(Prerequisites: ENGR1600)

As well as giving an extensive grounding in theoretical aspects of engineering, the professional engineer needs to appreciate the methods by which things are made and to understand and respect the skills involved in these processing. An elementary knowledge of manufacturing techniques is an essential for many undergraduate courses, so that some workshop experience is now regarded as necessary before starting an engineering course or in the initial year of that course. This course gives a “hands on” element in the workshop environment (using lathe, milling, drilling machines and other cutting machines). It also introduces the various welding techniques.

MEIE3102 Solid Mechanics (3 Credits)

(Prerequisites: MEIE2102 or MEIE2129)

Principles of basic mechanics are extended to cover range of simple stress calculations that all mechanical engineers should understand. These situations include concepts of normal and shear stress, concepts of normal and shear strain, relationship between stress and strain, normal stress and deformation in axially loaded members, shear stress and angle of twist in torque loaded members, stresses and deflection in beams, stresses in pressure vessels, statically indeterminate problems, and buckling of columns.

MEIE3107 Engineering Drawings and Graphics (3 Credits)

(Prerequisites: FPEL (0560 or 0600 or 0601 or 0602 or 0603 or 0604)

Engineering drawing is the technical language of engineers and technicians in academic or industrial settings. This course provides introduction to the theory and standards of technical drawings, computer aided solid modelling. The course covers theory of technical drawing and modeling of two and three-dimensional objects. Topics covering in the theory are: conventions and standards of engineering drawing, sketching techniques, theory of projections, rules of dimensioning, auxiliary views, isometric views, pictorial views and tolerencing. The course extensively covers two and three-dimensional geometric modeling using latest CAD programs. Student will learn how to create solid models of parts and assemble them through several tutorial sessions. Modifying geometry, dimensioning, storing and retrieving predefined shapes, generating multiviews, designing and manipulating drawing sheets are also taught.

MEIE3109 Product Design (3 Credits)

(Prerequisites: MEIE3107)

This is a project based course that covers the product design process. Topics include: introduction; product design strategies; identification of customer needs; translation of customer needs into product design specifications; concept generation, selection and testing; product architecture with focus on developing interfaces; prototyping and design for manufacturing. An idea of patents and intellectual property, and economics of product design will be discussed.

MEIE3121 Dynamics (3 Credits)

(Prerequisites: MEIE2102)

This course includes Rectilinear and curvilinear motion of particles and rigid bodies, kinematics and kinetics of particles and rigid bodies, rotational and translational motion of rigid bodies, principle of work and energy in particles and rigid body dynamics, and principle of impulse and momentum in particle and rigid body dynamics.

MEIE3122 Machine Dynamics (3 Credits)

(Prerequisites: MEIE3121)

This course includes dynamic analysis and design of machines, kinematic analysis of mechanisms, cams, gears, force analysis, flywheels, balancing of machines-rotating and reciprocating unbalance, mechanical vibration, and case studies.

MEIE3141 Thermodynamics I (3 Credits)

(Corequisite: PHYS2108)

This fundamental course introduces basic concepts and laws of thermodynamics through a balanced handling of theory and engineering applications. Main topics include: Forms of energy. Systems and control volumes. Properties, states, processes and cycles. Heat and work. The zeroth law of thermodynamics. Phase diagrams and property tables. Equations of state. The first law of thermodynamics. Heat engines and heat pumps. The second law of thermodynamics. The Carnot cycle. The Clausius inequality. Entropy.

MEIE3142 Thermodynamics II (3 Credits)

(Prerequisites: MEIE3141)

This course is the continuation of Thermodynamics I course (MEIE3141). The course will review the first and the second laws of thermodynamics, entropy and entropy generations for different thermodynamics systems. The course will discuss and analyze exergy, different power cycles, refrigeration and heat pump systems, air-conditioning processes, reacting mixture and combustion. Various examples will be discussed and analyzed throughout the course. Different power cycles efficiency will be discussed and analyzed. Different cycle components will be introduced and discussed, so students can relate their knowledge to engineering applications.

MEIE3159 Thermofluids (3 Credits)

(Co-requisite: PHYS2108)

This fundamental course introduces basic concepts and laws of thermodynamics and fluid mechanics through a balanced handling of theory and engineering applications, properties of pure substances, mass and energy transfer, first law of thermodynamics (closed and open systems), second law of thermodynamics (closed and open systems), basic concepts of fluid mechanics, Bernoulli equation and flow in pipes, head losses in pipes and pipe network. Students are expected to conduct experiments and write a report.

MEIE3161 Materials Science (3 Credits)

(Prerequisites: CHEM1071)

This course is designed to introduce the students to Materials Science and Engineering. Topics covered include the following: Atomic and Crystal Structures, Imperfections in crystalline materials, Mechanical properties of materials, fracture of metallic materials, phase diagrams and corrosion. In addition engineering materials (eg. alloys, polymers, ceramics, composites and advanced materials) and their properties and applications are introduced to the students.

MEIE3181 Electromechanical Systems (3 Credits)

(Prerequisites: MATH2107, PHYS2108)

This course introduces the fundamentals of electrical circuit analysis, electric machines and simulation of electromechanical systems. DC and AC circuits are discussed in this course, and students will be exposed to hands-on experience with electrical circuits. Moreover, simulation of electromechanical systems through finding their transfer functions is practiced. The course also covers the capabilities and limitations of different types of DC and AC electric machines in various drive applications.

MEIE3262 Materials Science and Engineering (3 Credits)

(Prerequisites: CHEM1071)

Materials Science and Engineering course introduces the students to different engineering

materials; metals and alloys, polymers, ceramics and composites. Topics included are structures and mechanical properties and applications of different materials, engineering alloys, polymers, ceramics, composites, advanced materials and corrosion.

MEIE3269 Mathematics of Linear Programming (3 Credits)

(Corequisite: MATH3171)

This course focuses on the mathematical techniques useful to understand and apply of Operations Research and their applications in engineering. Topics include the optimal solution of deterministic mathematical models, modeling process, theory of linear programming, the simplex method, duality theory and sensitivity analysis.

MEIE3271 Methods of Operations Research (3 Credits)

(Prerequisites: MEIE3269)

This course focuses on the optimization methods and algorithms to solve Operations Research problems arising in engineering applications. Topics include the dual simplex, branch & bound, cutting plane, algorithms to solve network problems, dynamic programming, goal programming, nonlinear programming, etc. Specialized package software will be also used in order to solve real-life engineering applications in reasonable amount of time.

MEIE3281 Probability & Statistics for Engineers (3 Credits)

(Prerequisites: MATH2107)

This course emphasizes on the role of probability and statistics in engineering. The course will cover data summary and presentations; Introduction to probability; Discrete and continuous probability distributions; Hypothesis testing; Curve fitting, regression and correlation; Introduction to statistical quality control; Also, the use of Computer applications in statistical analysis will be emphasized with its application to engineering problems.

MEIE3284 Industrial Information System (3 Credits)

(Prerequisites: COMP2002)

Industrial Information Systems presents a body of knowledge applicable to many aspects of industrial and manufacturing systems. This course provides a background in, and an introduction to, the relevant information technologies and shows how they are used to model and implement integrated IT systems.

MEIE3292 Work System Analysis & Design (3 Credits)

(Prerequisites: MEIE3281)

The objective of this course is to provide students with skills in systematic analysis of work methods, work measurement and work design to improve productivity. Topics include: Methods Engineering concept; Methods analysis tools and techniques, Methods improvement principles, Charting methods, Operations analysis; Motion study and Work measurement techniques, Time study, performance rating and allowances, Predetermined time system, Work sampling; Standards development. The course contains a term project, where the students work on teams to study a real-life task to improve it.

MEIE4102 Machine Design I (3 Credits)

(Prerequisites: MEIE 3102, MEIE 3107)

This course deals with design of basic machine elements. The course is intended to present the fundamental theory of machine design and teach students how to design and analyze machine components. It utilizes the background of knowledge in mechanics of materials and properties of materials. It gives the student straightforward tools for stresses, strains and strengths analyses of machine components subjected to axial, torsional, bending and combined loading. The course starts by introducing students to the various types of stresses and the different types of failure theories of static and cyclic loading conditions. The course will then cover the various methods of designing different machine components such as springs, shafts, gears, screws and bearings using appropriate fundamentals and failure theories. The domains of applicability of the course fundamentals in a wide range of engineering applications are also discussed. Emphasis is placed on design and not simply on problem solving or analysis. This course is designed to develop sound judgment and practice in design.

MEIE4122 Engineering System and Control (3 Credits)

(Prerequisites: MEIE3121, MATH4174)

Introduction to control systems, mathematical models of physical systems, input-output and state variable models, characteristics of feedback control systems, design specifications of feedback control systems, stability of linear feedback systems, the root-locus method, frequency response methods, stability in the frequency domain, design of feedback control systems.

MEIE4125 Instrumentation & Measurements (4 Credits)

(Prerequisites: MEIE3181, MEIE3281)

This course reviews the measurement systems; static and dynamic characteristics of signals; measurement system behavior; uncertainty analysis; Analog electrical devices and measurements; Sampling and data acquisition. Measurement of motion, force, torque, pressure, flow, temperature, magnetic flux; Signal conditioning and transmission; Computer aided data acquisition and analysis; Case studies. Throughout the course the students will learn how to design and conduct an experiment as well as to analyze and interpret the data.

MEIE4141 Fluid Mechanics (3 Credits)

(Prerequisites: PHYS2108)

This course covers the fundamental principles of fluid mechanics: fluid properties, fluid statics and kinematics, governing laws related to fluid flow (continuity, momentum and energy equations) and their applications, dimensional analysis, concept of laminar and turbulent flows, flow in pipe, drag and lift forces for simple bodies, introduction to compressible flows.

