جامعة الفيصل
Alfaisal University

Mechanical Engineering Program

Alfaisal University, College of Engineering

Revised: May 29, 2016

Curriculum Structure and Study Plan

The Mechanical Engineering curriculum is composed of **135** Credit Hours (CRHs) divided as follows:

I. General Education Requirements (53 CRHs)
1. Mathematics & Statistics (21 CRHs)
2. Basic Sciences (12 CRHs)
3. Humanities (20 CRHs)

II. Core Requirements (82 CRHs)
1. Mechanical Engineering Courses (65 CRHs)
2. College of Engineering Courses (11 CRHs)
3. Technical Electives (6 CRHs)
4. Summer Internship (0 CRHs)

I. General Education Requirements (53 CRHs)

1. Mathematics & Statistics (21 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
MAT 101	Calculus I	3	3	0	2		
MAT 112	Calculus II	3	3	0	2	MAT 101	
MAT 211	Calculus III	3	3	0	0	MAT 112	
MAT 212	Linear Algebra	3	3	0	0	MAT 112	
MAT 224	Numerical Methods	3	3	0	0	MAT 212, CSC 112 or equivalent	
STA 212	Probability and Statistics for Engineers	3	3	0	0	MAT 112	
MAT 213	Differential Equations	3	3	0	0	MAT 112	MAT 212

2. Basic Sciences (12 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
CHM 102	Introduction to Chemistry	3	3	0	1		
CHM 102 L	Introduction to Chemistry Lab	1	0	2	0		CHEM 102
PHU 103	Mechanics and Waves for Engineers	3	3	0	1		MAT 101
PHU 103 L	Mechanics and Waves for Engineers Lab	1	0	2	0		PHU 103
PHU 124	Electromagnetism and Optics for Engineers	3	3	0	1	PHU 103 & MAT 101	
PHU 124 L	Electromagnetism and Optics for Engineers Lab	1	0	2	0	PHU 103 & MAT 101	PHU 124

3. Humanities (20 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ENG 101	Freshman English I	3	3	0	0		
ENG 112	Freshman English II	3	3	0	0	ENG 101	
ENG 222	Technical Writing	3	3	0	0	ENG 112	
PHL 101	Engineering Ethics	3	3	0	0		
ISL 101	Islamic Studies I	2	2	0	0		
ISL 112	Islamic Studies II	2	2	0	0	ISL 101	
ARB 101	Arabic Language and Literature I	2	2	0	0		
ARB 112	Arabic Language and Literature II	2	2	0	0	ARB 101	

II. Core Requirements (82 CRHs)

1. Mechanical Engineering Courses (65 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ME 201	Materials Science and Engineering	3	3	0	1	CHM 102	ME 201L
ME 201L	Materials Science and Engineering Lab	1	0	2	0	CHM 102	ME 201
ME 203	Applied Mechanics: Statics and Dynamics I	3	3	0	1	PHU 103& MAT 112	
ME 205	Introduction to Computer Aided Design	3	3	0	0	-	
ME 206	Thermal Fluids Engineering I	3	3	0	1	PHU 103	ME 206L
ME 206L	Thermal Fluids Engineering I Lab	1	0	2	0	PHU 103	ME 206
ME 208	Mechanics of Materials I	3	3	0	1	ME 201	ME 208L
ME 208L	Mechanics of Materials I Lab	1	0	2	0	ME 201	ME 208
ME 305	Manufacturing and Workshop Training	3	3	0	0	ME 201	ME 305L
ME 305L	Manufacturing and Workshop Training Lab	1	0	2	0	ME 201	ME 305
ME 306	Instrumentation and Control Engineering	3	3	0	0	EE 207	ME 306L
ME 306L	Instrumentation and Control Engineering Lab	1	0	2	0	EE 207	ME 306
ME 307	Thermal Fluids Engineering II	3	3	0	1	ME 206	ME 307L
ME 307L	Thermal Fluids Engineering II Lab	1	0	2	0	ME 206	ME 307

ME 308	Advanced Manufacturing Processes	3	3	0	0	ME 305	ME 308L
ME 308L	Advanced Manufacturing Processes Lab	1	0	2	0	ME 305	ME 308
ME 310	Aircraft /Machine Design with Project	3	3	0	0	ME 312, ME 311	ME 310L
ME 310L	Aircraft /Machine Design with Project Lab	1	0	2	0	ME 312, ME 311	ME 310
ME 311	Applied Mechanics: Statics and Dynamics II	3	3	0	1	ME 203	
ME 312	Mechanics of Materials II	3	3	0	1	ME 208	ME 312L
ME 312L	Mechanics of Materials II Lab	1	0	2	0	ME 208	ME 312
ME 314	Vibration and Damping	3	3	0	1	ME 311	
ME 315	Machine Design	3	3	0	1	ME 208	
ME 403	Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling)	3	3	0	1	ME 312, ME 311	ME 403L
ME 403L	Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling) Lab	1	0	2	0	ME 312, ME 311	ME 403
ME 405	Engineering Safety and Risk Analysis	3	3	0	1	STA 212	
ME 407	Heating, Ventilation, and Air-Conditioning	3	3	0	0	ME 206	
ME 490	Mechanical Engineering Capstone Project	4	0	8	0	Department Approval	