MEIE4144 Heat Transfer (3 Credits)

(Prerequisites: MEIE3141, MEIE 4141)

The course covers the fundamentals of heat transfer mechanisms (conduction, convection, and radiation): heat transfer problem analysis methodology, heat conduction equations in various geometries, one-dimensional steady heat

conduction, electrical network analogy, fins, transient heat conduction, forced and free convection subjected to internal and external heat transfer surfaces, heat exchangers analysis, basic concepts of boiling and condensation.

MEIE4161 Engineering Materials (3 Credits)

(Prerequisites: MEIE3161)

This course concentrates on engineering materials, their properties and use in design or performance enhancement. Topics include: classification of engineering materials, their properties, and behavior; metal and alloys, plastics and rubber, ceramics; composites, manipulation of material properties; Ashby method for material selection; emphasis on Mechanical Engineering applications. For metals: effects of work hardening and heat treatment, corrosion, and elevated temperature properties; for plastics and rubber: viscoelasticity, stress relaxation and creep, and phase transitions; for ceramics: flaw-dominated strength, fracture energy, and statistical determination of strength; for composites: thermal and environmental effects on properties, tailoring material properties for specific applications.

MEIE4183 Numerical Methods for Engineers (3 Credits)

(Prerequisites: COMP2002 or ENGR2217, MATH3171)

This course covers the basics of numerical methods for the solution of applied problems in engineering. Course emphasizes an understanding of the mathematics underlying the various numerical methods that have developed for solving linear and nonlinear problems and for approximating functions using polynomial approximations, splines and curve fitting. The course includes a treatment of numerical differentiation, numerical integration and an introduction to the computational solution of ordinary differential equations.

MEIE4191 Seminar (1 Credit)

(Prerequisites: None)

Presentations on current engineering topics and industrial practices. The course reflects current trends in research and development in Mechanical Engineering, and emerging industrial applications of Mechanical systems. Students will choose a topic

for presentation in consultation with a faculty member as seminar advisor. The students will collect the literature, read it, prepare a summary of it and present it in the seminar.

MEIE4201 Ergonomics & Safety (3 credits)

(Prerequisites: MEIE3292)

The objectives of this course are to expose students to the field of Ergonomics/ Human Factors engineering so as to enable them to identify safety problems and their nature as they relate to the human involved and to develop skills in ergonomic design for improved efficiency, health and safety. Topics include Ergonomics/ Human Factors Engineering concept; Human capabilities and limitations: Anthropometry, Physiology and Biomechanics; Manual work design; Workplace, equipment and tool design; Human-machine-environment system design: Design and layout of controls and displays; Physical environment; Ergonomics assessment and implementation of ergonomics programs.

MEIE4218 Advanced Probability & Statistics (3 credits)

(Prerequisites: MEIE3281)

The course includes the following topics: design and analysis of variance, single-factor experiment, simple linear regression and correlation; several factors (factorial experiments); multiple linear regression two-level factorial designs, and two-level fractional factorial designs as well as the use of computer applications in statistical analysis. The examples and exercises strongly emphasize engineering applications through software packages.

MEIE4222 Production Planning & Control (3 Credits)

(Prerequisites: MEIE3281, Corequisite:MEIE3269)

This is an introductory course in the area of analysis and control of production systems, with an emphasis on short to intermediate term decision making and quantitative techniques. The topics to be covered will include an introduction to production systems; forecasting; inventory systems; aggregate planning; production,

capacity and material planning; job sequencing and operations scheduling; integrated production planning including manufacturing resource planning (MRP II) and just in time Manufacturing (JIT); and an introduction to supply chain.

MEIE4224 Quality Engineering and Six Sigma (3 Credits)

(Prerequisites: MEIE3281)

This course provides students with the statistical tools necessary to solve quality problems in the manufacturing and service industries. The course covers introduction to the philosophy and basic concepts of quality improvement; control charts for variables and attributes; estimation of process parameters; acceptance sampling; issues of standardization; and computer applications to statistical quality control. This course also introduces students to Six Sigma.

MEIE4262 Manufacturing Process (3 Credits)

(Prerequisites: MEIE3161 or MEIE3262)

Introduction to manufacturing, manufacturing engineering and manufacturing processes. Casting processes including sand casting, permanent mold casting and disposable plaster mold casting. Pattern, mold and die design and casting defects. Engineering metrology, dimensional tolerances, testing and inspection, and quality assurance. Metal forming including rolling, forging, extrusion, drawing, and swaging processes. Welding process and technology selection.

MEIE4265 Stochastic Optimization (3 Credits)

(Prerequisites: MEIE3269, MEIE3281)

This course extends the knowledge earned in previous Operations Research courses and their application in order to cover the stochastic context. Topics include decision theory, queuing theory, probabilistic models, recourse paradigm and game theory.

MEIE4272 Simulation Models (3 Credits)

(Prerequisites: MEIE4271 or MEIE4250 or MEIE4265)

In this course students will learn the theoretical background of simulation and how to apply it to real world systems. This course deals with this category of systems. Topics will include modeling techniques, introduction to queuing theory, random number generators, discrete-event simulation, Monte Carlo simulation, simulated data analysis, and simulation variance reduction techniques. Students will learn how to use integrated simulation/animation environment to create, analyze, and evaluate realistic models using simulation software (ARENA).

MEIE4275 Facility Design and Logistics (3 Credits)

(Prerequisites: MEIE4222)

This course covers the basic principles of plant (factory) design and layout: introduction to facilities planning, facility location; requirements for facilities design, flow, space and activity relationships, personnel requirements; facility layout; computerized layout planning; logistics and material handling systems; storage and warehousing operations.

MEIE4285 Engineering Economics (3 Credits)

(Prerequisites: MATH2107)

This course is an introduction to engineering economics, time value of money, discounted cash flow calculations, present-worth comparisons, equivalent annual-worth comparisons, rate-of-return comparisons, structural analysis of alternatives, financial analysis and balance sheet, accounting and depreciation, effects of inflation, sensitivity analysis, industrial practices, break-even analysis, and engineering applications involving economical analysis.

MEIE5145 Design of Thermal Systems (3 Credits)

(Prerequisites: MEIE3142, MEIE4144, MEIE4183)

This course is designed to focus on engineering systems that involve thermal and fluid transport. It integrates thermofluid fundamentals (thermodynamics, fluid mechanics and heat transfer) along with engineering economics, optimization techniques, and computer programming/software. It covers system design concepts, detail design, mathematical modeling, optimization techniques, steady-state analysis of components of thermofluid systems, e.g., pumps,

fans, compressors, heat exchangers, turbines, cooling towers and fluid distribution networks. Students will work on the projects that focus on thermofluid system, sizing of components, overall system design and performance analysis using computer programing and/or dedicated software packages.

MEIE5149 Capstone Design (3 Credits)

(Prerequisites: MEIE3109, MEIE4102)

Capstone Design provides the senior mechanical engineering students with a realistic understanding of the design process. The course is concern with developing students attitudes, approaches, design techniques and tools. The students will apply their knowledge to design a component and/or product by working on a term project. They will work in teams, prepare written and oral presentations, and discuss the economical, environmental, and ethical aspects of a proposed design. Main topics include: detailed design of a mechanical systems, modeling and simulation in design, materials selection and materials in design, reliability/safety, economic decision making, and communicating the design and applications.

MEIE5193 Final Year Project I (2 Credits)

(Prerequisites: MEIE4144, MEIE5149)

Final Year Project signifies the culmination of study towards a Degree of Bachelor of Science (B.Sc.) in Mechanical and Industrial Engineering (MIE). This course consists of a combination of two phases: Part I (MEIE5193) and Part II (MEIE5194). The course offers the opportunity for MIE students to apply and integrate knowledge and skills have gained throughout their studies. Students are thoroughly engaged in solving open-ended engineering design problems. The solution typically require synthesis of design, sound judgment, technical and writing skills, analysis, creativity, innovation and cost analysis. MEIE5193 (FYP-I) topics include identifying customer/supervisor requirements; translating requirements into specifications in line with realistic constraints and design standards ; generating feasible conceptual designs; selecting and testing the best concept. It puts emphases on design architectures, environmental, economic and ethical aspects. Detailed design; design for manufacturing; prototyping and testing will be carried out in MEIE5194 (FYP-II). At the end of his/her work, the student is required to submit a technical report and deliver a poster presentation.

MEIE5194 Final Year Project II (3 Credits)

(Prerequisites: MEIE5193)

The course will focus on detail design. Teach students how to integrate knowledge from the separate courses studied previously and concurrently. The students will tackle open-ended engineering problems whose solutions require a synthesis of design, judgment, technical skills, analysis, creativity, innovation and cost analysis. Afford students the opportunities to practice their skills in preparing and presenting reports. Teach students how to design and conduct experiments, as well as to analyze and interpret data.

MEIE5262 Industrial Systems Design (3 Credits)

(Prerequisites: MEIE4275)

This is a crowning course integrate most content of the IE degree plan. It is open to the senior students of industrial engineering major. This course is emphasizing on applying industrial engineering principles and techniques to analyze, design and/or improve industrial enterprises and services systems by working on a tern project. In addition to bringing together the knowledge gained in many previous courses, the topics of this course include tools and methods for product design and development, design of manufacturing/production systems; manufacturing resources planning; financial analysis and economical justification and consideration of health and safety environmental.

MEIE5273 Product design and Manufacturing (3 Credits)

(Prerequisites: MEIE3262, Corequisite: MEIE4262)

This course examines the process of new product development from an interdisciplinary standpoint (business, engineering, and industrial design and manufacturing). Product design and development, concept generation and selection, parametric feature-based CAD, design for manufacturability (DFM) and assembly (DFA), The cornerstone is a project in which teams of management, engineering, and industrial design students conceive, design, and prototype a physical product. Topics include identifying customer needs, concept generation, product architecture, industrial design, and design-for-manufacturing.

MEIE5275 Automated Industrial Systems (3 Credits)

(Prerequisites: MEIE3181, MEIE4262)

This course is used to introduce automation and computer-integrated concepts for industrial systems. This course is emphasizing on applying control and automation principles and applied these concepts into computerized numerical control machines (CNC), other automated equipments and industrial robotics.

MEIE5288 Innovation and Entrepreneurship (3 Credits)

(Prerequisites: MEIE4285)

Innovation at its simple definition is the process of turning ideas into reality and capturing a value from them. In this course the student will learn how to innovate, create value which will eventually lead to start-up company. Finally, the student will learn how to manage resources i.e. money, people and equipments.

MEIE5291 Project I (2 Credits)

(Prerequisites: MEIE4275 or MEIE4272)

The course will focus on detail design. Teach students how to integrate knowledge from the separate courses studied previously and concurrently. The students will tackle open-ended engineering problems whose solutions require a synthesis of design, judgment, technical skills, analysis, creativity, innovation and cost analysis. Afford students the opportunities to practice their skills in preparing and presenting reports. Teach students how to design and conduct experiments, as well as to analyse and interpret data.

MEIE5292 Project II (3 Credits)

(Prerequisite: MEIE5291)

The course will focus on detail design. Teach students how to integrate knowledge from the separate courses studied previously and concurrently. The students will tackle open-ended engineering problems whose solutions require a synthesis of design, judgment, technical skills, analysis, creativity, innovation and cost analysis. Afford students the opportunities to practice their skills in preparing and presenting reports.

Teach students how to design and conduct experiments, as well as to analyse and interpret data.

MEIE5295 Seminar (0 Credits)

Presentations on current engineering topics and industrial practices. The course reflects current trends in research and development in Industrial Engineering, and emerging industrial applications. The students will listen to the seminar and participate in question session and discussion and write a short report on the materials present during the seminar. They are also asked to prepare a seminar and deliver a presentation to their peers.

MEIE5013 Refrigeration & Air Conditioning (3 Credits)

(Prerequisites: MEIE4144, MEIE3142)

Low temperature applications in industry are studied by the thermodynamics learned in previous courses. Control of the environment temperature and humidity is fundamental to many industrial processes. How to do this involves learning refrigeration and humidification operations learned in these lectures and laboratory work. Computer methods are used for design and prediction of performance.

MEIE5019 Internal Combustion Engines & Control of Exhaust Emissions (3 Credits)

(Prerequisites: MEIE3142)

This advanced course teaches students how to apply the fundamentals they have learnt to the practical field of Internal Combustion Engines. The course of lectures and experimentation cover both petrol and diesel engines. Fuel, ignition, cooling and lubrication systems are student. The formation and control of exhaust emissions are discussed on the basis of combustion characteristics and performance requirements.

MEIE5101 Engineering Vibration (3 Credits)

(Prerequisites: MEIE3121)

The main objective of this course is to study the mechanisms of generation and transmission of machinery vibration. The flexibility of the mechanical components and damping mechanisms are taken into account in designing methods of reduction and isolation of vibration in machines.

MEIE5106 Pressure Vessel & Piping System Design (3 Credits)

(Prerequisites: MEIE4101 or MEIE4102)

This course includes introduction to axial, bending, shear stresses, stress-strain relations, equilibrium equations, failure criteria, stresses in pressure vessels, general design guidelines, design of vessels and piping supports, stresses in cylindrical shells, piping systems, storage tanks, introduction to equipment related to pressure vessels and piping, introduction to various standards such as ASME pressure vessels, ANSI, API, etc.?, case studies of typical engineering design problems.

MEIE5110 Applied Finite Element Methods (3 Credits)

(Prerequisites: MEIE3102)

This course introduces students to the fundamental concepts of the finite element method (FEM), and how to use this powerful design and analysis tool to tackle common mechanical engineering problems. The first half of the course will cover the fundamentals of FEM. The second half will focus on the application of the method. The course emphasizes the various methods of FE modeling and includes practical case studies in which problems are solved and critically examined by means of available commercial software.

MEIE5121 Modeling & Simulation of Engineering Systems (3 Credits)

(Prerequisites: MATH4174)

This course covers the “art” and “science” of translating the behavior of a physical system to an abstract description of that system in the form of differential equations. This course provides students with the “Bond Graph” methodology, utilized for the unified modeling, analysis and synthesis of engineering systems. This course will introduce students not only to the simple building blocks from which models (for hybrid systems)

can be constructed, but also to the mindset with which a modeling challenge must be approached.

MEIE5122 Applied Multibody Dynamics (3 Credits)

(Prerequisites: MEIE3122)

The basic course in dynamics or Basic Mechanics often deals well with the dynamics of one rigid body. In this course, a systematic approach to the generation and solution of equations of motion for interconnected rigid bodies will be covered. The systems studied consists of multiple interconnected rigid bodies (Robots, beam pump, walking machines,...) the so-called multibody systems. The course covers derivation of the equations of motion using Newton/Euler equations; angular momentum principle; Kane's method; and Lagrange's equations, with more focus on using Kane's method. It will also cover Numerical solutions of nonlinear algebraic and differential equations governing the behavior of multiple degree of freedom systems; Symbolic and numerical computational methods; Computer simulation of multi-body dynamic systems using tools such as Matlab, and the multibody dynamics analysis program AUTOLEV; Treatment of holonomic and non-holonomic constraints, the extraction of data from equations of motion, and computational issues.

MEIE5124 Condition Monitoring and Diagnosis (3 Credits)

(Prerequisite: MEIE3121)

This course includes Maintenance Strategies (Policies), Critical Machinery, Common machinery failures, Root-causes of, Economics of Maintenance, Machinery Reliability, Condition Monitoring: Observation, Vibration, Acoustic Emission, Ultrasound, Performance, Oil Analysis, Oil Debris Analysis, Thermography, and Corrosion. Condition Monitoring Instruments, Data Acquisition systems, Time and Frequency Domain Analysis of Signals, Statistical Analysis of signals, Trending, Machinery Failures and Diagnostics, Computerized Maintenance Management Systems.

MEIE5127 Analysis and Design of Control Systems (3 Credits)

(Prerequisites: MEIE 4122 or MCTE 4450)

The aim of this course is to provide the student with a clear exposition of the basic principles of frequency-and-time analysis and control design with more emphasis on design for real world applications. The main topics are linear control systems analysis and design in transform domain and time domain, transfer functions and state equations, Frequency response and Nyquist stability, Loop shaping. State feedback controller and observer design, applications to mechanical and mechatronics systems and Computer control.

MEIE5128 Theory & Practice of Rotor Dynamics (3 Credits)

(Prerequisites: MEIE3142)

Rotating shafts are employed in industrial machines such as steam and gas turbines, turbogenerators, internal combustion engines, reciprocating and centrifugal compressors for power transmission. The shafting of these machine installations is subjected to torsional and bending vibration and possibly unstable operation. This demands careful study of the vibratory motion of such systems. The main objective of this course is to study the basic of rotor dynamics with the help of simple rotor models and to demonstrate a number of methods available for calculating the complete dynamical performance of rotors - solving and discussing problems such system critical speeds, forced response, stability, Influence of bearings on rotor vibrations, balancing.

MEIE5130 Mechatronics Systems and Applications (3 Credits)

(Prerequisites: MEIE4125, (MEIE4101 or MEIE4102)

Mechatronics is an interdisciplinary field that integrates Mechanical, Electronics, Control and Computer Engineering in the design of systems and products. The course deals with basic of sensors, actuators, measurements, electronics, microprocessors, programmable logic controllers (PLC), feedback control, robotics and their implementation. The course includes provide hands on working knowledge of real time programming, computer interfacing, mechanical design and fabrication.

MEIE5131 Legged Locomotion of Robots and Animals (3 Credits)

(Prerequisites: MEIE3122)

Introduction to the biomechanical analysis of terrestrial Locomotion based on the mechanical laws of motion. The course covers legged locomotion, as they apply to robots and animals. Topics include Passive Dynamics in Legged Locomotion, Spring like models and running, Raibert Hopping Robots, Energetic of Locomotion, Introduction to Control and Optimality in Locomotion, ZMP and Capture Point Method.

MEIE5132 Smart Materials and Structures (3 Credits)

(Prerequisites: MEIE4125 or MCTE4145)

Generalized configurations and functional descriptions of smart materials, Review of Maxwell Equations, Design of Permanent Magnet circuits and applications, Modeling and dynamic characteristics of 1st and 2nd order systems, Principle of magnetostrictive/piezoelectric materials and their effects, Design of magnetostrictive/piezoelectric actuators, mechanical and electromagnetic analysis of the magnetostrictive/piezoelectric actuators using finite element method (FEM) for both resonant and non-resonant actuators, Design of magnetostrictive/piezoelectric sensors, Electromagnetic analysis of the magnetostrictive/piezoelectric sensors (displacement, temperature, force sensors, accelerometer) using FEM, Static and dynamic characteristics of actuators and sensors.

MEIE5141 Solar Energy Systems (3 Credits)

(Prerequisites: MEIE4144)

The course aims at providing the student with solar energy fundamentals and applications. The course includes Solar geometry, extraterrestrial radiation, solar radiation measurement and estimation. Solar thermo collectors and storage solar thermal system performance. Solar cooling, solar thermal power systems, solar desalination. Solar PV principles and applications.

MEIE5142 Solar Thermal Processes (3 Credits)

(Prerequisites: MEIE4144)

Description: This courses introduces mechanical engineering students to the fundamentals and principles of solar thermal processes which will qualify them for modeling and designing solar thermal systems that works on solar energy. The course focuses on solar radiation calculations and the modeling of solar thermal processes using flat-plate collectors and concentrating collectors.

MEIE5146 Renewable Energy (3 Credits)

(Prerequisites: MEIE3142 or MEIE3159 or MCTE4230)

This course introduces through a balanced handling of theory of the fundamentals of renewable energy processes and engineering application of basic principles of renewable energy sources, such as solar energy and solar radiation, energy from the ocean, tides energy, geothermal energy, biogas production, photo voltaic, fuel cells, wind energy and fission and fusion reactions.