2. College of Engineering Courses (11 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
SE 100	Programming for Engineers	3	3	0	0	-	
SE 100L	Programming for Engineers Lab	1	0	2	0	-	SE 100
IE 315	Engineering Economy and Cost Analysis	3	3	0	0	Department Approval	
EE 207	Foundations of Electrical Engineering	3	3	0	1	PHU 124	MAT 213
EE 207L	Foundations of Electrical Engineering Lab	1	0	2	0	PHU 124	MAT 213

3. Technical Electives (6 CRHs)

Select from the following courses:

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ME 401	Computational Fluid Dynamics and Heat Transfer (CFD Modelling)	3	3	0	1	ME 307	ME 401L
ME 401L	Computational Fluid Dynamics and Heat Transfer (CFD Modelling) Lab	1	0	2	0	ME 307	ME 401
ME 406	Mechatronics	3	3	0	0	ME 306	
ME 410	Energy Conversion and Cogeneration Systems	3	3	0	0	ME 307	ME 410L
ME 410L	Energy Conversion and Cogeneration Systems Lab	1	0	2	0	ME 307	ME 410

ME 412	Renewable Energy Systems	3	3	0	0	ME 307	ME 412L
ME 412L	Renewable Energy Systems Lab	1	0	2	0	ME 307	ME 412
ME 414	Introduction to Compressible Flow Turbomachinery	3	3	0	0	ME 307	ME 414L
ME 414L	Introduction to Compressible Flow Turbomachinery Lab	1	0	2	0	ME 307	ME 414
ME 416	Automotive Engineering	3	3	0	0	ME 307	ME 416L
ME 416L	Automotive Engineering Lab	1	0	2	0	ME 307	ME 416
ME 418	Water Desalination	3	3	0	0	ME 307	
ME 435	Undergraduate Research in Mechanical Engineering	3	0	6	0	Department Approval	

4. Summer Internship (0 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)	Pre-Requisite Course Code	Co-Requisite Course Code
SE 390	Mechanical Engineering Summer Internship	0	Department Approval	

Typical Study Plan-Mechanical Engineering Program

4-Year Curriculum: ***135 Credit Hours Total***

Each course below follows the following format:
Course code, Course Title, and Course Credit Hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)

1st Year			
Fall	**Course Code**	**Course-Title**	**CRHs**
	ENG 101	**Freshman English I**	**3 (3-0-0)**
	MAT 101	**Calculus I**	**3 (3-0-2)**
	PHU 103	**Mechanics and Waves for Engineers**	**3 (3-0-1)**
	PHU 103L	**Mechanics and Waves for Engineers Lab**	**1 (0-2-0)**
	SE 100	**Programming for Engineers**	**3 (3-0-0)**
	SE 100L	**Programming for Engineers Lab**	**1 (0-2-0)**
	CHM 102	**Introduction to Chemistry**	**3 (3-0-1)**
	CHM 102L	**Introduction to Chemistry Lab**	**1 (0-2-0)**
		Total	**18**
Spring	**Course Code**	**Course-Title**	**CRHs**
	PHL 101A	**Engineering Ethics**	**3 (3-0-0)**
	ENG 112	**Freshman English II**	**3 (3-0-0)**
	MAT 112	**Calculus II**	**3 (3-0-2)**
	PHU 124	**Electromagnetism and Waves for Engineers**	**3 (3-0-1)**
	PHU 124L	**Electromagnetism and Waves for Engineers Lab**	**1 (0-2-0)**
	ME 201	**Materials Science and Engineering**	**3 (3-0-1)**
	ME 201L	**Materials Science and Engineering Lab**	**1 (0-2-0)**
		Total	**17**

2nd Year			
Fall	**Course Code**	**Course-Title**	**CRHs**
	MAT 212	**Linear Algebra**	**3 (3-0-0)**
	MAT211	**Calculus III**	**3 (3-0-0)**
	EE 207	**Foundations of Electrical Engineering**	**3 (3-0-1)**
	EE 207L	**Foundations of Electrical Engineering Lab**	**1 (0-2-0)**
	MAT 213	**Differential Equations**	**3 (3-0-0)**
	ME 203	**Applied Mechanics: Statics and Dynamics I**	**3 (3-0-1)**
		Total	**16**