MEIE5147 Energy Conservation and Management (3 Credits)

(Prerequisites: MEIE3142 or MEIE3159)

This course introduces the energy conservation and energy management principles and covers fuels and energy use, forms of energy, trends in energy demand and impact on environment, sustainability and renewable energy sources, review of thermo-fluids science, power cycles and efficiency measures, waste energy recovery and cogeneration in steam and gas turbines and other energy systems and processes. It also covers energy management, energy auditing procedures, tools and instrumentation, energy saving opportunities in industrial as well as building energy systems, electrical motors and variable speed drive and power factor. Students will be exposed to real-world energy conservation and management problems by conducting energy audit of actual energy systems and analysis and economic assess.

MEIE5148 Desalination (3 Credits)

(Prerequisites: MEIE4144)

This course covers: Water resources, Chemistry of saline water, thermal desalination, Reverse Osmosis, Scale formation; pre-and post-treatment operations. Economic consideration of various desalination processes.

MEIE5151 Fundamentals of Turbomachinery (3 Credits)

(Prerequisites: MEIE3142, MEIE4141)

The course introduces the fundamentals of turbomachines machines including pumps turbines and compressors. Comprehension of dynamics of the turbomachinery and its industrial applications. The understanding of the concept fluid power transformation and design of fluid machines. Introduction to fundamentals of turbomachinery design and selection process as per the industrial requirements, standards and codes.

MEIE5152 Fundamental of Thermal Energy Storage Systems (3 Credits)

(Prerequisites: MEIE3142)

This course is intended to provide students with an overview on energy storage schemes/devices and a discussion of how energy storage systems can be used to benefit the energy efficient concept. The course will explain the engineering concepts, operating principles, physics behind them, characterization methods and advantages of each energy storage system.

MEIE5162 Corrosion Engineering (3 Credits)

(Prerequisites: MEIE4161)

Corrosion engineering course provides the students with a fundamental understanding of corrosion through discussion of electrochemistry, the forms of corrosion, the method of testing, and protection techniques. The corrosion and related chemical properties in general are also introduced as a main topic in the course. The design implications of selecting materials for corrosion resistance are discussed too. Term papers, case studies and projects are used to enhance the students understanding and introduce them to the real problems in the field of engineering.

MEIE5165 Introduction to Fracture Mechanics (3 Credits)

(Prerequisites: MEIE3161 and (MEIE3102 or MCTE3230)

This course provides a basic understanding of Fracture Mechanics, the study of

propagation of existing cracks leading to failure. It is aimed at a basic understanding of the causes of fatigue and fracture failure, design against fracture, and methods of failure prediction. This can be a useful course for students of Mechanical, Civil, and Aerospace Engineering, and Material Science.

MEIE5166 Introduction to Nanotechnology Engineering (3 Credits)

(Prerequisites: MEIE4161)

This course will introduce the basic concepts of nanotechnology. The course will cover the following topics: introduction to nanotechnology, nano-materials classes and fundamentals, properties, synthesis and characterization, nano fabrication techniques, introduction to MEMS and NEMS sensors, nanotechnologies in health and environment.

MEIE5167 Mechanics of Composite Materials (3 Credits)

(Prerequisites: MEIE3161 and (MEIE3102 or MCTE3230)

This is a technical elective undergraduate course. The course provides an introduction to the mechanics of anisotropic, inhomogeneous composite materials; anisotropy of stress and the general equations of the theory of elasticity and thermoelasticity of the anisotropic 3D solids. The class introduces classification of composite materials, fabrication processes and applications of composites, and micro- and macro-mechanical modeling of composite materials. The elastic behaviour of laminated and fibre-reinforced composites is studied; the effective moduli theory is considered. The fundamentals of fracture mechanics and the applications of fracture mechanics to the mechanical design are introduced. Topics on strength and fracture of composite materials are also covered. Use of computer modeling for the analysis of practical examples of composite is considered. This can be a useful course for students of Mechanical, Civil, and Aerospace Engineering, and Material Science.

MEIE5182 Fundamentals of Biomechanics (3 Credits)

(Prerequisites: MEIE3102, MEIE3121)

Biomechanics is the study of the structure and function of biological systems using principles of mechanics. This course is designed to build the concepts of the students to apply engineering knowledge to biological systems and analyzing them.

The course integrates principles of engineering mechanics and anatomical components to evaluate forces and associated deformations in biological tissues. Particular emphasis has been placed to discuss kinematics and kinetics of the musculoskeletal systems. Specific course topics will include structural and functional relationships in tissues and organs, analysis of forces in human activities, measurements and analysis of stress and strain in biological tissues, energy and power in human activity.

MEIE5190 Special Topics (3 Credits)

(Prerequisites: None)

This course will teach students the state-of-the-art topics in mechanical engineering. The course will focus on recent advances and their applications to solve real world engineering problems in the field of mechanical engineering. Emphasis will be given to use experimental and/or computational tools to find viable engineering solutions. A term project will allow the students, at the same time, to apply the knowledge gained in the class.

MEIE5264 CAD/CAM (3 Credits)

(Prerequisites: MEIE3102, MEIE 3107)

This course is designed to address the geometric modeling, using selected CAD/CAM packages to graphically model parts in 2D, 3D wire-frame and solid; graphic display manipulation; geometrical analysis; graphic and data files management; exchange, and conversion of graphic files to standardized formats such as DXF, IGES. Generating G-codes, post processing G-codes into formats interpretable by given CNC controllers. Editing G-Codes with verification of validity of tool paths in 3D and solid graphical simulation. Disciplines of the numerical control hardware. Rapid prototyping, automation in CAM, integration of machine vision with CAM and applications in manufacturing and data communications.

MEIE4286 Management for Engineers (3 Credits)

The intent of this course is to provide some insight into the nature of management in which the engineer is most likely to encounter the need for an understanding of Management as his career processes. Introduction to Engineering Management

with emphasis on the management functions of planning, organizing, motivating, controlling and leading. The nature and types of decision-making are also discussed.

MEIE5202 Industrial Safety (3 Credits)

A presentation of those aspects of occupational safety and health which are most essential to the first-line supervisor in business and industrial organizations. Emphasis is placed on developing an understanding of the economic, legal, and social factors related to providing a safe and healthful working environment. Main topics include: Safety and Health Management, Concepts of Hazard Avoidance, Standards and Regulations, Hazard Communication, Chemical Hazards, Environmental Control and Noise, Personal Protection and First Aid, Fire Protection, Material Handling and Storage, Machine Guarding, and Electrical Hazards.

MEIE5222 Introduction to Healthcare Engineering (3 Credits)

This course places emphasis, but not limited to, on the application of quantitative techniques to problem solving and decision making related to the management of health care providers such as hospitals, physician group practices, health maintenance organizations, and nursing homes. Topics include management fundamentals, decision-making resource planning and scheduling, productivity measurement and role of information technology in healthcare system.

MEIE5224 Six Sigma Methodology (3 Credits)

The student will learn the Six Sigma methodology through the DMIAC (Define-Measure-Analyze-Improve-Control). The aim is to meet or exceed customer expectations by improving process quality. The Six Sigma methodology objective is to eliminate or manage the source of variations.

MEIE5233 Maintenance and Reliability Engineering (3 Credits)

(Prerequisites: MEIE3281)

Fundamental concepts of reliability; analysis of failure data; reliability models, reliability of systems; reliability testing; maintainability and maintenance models; computer applications.

MEIE5263 Design for Manufacturing (3 Credits)

(Prerequisites: MEIE3107 and MEIE4262)

The course covers the product design process; interaction of materials, processes and design; economic considerations and design considerations for machining, casting, forging forming and other processes of materials transformation; designing with plastics; design for assembly; actual product design projects and case studies from industry and business.

MEIE5265 Computer Integrated Manufacturing (3 Credits)

(Prerequisites: MEIE4262)

This course is designed to address the computerized integration of product design, planning, production, distribution, and management. Intended to provide knowledge for computer integrated manufacturing (CIM) system, including how to apply robot and manufacturing automation. Emphasize methodology and goal for on-line computer control that link all functions in manufacturing plant.

MEIE5271 Decision Analysis Models and Applications (3 Credits)

(Prerequisites: MEIE4265, MEIE4285)

This course provides an overview of modeling techniques and methods 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. Practical applications through real-world model building are described and conducted, including business management, supply chain and logistics, transportation, health care, and homeland security. Each group, which consists 1-3 students, will work on a project throughout the semester, including oral presentations and written reports.

MEIE5280 Sustainable Manufacturing Systems (3 Credits)

Sustainability/sustainable development has become imperative for manufacturing systems, firms, enterprises, industrial estates and/or sectors and countries to survive global competition and satisfy expectations of stakeholder. Nowadays, there is an urgent to adopt sustainability/sustainable development concepts,

analyses and assessments to support manufacturing systems. This course will look at the overall sustainability/sustainable development issues including economic, social and environmental perspectives. The emphasis will be on every process and issue identifying the existing value and moving towards target value and the assessment of sustainability and sustainable development index for each aspect, pillar and manufacturing enterprises, industrial estates and/or sectors and countries.

MEIE5286 Supply Chain Management (3 Credits)

(Prerequisites: MEIE4222)

This course brings together the strategic, planning, and operational roles of the supply chain. The function of supply chain management is to design and manage the processes, assets, and flows of material and information required to satisfy customers' demands. Globalization of economy and electronic commerce has heightened the strategic importance and of supply chain management and created new opportunities for using supply chain strategy and planning as a competitive tool.

MEIE5287 Project Management (3 Credits)

(Prerequisites: MEIE3290 or MEIE4161)

This is an intermediate course in the area of project management, with an emphasis on short to intermediate term decision making and quantitative techniques. The course introduces the key activities for project success and help to identify and understand the importance of key people in every project. Project planning, budgeting and cost estimation for a project are covered in details. Furthermore, the knowhow required to achieving timely completion of projects through proper scheduling is addressed. In addition, the course covers the important aspect of identifying, assessing, and controlling risk throughout the execution of projects.

MEIE5290 Data Mining (3 Credits)

This course on data mining will cover methodology, major software tools and applications in this field. By introducing principal ideas in statistical learning, the course will help students to understand conceptual underpinnings of methods in data mining. Considerable amount of effort will also be put on computational aspects of algorithm implementation.

To make an algorithm efficient for handling very large scale data sets, issues such as algorithm scalability need to be carefully analyzed. Data mining and learning techniques developed in fields other than statistics, e.g., machine learning and signal processing, will also be introduced.

MEIE5297 Special Topics (3 Credits)

This course will teach students the state-of-the-art topics in industrial engineering. The course will focus on recent advances and their applications to solve real world engineering problems in the field of industrial engineering. Emphasis will be given to use experimental and/or computational tools to find viable engineering solutions. A term project will allow the students, at the same time, to apply the knowledge gained in class.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Department of Petroleum and Chemical Engineering

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COLLEGE OF ENGINEERING

Introduction

The Petroleum and Chemical Engineering Department (PCED) in the College of Engineering at Sultan Qaboos University was established in 1986. Considering the country's development, the department thereafter underwent several transformations. In 2003 a comprehensive self-study led to two independent undergraduate degree programs in Petroleum and Natural Gas Engineering (PNGE) and Chemical and Process Engineering (CHPE) which are both currently accredited by the Accreditation Board for Engineering and Technology (ABET). The Department aims at providing a comprehensive state-of-the-art education for its students and thus equipping those with essential skills needed to prepare them for the challenging highly competitive job market in the Petroleum/Chemical sectors. This is achieved through a progressive sequence of subjects well-tailored to build a deep and sound understanding of the principles of engineering, emphasizing reasoning and engineering application in problem solving. All the programs are solidly constructed, with an excellent technology base, to provide sound and internationally acclaimed engineering education. The programs were designed in such a way to allow broad perspective, engendering social, cultural, ethical components, all combined to produce the engineer, who is well aware of his/her leading role in the community.

Vision

PCE vision is to be considered among the top departments in the World, which produces graduates receiving worldwide recognition, and is able to attract top notch faculty.

Mission

PCE mission is to provide students with quality petroleum and chemical engineering education, provide services, and carry out basic and applied research.

The Department will specifically strive to:

- Provide educational experience to produce quality engineers.
- Carry out services that reinforce the public understanding of technology and lead to an improvement in the quality of life.

- Provide an environment, which will enable students and faculty members to contribute to the advancement of knowledge and innovative practice of engineering.

Educational Objectives

The PCE Department offers bachelor degrees in both:

- Petroleum & Natural Gas Engineering (PNGE)
- Chemical & Process Engineering (CHPE)

The Program Educational Objectives (PEO's) of the PNGE/CHPE Programs are to produce graduates who will:

- Become professional and competent engineers
- Demonstrate creativity, innovation, cultural appreciation, and, an understanding of the dynamic global issues that are consistent with sustainable development.
- Pursue higher studies, and/or become entrepreneurs

Degree Requirements

To be awarded a bachelor degree, a student must successfully complete 136 credits of University, College and Departmental Requirements. The courses prescribed and the total credit hours needed for fulfilment of the two programs are given below.

Summary of Credits

University Requirements	12
College Requirements	35
Department Requirements	26
Major Requirements	63
TOTAL	**136**

The Department Requirements are listed below:

Mandatory Courses for PNGE and CHPE (26 Credits)

Code	Title	Credits
CHPE3102	Engineering Thermodynamics	3
CHPE3402	Heat Transfer	3
PNGE3202	Numerical Methods	3
PNGE4101	Statistics for Engineers	3
ECCE3015	Electrical Engineering Fundamentals	3
PNGE5103	Engineering Economy	3
PNGE5203	Management for Petroleum and Chemical Engineers	3
CHPE3302	Fluid Flow	3
CHPE3103	Professional Practice	2

Petroleum and Natural Gas Engineering Program Requirements (57 Credits)

Code	Title	Credits
CIVL3086	Mechanics of Materials	3
ERSC2101	Introduction to Geology I	4
ERSC5051	Petroleum Geology	3
GEOP3041	General Geophysics	3
PNGE2102	Basic Mechanics	3
PNGE3111	Chemistry for Petroleum Engineering	3
PNGE3112	Intro. to Petroleum & Natural Gas Eng.	2
PNGE3212	Rock and Fluid Properties	3
PNGE4212	Drilling Technology	3
PNGE4312	Drilling Technology Lab	1
PNGE4512	Formation Evaluation	3
PNGE4612	Well Testing	3
PNGE4412	Reservoir Engineering	3
PNGE4712	Reservoir Simulation	3
PNGE5102	Health, Safety and Environment	3
PNGE5112	Production Engineering	3
PNGE5115	Project I	2

Code	Title	Credits
PNGE5212	Secondary and Enhanced Oil Recovery	3
PNGE5215	Project II	3
PNGE5412	Field Processing of Natural Gas	3

In addition to the above list of required courses, students have to select two program technical electives from the following list of elective courses.

Petroleum and Natural Gas Engineering Program Technical Electives (6 Credits)

Code	Title	Credits
PNGE 5122	Introduction to Rock Mechanics	3
CHPE 5207	Petroleum Refining Processes	3
CHPE 4102	Polymers	3
CHPE 4302	Desalination	3
ERSC 3021	Structural Geology	3
GEOP 4001	Applied Geophysics I	3
CHEM 5537	Surfactants: Principles & Applications in the Petroleum Industry	3
GEOP 3000	Earthquakes and Society	3

Chemical and Process Engineering Program Requirements (54 Credits)

Code	Title	Credits
CHEM2102	General Chemistry II	4
CHEM3324	Organic Chemistry	4
CHEM3348	Introduction to Chemical and Instrumental Analysis	
CHPE3101	Materials Engineering	3
CHPE3112	Principles of Chemical Processes	3
CHPE4112	Chemical Engineering Thermodynamics	3
CHPE4114	Computer Aided Design	2
CHPE4212	Unit Operations I	3
CHPE4312	Chemical Engineering Lab I	2
CHPE4412	Process Heat Transfer	3
CHPE4512	Chemical Reaction Engineering	3

Code	Title	Credits
CHPE4612	Unit Operations II	3
CHPE4712	Chemical Engineering Lab II	2
CHPE5112	Chemical Process Control	3
CHPE5212	Chemical Engineering Lab III	2
CHPE5312	Project I	2
CHPE5412	Plant and Process Design	3
CHPE5512	Project II	3
CHPE5612	Chemical Process Safety	3

In addition to the above list of required courses, CHPE students have to select three program technical electives from the following list of elective courses.

Chemical and Process Engineering Program Technical Electives (9 Credits)

Code	Title	Credits
CHPE4102	Polymers	3
CHPE4202	Corrosion Engineering	3
CHPE4302	Desalination	3
CHPE4402	Natural Gas Processing	3
CHPE4812	Special Topics I	3
CHPE4912	Special Topics II	3
CHPE5207	Petroleum Refining Processes	3
CHPE5712	Process Integration, Synthesis and Simulation	3
CHPE5812	Heterogeneous Catalysis and Reactor Design	3
CIVL4136	Environmental Engineering I	3
CHPE3212	Chemical Process Industries	3
CHPE5116	Biochemical Engineering	3
CHPE4106	Introduction to Colloids and Interface Science	3
CHPE4206	Introduction to Nanotechnology	3
CHPE4306	Wastewater Treatment	3
MEIE5288	Innovation and Entrepreneurship	3

Course Description for CHPE and PNGE Programs

CHEM3324 Organic Chemistry (4 credits)

(Prerequisite:CHEM1071 or CHEM2101, LANC2161)

The course will give an introduction into the principles of organic chemistry including a definition of organic compounds, bonding and isomerism, structure, nomenclature and reactions of aliphatic and aromatic compounds. Synthesis of some industrial organic compounds will be introduced. Laboratory experiments support the course. A brief introduction to spectroscopy exposes the student to basic principles of a modern method in structure determination.

CHEM3348 Introduction to Chemical and Instrumental Analysis (3 credits)

(Prerequisite: CHEM2102)

This course is designed specifically to non-chemistry majors who need a broad-based introduction to chemical analysis and analytical instrumentation. The course covers fundamentals of modern analytical instrumentation, providing general background theory and principles of operation.

CHPE3101 Materials Engineering (3 credits)

(Prerequisite: CHEM1071 or CHEM2101)

This course covers: Materials engineering; Properties and performance; Crystalline phases; Imperfection in crystalline solids; Solid solution; Elastic and Plastic deformation; Hardness testing; Fatigue and creep testing; Phase diagrams, engineering alloys and Corrosion.

CHPE3102 Engineering Thermodynamics (3 credits)

(Prerequisite: CHEM1071 or CHEM2101, MATH2107)

This course covers: Basic concepts of thermodynamics; PVT of pure fluids and equations of state; First and second laws; Thermodynamic properties of pure fluids; Applications to flow processes.

CHPE3103 Professional Practice (2 credits)

(Prerequisite: LANC2161)

This course introduces the student to basic issues in Engineering Ethic by the study of the morality of engineers' actions, duties and ideals and their interactions and consequences on the society. The societal responsibilities of engineers are analysed through chemical and petroleum engineering code of practice. Thus, students will understand issues such as: moral autonomy, corporate responsibility, whistle blowing, conflict of interest, risk assessment, environment and sustainable development.

CHPE3112 Principles of Chemical Processes (3 credits)

(Prerequisite: CHEM1071 or CHEM2101)

This course covers: Application of physical and chemical principles to problems in chemical and processing industries; Stoichiometry; Processes and process variables, Thermodynamic data; Material balance on non-reactive and reactive systems. General energy balance; Heat of reactions; Energy balance for reactive systems.Department of Petroleum and Chemical Engine

CHPE3302 Fluid Flow (3 credits)

(Prerequisite: CHPE3102)

This course covers: Fluid statics; Newtonian and non-Newtonian fluids; Bernoulli equation; Flow of fluids; Flow meters, Pumps and compressors; Two-phase flow, Fluid flow in porous media, Packed and Fluidized beds; Agitation and mixing.

CHPE3402 Heat Transfer (3 credits)

(Prerequisite: CHPE3302, MATH4174)

This course covers: Concepts and theories of heat transfer; Introduction to different modes of heat transfer; Steady state and transient heat transfer: Conduction, natural and forced convection, and radiation; Heat Transfer coefficients; Introduction to heat exchangers.

CHPE4112 Chemical Engineering Thermodynamics (3 credits)

(Prerequisite: CHPE3102)

The objective of this course is to develop the laws of thermodynamics into working equations, and to cover the fundamental property relations, residual properties, vapor-liquid equilibrium of ideal and non-ideal systems and chemical reaction equilibrium in order to apply these concepts in the design of chemical process equipment.

CHPE4114 Computer Aided Design (2 credits)

(Prerequisite: PNGE3202), (Co-requisite: CHPE4512, CHPE4612)

This course covers: Modeling and simulation; Introduction to computational tools available for the solution of chemical and process engineering problems; Chemical process simulators; Spreadsheets.

CHPE4212 Unit Operations I (3 credits)

(Prerequisite: CHPE3402)

This course covers: Molecular, convective and interphase mass transfer; Transport properties; Continuous and stagewise mass transfer; Absorption/stripping operations; Design of certain separation equipment.

CHPE4312 Chemical Engineering Lab I (2 credits)

(Prerequisite: ENGR3006)

This is the first of a three-semester laboratory course sequence that includes experiments covering the application of fundamental principles of chemical and process engineering to thermodynamics, fluid flow, and heat transfer. Experimental planning, automated data acquisition and report writing are stressed. Safety considerations are emphasized throughout.

CHPE4412 Process Heat Transfer (3 credits)

(Prerequisite: CHPE3402 and CHPE3101)

This course aims at investigating the design and the implementation of industrial heat exchangers. It provides the background needed to understand and master the commercial software packages used by professional engineers for design and analysis of heat exchangers. It also focuses on the types of heat exchangers most widely used by industry, namely shell-and-tube exchangers (including condensers, reboilers and vaporizers), air-cooled heat exchangers and double-pipe (hairpin) exchangers. It provides a substantial introduction to the design of heat exchanger networks using pinch technology, the most efficient strategy used to achieve optimal recovery of heat in industrial processes.

CHPE4512 Chemical Reaction Engineering (3 credits)

(Prerequisite: CHEM3324)

This course covers kinetics of homogeneous and heterogeneous reactions, design of isothermal reactors such as Batch, CSTR and PFR. Other topics include data collection and handling; catalysis and catalytic reactions; non-isothermal reactor design; multiple reactions; and residence time distribution. Petroleum and Chemical Engineer.

CHPE4612 Unit Operations II (3 credits)

(Prerequisite: CHPE4112, CHPE4212)

This course covers: Distillation; Liquid-liquid and solvent extraction; Design of industrial separation equipment. Flowsheeting programs will be used.

CHPE4712 Chemical Engineering Lab II (2 credits)

(Prerequisite: CHPE4312,CHPE4612, CHEM3348, PNGE4101)

This is the second of a three-semester laboratory course sequence that involves experiments, covering the application of fundamental principles of chemical and process engineering to process unit operations. Experimental planning, automated data acquisition and report writing are stressed.

CHPE4812 Special Topics I (3 credits)

(Prerequisite: CHPE3402)

This is one of two Special Topics courses which are used to introduce new subjects in Chemical and Process Engineering in regular course format. Topics of interest to Oman's industrial development will be given priority. Topics given in this course cannot be repeated in CHPE4912 Special Topics II.

CHPE4912 Special Topics II (3 credits)

(Prerequisite: CHPE3402)

This is one of two Special Topics courses which are used to introduce new subjects in Chemical and Process Engineering in regular course format. Topics of interest to Oman's industrial development will be given priority. Topics given in this course cannot be repeated in CHPE4812 Special Topics I.

CHPE5112 Chemical Process Control (3 credits)

(Prerequisite: CHPE4512, MATH3171)

This course introduces the principles of dynamic process modeling and control. Methods and techniques are developed for the analysis, design and simulation of automatic control systems for chemical process plants. Subject covers modeling the static and dynamic behavior of processes; principles of process instrumentation, control strategies; design of feedback, feedforward, and other control structures as well as performing stability analysis of control loops.

CHPE5207 Petroleum Refining Processes (3 credits)

(Prerequisite: CHEM3324 or PNGE3111)

This course describes all the processes involved in modern crude oil refineries such as desalting, atmospheric distillation, vacuum distillation, thermal cracking, catalytic cracking, hydrotreating, catalytic reforming, isomerization, polymerization, absorption processes, adsorption processes, gasoline blending, wastewater treatment, and sulfur removal. It starts with an introduction to crude oil composition and characterization and specifications of the desired products from refineries.

CHPE5212 Chemical Engineering Lab III (2 credits)

(Prerequisite: CHPE4712, CHPE5112)

This is the third of a three-semester laboratory course sequence involving experiments covering the application of fundamental principles of process control as well as reaction engineering in chemical engineering operations. In the process control experiments, the students will practice on areas such as level, flow, pressure and temperature control and instrumentations. Additionally, in the reaction engineering experiments, the batch, continuous and tubular reactors will be covered. Experimental planning, automated data acquisition and report writing are stressed.

CHPE5312 Project I (2 credits)

(Prerequisites: CHPE4114, CHPE4512, CHPE4612, CHPE3103)

This is the first part of the cap-stone design project. Students perform raw material selection, process selection and flow sheeting, mass and energy balance, and plant location.

CHPE 5412 Plant and Process Design

(Prerequisites: CHPE4412, CHPE4512, CHPE4612, PNGE5103)

This course intends to introduce students to the principles of chemical process design, process flow diagrams including symbols, piping and instrumentation, representation of the structure of complex, interconnected chemical processes with recycles streams, general design considerations regarding environmental, health, safety and selection of plant location and layout, process design development, selection, materials of construction and corrosion considerations. Capital and operating cost estimation and profitability analysis.

CHPE5512 Project II (3 credits)

(Prerequisite: CHPE5312, CHPE5412, CHPE5612)

This is the second part of the cap-stone design project. Students perform detailed design of the major equipment, process control, HSE studies, and economic analysis.

CIVL3086 Mechanics of Materials (3 Credit)

(Prerequisite: PNGE2102 or CIVL3216)

A basic course which examines two-dimensional stresses and strains and deflections of statically-determinate members subjected to axial and transverse loads. This lecture course, which forms the basis of subsequent studies of the analysis of structure, is supplemented by tutorials and laboratory work.

PNGE2102 Basic Mechanics (3 credits)

(Prerequisite: PHYS2107)

PNGE students are introduced to the basic mechanics of particles and rigid bodies. The course has two parts. Statics part covers: Concepts of force, Moment, Resultant, Free body diagram; Equilibrium state and friction. Dynamics part covers: Concepts of velocity; Acceleration; Inertia forces; Centrifugal forces; Particle and rigid body dynamics.

PNGE3111 Chemistry for Petroleum Engineering (3 credits)

(Prerequisite: CHEM1071 or CHEM2101)

The course covers: The origin of petroleum; Introduction to organic chemistry; Chemistry of petroleum fluids; hydrocarbon, oxygen, sulfur and nitrogen compounds; Introduction to surface chemistry; Emulsions and surfactants; Corrosion and chemical prevention.

PNGE3112 Introduction to Petroleum & Natural Gas Engineering (2 credits)

This course gives a brief idea about introduction to petroleum and natural gas engineering as part of the petroleum and natural gas engineering curriculum. The class includes Elementary knowledge and assessment of petroleum and natural gas; Overview of petroleum industry and petroleum engineering; Nature of oil and gas reservoirs; Petroleum exploration and drilling; Formation evaluation, Completion and production, Surface facilities, Reservoir mechanics; Improved oil recovery; Relevant terminology and nomenclature.

PNGE3202 Numerical Methods (3 credits)

(Prerequisite: COMP2xxx, MATH3171)

To provide students with the basic knowledge of numerical methods enabling them to appreciate approximation, analyze computational errors; utilize numerical techniques for root-finding, numerical linear algebra, curve fitting, differentiation and integration and numerical solution to ordinary differential equations. Computer software (e.g. Matlab) is used for the implementation and application of the numerical methods' techniques, through tutorials and assignments.

PNGE4101 Statistics for Engineers (3 credits)

(Prerequisite: MATH2107)

This course introduces the students to the basic concepts of statistics and probability that can be used in many engineering fields and in particular in the analysis of experimental data. The examples and exercises emphasize applications in engineering as general and petroleum, chemical, and mineral resources in particular. MINITAB and Excel will be used during the tutorial Lab.

PNGE4212 Drilling Technology (3 credit hours)

(Prerequisite: CIVL3086)

This course gives an introduction to oil well drilling. The aim of this course is to provide a clear coverage of the principals of oil well drilling engineering. The class includes an introduction to drilling, hoisting, drill string design, drilling bits, mud engineering, rig hydraulics, casing design, cementing, blowout control, directional drilling, hole problems, and an introduction to well completion and stimulation.

PNGE4312 Drilling Technology Lab (1 credit)

(Corequisite: PNGE4212)

This course gives the students an introduction to drilling laboratory measurements. The students are asked to prepare, set-up and take measurements in each week according to the lab schedule. The objective is to measure drilling fluid properties. Properties are measured for both drilling mud and drilling cements. Measurements include mud and cement density, mud and cement viscosity, mud and cement fluid loss, and compressive strength of set cement.

PNGE4412 Reservoir Engineering (3 credits)

(Prerequisite: PNGE3212, ERSC3081)

This is an intermediate level reservoir engineering course. Students are introduced to reservoir characteristics; Oil and gas volumetrics; Reservoir mechanics: reservoir energy, drive mechanisms, and recovery factors; Material balance equations: oil and gas material balance, material balance calculations for various reservoir types and applications, drive indexes; Decline curves and reserves.

PNGE4512 Formation Evaluation (3 credits)

(Prerequisite: PNGE3212 or GEOP3041)

This course deals mainly with theories of well log analyses and their applications. The course begins with the description and purposes of formation evaluation using well logs. After revising the formation and rock properties, the Archie Equation and its modified versions are introduced. Main emphasis is on the resistivity concept and porosity. After a brief description of the data acquisition principles, the use of the resistivity, triple porosity, gamma ray and SP logs are discussed and the discussion is strengthened with practical applications. Finally, STOIIP calculations and porosity-permeability relationships are covered with a case study (a full well log analysis) solved in the classroom.

PNGE4612 Well Testing (3 credits)

(Prerequisite: PNGE4412, PHYS2108)

This is an advanced level course designed for formulation and analysis of fluid flow in porous media. Topics covered: Review of the mathematical basis for pressure analysis; Solution of diffusivity equation: steady/semi-steady state and transient; Oil and gas well testing; Multi-rate multi-well pressure transient test; Modern methods.

PNGE4712 Reservoir Simulation (3 credits)

(Prerequisite: PNGE3202, PNGE4412)

Topics covered in this course are: Formulation of single phase; Multidimensional fluid flow equations in porous media; Approximation of partial differential equations using finite difference schemes, grid types and boundary conditions; Solution of the incompressible

fluid flow equation (elliptic PDE), solution of the slightly compressible fluid flow equation (parabolic PDE); Multiphase hydrocarbon reservoir simulation using well established black-oil simulators.

PNGE5102 Health, Safety and Environment (3 credits)

(Prerequisite: CHPE3103)

This course covers: Sources of hazards, inherent hazards; Safety fundamentals in chemical, petroleum and natural gas production processes; Health and safety in work place, industrial hygiene, monitoring and measures; Consequence analysis; Safety procedures and measures; Engineering code of practice, critical ethics analysis. HAZOP Case studies and a Project.

PNGE5103 Engineering Economy (3 credits)

(Prerequisite: MATH2107)

Engineers produce products and services that are employed to make life easier and more enjoyable. The worth of these products and services is measured in economic terms. Engineering Economy deals with the concepts and techniques of analysis useful in evaluating the worth of systems, products, and services in relation to their cost. The course helps students grasp and understand the significance of the economic aspect of engineering, and to be proficient in the evaluation of engineering proposals in terms of worth and cost.

PNGE5112 Production Engineering (3 credits)

(Prerequisite: CHPE4412)

The course introduces students to petroleum production systems. The topics covered are: Overview of surface facilities; Gravel pack completions; Wellbore flow performance and well deliverability; Pressure loss calculations; Matrix acidizing; Hydraulic facturing; Gas lift; Sucker rod pumping.

PNGE5115 Project I (2 credits)

(Prerequisites: PNGE4212, PNGE4512, PNGE4612, PNGE4712, CHPE3103)

This course is the first course of a 2-course 2-semester sequence, which involves professional applications of most of the specialization courses in PNGE curriculum. The objective of these two courses is to give final-year students the opportunity to work in functioning teams to produce optimal Field Development Plan (FDP) for a real Omani hydrocarbon field. The work is conducted in an extensive collaboration with Oman's oil and gas industry. This will build knowledge in many sub-surface disciplines. In Project 1, students will practice industry's standard procedure in areas such as geology, petrophysics, reservoir-engineering and production technology. Project 1 involves the following: geological structure maps and cross-sections for volumetric calculations, log interpretation and formation evaluation for petrophysical data, PVT data analysis, and reserve estimations and prediction of recoveries with understanding of key uncertainties.

PNGE5203 Management for Petroleum and Chemical Engineers

(Prerequisite: PNGE5103)

This course covers the essential elements for managing resources such as planning, organizing, leading and controlling. In addition, the following topics are covered: mineral resources and types; uniqueness of mineral industries; management science techniques and optimization of scarce resources, theory of optimal depletion, exploitation, environmental impacts and sustainable development.

PNGE5212 Secondary and Enhanced Oil Recovery (3 credits)

(Prerequisite: PNGE4412, CHPE3402)

This course provides an overview of secondary and enhanced oil recovery (EOR) techniques and their evaluation. The topics covered are: Frontal-advance theory and application; Mechanisms of water flooding processes, and application to reservoir performance prediction; Water flooding and EOR applications.

PNGE5215 Project II (3 credits)

(Prerequisite: PNGE5115)

This course is the second course of a 2-course 2-semester sequence, which involves professional applications of most of the specialization courses in PNGE curriculum. In Project 2, students will practice industry's standard procedure in areas such as: well design and completion, well testing, filed development scenarios using simulation models and history matching, sensitivity analysis of simulation models, production forecast, surface facility design for processing of produced fluids, HSE, economic analysis and evaluations, well-reservoir-filed management (WRFM), reporting and presentation.

PNGE5412 Field Processing of Natural Gas (3 credits)

(Prerequisite: PNGE5112)

The course is designed to provide students with the basic understanding of gas phase behaviour, gas production and processing. The student will be equipped with basic tools to design and optimize gas processing related problems.

Mechatronics Engineering Program

كلية الهندسة

COLLEGE OF ENGINEERING

Introduction

The Mechatronics Engineering is defined as a synergistic combination of Mechanical Engineering, Electronics and Computer Systems. The College of Engineering started offering the Mechatronics Engineering (MCE) program with the 2002 students' intake. The MCE program is jointly run by the Electrical & Computer Engineering (ECE) and Mechanical & Industrial Engineering (MIE) departments. The program was designed in line with the College of Engineering mission of continuous strive for excellence and to fulfill the needs of human resources for the country's industrialization process in the coming decades in an increasingly competitive world. The program was accredited by the Engineering Accreditation Commission (EAC) of ABET since 2007, and the next visit of ABET will be in 2019.

Vision

The vision of the Mechatronics Engineering Program is to be among the leading and outstanding program of Mechatronics Engineering in the Gulf region and beyond.

Mission

Our mission is to provide an outstanding education in Mechatronics Engineering with a rich diversity of skills, to contribute to the community prosperity through professional services and research, and to prepare graduates able to engage in life-long learning and capable of carrying out engineering practice with competence.

Educational Objectives

Our mission shall be achieved by delivering an educational program with objectives to graduate engineers, who will:

- Develop and innovate products and processes through the synergistic integration of Mechatronics Engineering Systems.
- Continue developing professionally with an entrepreneurial mindset to assume positions of technical and management leadership.
- Recognize the ethical and social responsibilities, and contribute to the societal and global development.

The Mechatronics Engineering Program is spread over eight to nine semesters depending on English language requirement. However, highly motivated, smart and dedicated students do finish their studies earlier than the stipulated duration. It provides a solid foundation in maths and basic science before embarking on program related courses. Through a nice blend of course work and projects, the two departments endow students with the ability to apply knowledge of science, mathematics and engineering to work effectively in multidisciplinary teams, provide leadership and technical expertise, and practice engineering with concern for society and environment.

Degree Requirements

To graduate, a student is required to complete a total of 136 credit hours resulting in the award of a Bachelor Degree in Mechatronics Engineering. The credit hours are allocated to University, College and program requirements as summarized below:

Summary of Credits

University Requirements	6
University Electives	6
College Requirements	35
Major Requirements	80
Major Electives	9
TOTAL	**136**

The Program requirements include 80 credit hours of core courses and 9 credit hours of elective courses. The core courses for students in the Mechatronics Engineering Program include the following courses.

Major Requirements (80 Credits)

Code	Title	Credits
ECCE2016	Circuit Analysis I	3
MCTE3110	Electronics	4
MEIE2129	Basic Mechanics	3
ECCE3016	Circuit Analysis II	3
MCTE4145	Instrumentation & Measurement	3
MCTE3230	Properties and Strength of Materials	3
MEIE3107	Eng. Drawing & Comp. Graphics	3
MEIE3281	Probability & Statistics for Engineers	3
MEIE4102	Machine Design 1	3
MCTE4185	Signals & Systems for Mechatronics	3
MCTE3210	Electromechanical Systems & Actuators	3
ECCE3206	Digital Logic Design	3
MCTE4210	Power Electronics & Drives	3
MEIE4141	Fluids Mechanics	3
ECCE4227	Embedded Systems	3
ECCE5004	Engineering Managements & Economics I	3
MCTE4150	Modeling & Simulation	3
MEIE4183	Numerical Methods for Engineers	3
MEIE3122	Machine Dynamics	3
MCTE5191	Project I	2
MCTE4230	Thermal Sciences	3
MCTE3240	Engineering System Design	2
MCTE5210	Real-time control and interfacing	3
MCTE4450	Control Systems Engineering	3
MCTE4255	Mechatronics System Design	3
MCTE5291	Project II	3
MCTE5142	Robotics	3

The elective courses for the Mechatronics Engineering program Include courses like:

Two courses: 6 credits

Code	Title	Credits
MCTE5420	Pneumatic and Hydraulic Systems	3
MCTE5148	Industrial Control Systems	3
MCTE5410	Industrial Process Control	3
MCTE5430	Industrial Instrumentation	3
ECCE4253	Object Oriented Programming	3
ECCE4422	Digital Control Systems	3
ECCE5433	Modern Control Systems	3
ECCE5453	Mobile Robot Control	3
ECCE4436	Industrial Control Systems	3
ECCE5008	Project Management	3
ECCE5223	Advanced Embedded Systems	3
ECCE5445	Control System Design	3
ECCE5432	Programmable Logic Controllers	3
ECCE4255	Applied Programming & Algorithms for Eng.	3
ECCE5443	Optimization Techniques in Eng.	3
MEIE 5101	Engineering Vibration	3
MEIE5131	Legged locomotion of robots and animals	3
MEIE 5127	Process Control	3
MEIE 5122	Applied Multi-body Dynamics	3
MEIE5146	Renewable Energy	3
MEIE5180	Nanotechnology	3
MEIE5182	Fundamentals of Biomechanics	3
MEIE5288	Innovation and Entrepreneurship	3
MEIE5145	Design of Thermal Systems	3
MEIE5106	Pressure Vessel & Piping System Design	3
MEIE5110	Applied Finite Element Methods	3
MEIE5162	Corrosion Engineering	3

One Course: 3 credits

Code	Title	Credits
MATH4151	Discrete Math and Complex Analysis for ECE	3
MEIE3270	Operations Research	3
BIOL3051	Man and The Environment	3
GEOP3041	General Geophysics	3
PHYS2901	Introductory Astronomy	3
PHYS5010	Solar Energy	3
MATH3340	Discrete Math for CS	3
MATH4452	Introduction to Complex Variables	3
MATH4481	Introduction to Optimization	3
ECCE5443	Optimization Techniques in Eng.	3
MATH3350	Foundations of Math	3
MATH3360	Discrete Math	3
MATH3110	Calculus III	3
MATH3109	Calculus III	3

Course Description

MCTE3110 Electronics (4 credits)

Prerequisite: ECCE2016

Topics cover : Introduction to PN junction diode, Analysis and design of diode circuits, The Bipolar junction transistor (BJT), Analysis and design of BJT amplifier circuits, Field effect transistors, Analysis and design of FET amplifiers and circuits, Operational amplifiers and their applications, Filters and oscillators, Optoelectronic devices and circuits, Computer Aided design and simulation of electronic circuits.

MCTE3210 Electromechanical Systems and Actuators (3 credits)

Prerequisite: ECCE3016

Magnetic circuits, principles of electromechanical energy conversion, actuators for mechatronics applications including relays, solenoids, DC motors, AC motors, special motors, hydraulics and pneumatics.

MCTE3230 Properties and Strengths of Materials (3 credits)

Prerequisite: (PNGE2102 or MEIE2129 or CIVL3216)

This course is aimed to provide an understanding and appreciation of properties and strength of materials used in engineering. In addition the principles acquired in Basic Mechanics course will be extended to discuss stress and deformations and their applications in Mechatronics Engineering. Main topics are: introduction to materials, metals, polymers and smart materials, mechanical, electrical and thermal properties of materials, axial stress and strain, shear, torsion, beam stresses and deflections, combined axial and bending stress, columns, shear and moment diagrams, Mohr's circle introduction, thin-walled pressure vessels, working stresses and factors of safety, statically indeterminate problems.

MCTE3240 Engineering System Design (3 credits)

Prerequisite: MEIE3107

In this course, the students will be introduced to engineering design process. Topics include: introduction to engineering system design, customer requirements analysis, translation of customer requirements to system requirements/specifications, conceptual design, concept selection and testing methods, system synergistic design including detailed design of mechanical, electrical, electronics, and software subsystems, simulation and prototyping.

MCTE3261 Object Oriented Programming (3 credits)

Prerequisite: COMP2002

The course focuses on software techniques and methods for Mechatronics problem-solving using Object Oriented programming language (such as C++ or Java). The course would address some common patterns of program structures that commonly appear in moderate to large pieces of software and various merits of using Object oriented programming in modern Mechatronics System.

MCTE4145 Instrumentation and Measurement (3 credits)

Prerequisite: ((MCTE3110,MEIE3281) or (ECCE3016,MEIE3281))

Review of measurement systems; static and dynamic characteristics of signals; measurement system behavior, uncertainty analysis; Analog electrical devices and measurements; Sampling and data acquisition. Measurement of motion, pressure, temperature; Signal conditioning and transmission; computer aided data acquisition and analysis.

MCTE4150 Modeling and Simulation (3 credits)

Prerequisite: MATH4174

The objective of this course is to provide the students with the "Bond Graph" methodology, utilized for the unified modeling, analysis and synthesis of engineering systems. This course will introduce students not only to the simple building blocks from which models (for hybrid systems) can be constructed, but also to the mindset with which a modeling challenge must be approached.

MCTE4185 Signals and Systems for Mechatronics (3 credits)

Prerequisite: ECCE3016

Signals and systems characteristics and models. Systems defined by differential and difference equations, system modeling. Time and frequency-domain representation and analysis of continuous & discrete time signals and systems, Fourier series and Fourier transform, Laplace transform, z-transform. Investigation of the above concepts using MATLAB.

MCTE4210 Power Electronics and Drives (3 credits)

Prerequisite: MCTE3110 and MCTE3210

This is a basic course in power electronics and electrical drives. It covers, introduction about power electronics and drives, Power semiconductor devices, Single-phase Rectifiers, Three-phase Rectifiers, Choppers (class A, B), Single-phase Inverters, PWM techniques, Single-phase ac voltage controllers, DC motor drives.

MCTE4230 Thermal Sciences (3 credits)

Prerequisite: MATH2108, PHYS2108

This course provides a solid grounding in the theory and applications of engineering thermodynamics and heat transfer. The focus of the thermodynamics part is on the fundamental concepts (e.g., temperature, pressure, internal energy, work, heat, enthalpy, properties of a pure substance), on the first and second laws of thermodynamics, and on engineering applications of thermodynamics. The emphasis of the heat transfer part is on the essential mechanisms of heat transfer by conduction, convection, and radiation

MCTE4255 Mechatronics System Design (3 credits)

Prerequisite: ECCE4227, (MCTE4145 or MCTE4155), MCTE3240

The objective of this course is to allow the students to understand the synergy between mechanical design, computer control and electronic components in arriving at a mechatronics system. Students will be provided with the needed knowledge and understanding of issues related to integrating mechanical, electronic and software components towards building mechatronic devices. Subjects such as actuators, sensors as well as electronics and hardware components for mechatronics will be discussed. The course is project and design oriented and the focus is placed on learning to work with real hardware to provide hands on working knowledge of real time programming, computer interfacing, mechanical design and fabrication and control system design.

MCTE4450 Control Systems Engineering (3 credits)

Prerequisite: MCTE4150, MCTE4185

Fundamentals of feedback control with emphasis on classical and modern techniques and an introduction to discrete-time (computer controlled) systems. Topics include the following: review of input/output and input/state representations of dynamical systems ; feedback control system concepts and components; control system performance specifications such as stability, transient response, and steady state error; analytical and graphical methods for analysis and design - root locus, Bode plot, Nyquist criterion, pole placement, LQR; design and implementation of proportional, proportional-derivative, proportional-integral-derivative, lead, lag, and lead-lag controllers. Introduction to digital controllers - synthesis, implementation, constraints.

MCTE5142 Robotics (3 credits)

Prerequisite: MEIE3122

This is an introductory course in robotics with emphasis on the mathematical tools for kinematics and dynamics of robot arms. Topics include the geometry and mathematical representation of rigid body motion; forward and inverse kinematics of articulated mechanical arms; trajectory generation, interpolation; manipulator dynamics; and topics in manipulator control.

MCTE5148 Industrial Control Systems (3 credits)

Prerequisite: MCTE3210, MCTE4250

This course introduces the practical techniques used with Industrial Automated Systems. The course emphasize on control techniques for industrial components, such as electric motors, variable-speed drives, programmable logic controllers, servomechanisms, sensors, industrial robots. An introduction to NC programming, and CAD/CAM integration is included.

MCTE5191 Project I (2 credits)

Prerequisite: (MCTE4255 or MCTE5255)

Part I of the final year project which extends over two semesters. Topics will depend on student's and supervisor's interest. They may include data acquisition and interpretation, computer models and simulation or design and experimentation. Students are required to give a seminar to discuss the project results and submit a final report.

MCTE5210 Real Time Control and Interfacing (3 credits)

Prerequisite: (MCTE4450 or MCTE4250), ECCE4227

Real-time computer systems for the monitoring and control of laboratory and industrial processes are studied and implemented. Emphasis is on the Software Engineering of embedded systems with hard-real time constraints. Microcontrollers are interfaced with peripherals and used to control mechanical systems. Course work includes several small team project focused on developing software and hardware for an embedded real-time system.

MCTE5291 Project (2) (3 credits)

Prerequisite: MCTE5191

Part II of the final year project which extends over two semesters. Topics will depend on student's and supervisor's interest. They may include data acquisition and interpretation, computer models and simulation or design and experimentation. Students are required to give a seminar to discuss the project results and submit a final report.

MCTE5410 Industrial Process Control (3 credits)

Prerequisite: (MCTE4450 or MEIE4122 or ECCE4416)

The course is with project oriented content and the focus is placed on learning to work on real hardware to provide hands on how to control an industrial process. The course includes an overview on control system components, process diagrams, review of transducers and actuators of interest, signal conditioning instrumentation amplifiers, study of continuous- and discrete-state process, PID industrial controller design, tuning, and implementation, introduction to programmable controllers PLCs, introduction to data acquisition card and Matlab, Introduction to SCADA systems, introduction to CNC machine and G-code.

MCTE5420 Pneumatic and Hydraulic Systems (3 credits)

Prerequisite: (MCTE3210 or MEIE3181 or ECCE4455)

Fundamentals of electro-hydraulic and electro-pneumatic control using different techniques and platforms. Topics includes: Basic components of hydraulic and pneumatic systems, hydraulic and pneumatic circuits and applications, basic electrical controls of fluid systems, fluid logic control systems, servo-hydraulic and servo-pneumatic systems, programmable logic controllers

MCTE5430 Industrial Instrumentation (3 credits)

Prerequisite: (MCTE4155 or ECCE3038 or MEIE4125)

Industrial Instrumentation provides students with sound theoretical and practical training in the operation and maintenance of automated process measurement

systems used in the production of various commodities. Instrumentation Engineers use electronic test equipment to install, troubleshoot, calibrate, maintain and repair electrical/electronic measurement and control instruments. The Topics Mainly Cover the Type Of Instruments For The Measurements And Control Of Process Variables In Various Industries. Students will perform proper installation of instrumentation. They will also learn how to apply electrical/ electronic instruments to measure physical variables such as Flow, Level, Pressure, Temperature, and conduct Liquid Analysis.

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