	Course Code	Course-Title	CRHs
Spring	STA 212	Probability and Statistics for Engineers	3 (3-0-0)
	ME 305	Manufacturing and Workshop Training	3 (3-0-0)
	ME 305L	Manufacturing and Workshop Training Lab	1 (0-2-0)
	ME 208	Mechanics of Materials I	3 (3-0-1)
	ME 208L	Mechanics of Materials I Lab	1 (0-2-0)
	ME 205	Introduction to Computer Aided Design	3 (3-0-0)
	ME 206	Thermal Fluids Engineering I	3 (3-0-1)
	ME 206L	Thermal Fluids Engineering I Lab	1 (0-2-0)
		Total	**18**

3rd Year

	Course Code	Course-Title	CRHs
Fall	ISL 101	Islamic Studies I	2 (2-0-0)
	ME 311	Applied Mechanics: Statics and Dynamics II	3 (3-0-1)
	ME 315	Machine Design	3 (3-0-1)
	ME 312	Mechanics of Materials II	3 (3-0-1)
	ME 312L	Mechanics of Materials II Lab	1 (0-2-0)
	ME 307	Thermal Fluids Engineering II	3 (3-0-1)
	ME 307L	Thermal Fluids Engineering II Lab	1 (0-2-0)
		Total	**16**
	Course Code	**Course-Title**	**CRHs**
Spring	ARB 101	Arabic Language I	2 (2-0-0)
	ME 308	Advanced Manufacturing Processes	3 (3-0-0)
	ME 308L	Advanced Manufacturing Processes Lab	1 (0-2-0)
	ME 306	Instrumentation and Control Engineering	3 (3-0-0)
	ME 306L	Instrumentation and Control Engineering Lab	1 (0-2-0)
	ME 310	Aircraft /Machine Design with Project	3 (3-0-0)
	ME 310L	Aircraft /Machine Design with Project Lab	1 (0-2-0)
	MAT 224	Numerical Methods	3 (3-0-0)
		Total	**17**
	Course Code	**Course-Title**	**CRHs**
Summer	ME 390	Mechanical Engineering Summer Internship	0
		Total	**0**

4th Year			
Fall	CR#	Course-Title	CRHs
	ISL 112	Islamic Studies II	2 (2-0-0)
	ENG 222	Technical Writing	3 (3-0-0)
	ME 403	Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling)	3 (3-0-1)
	ME 403L	Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling) Lab	1 (0-2-0)
	ME 407	Heating, Ventilation, and Air-Conditioning	3 (3-0-0)
	ME 405	Engineering Safety and Risk Analysis	3 (3-0-1)
		Total	**15**
Spring	CR#	Course-Title	CRHs
	ARB 112	Arabic Language II	2 (2-0-0)
	ME 314	Vibration and Damping	3 (3-0-1)
	IE 315	Engineering Economy and Cost Analysis	3 (3-0-0)
		Technical Elective I	3 (3-0-0)
		Technical Elective II	3 (3-0-0)
	ME 490	Mechanical Engineering Capstone Project	4 (0-8-0)
		Total	**18**

Technical Electives

Course Code	Course Name	CRHs	Pre-Requisite Course Code
ME 401	Computational Fluid Dynamics and Heat Transfer (CFD Modelling)	3 (3-0-1)	ME 307
ME 406	Mechatronics	3(3-0-0)	ME 306
ME 410	Energy Conversion and Cogeneration Systems	3(3-0-0)	ME 307
ME 412	Renewable Energy Systems	3(3-0-0)	ME 307
ME 414	Introduction to Turbomachinery	3(3-0-0)	ME 307
ME 416	Automotive Engineering	3(3-0-0)	ME 307
ME 418	Water Desalination	3(3-0-0)	ME 307
ME 435	Undergraduate Research in Mechanical Engineering	3 (0-6-0)	Department Approval

Course Descriptions

In this section we give the course descriptions of Mechanical Engineering courses of the program.

Each course below follows the following format:
Course code: Course Title Course credit hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)
Course Description
Pre-requisites
Co-requisites

ME 201 Materials Science and Engineering 3 (3-0-1)
The course teaches an introduction to fundamental underlying concepts of atomic bonding, crystal structure, structure-property relationships, mechanical properties, phase diagrams, and time-temperature diagrams.
Pre-requisites: CHM 102
Co-requisites: ME 201L

ME 201L Materials Science and Engineering Lab 1 (0-2-0)
Laboratory experiments dealing with Materials Science and Engineering, crystal structure, structure-property relationships, and mechanical properties.
Pre-requisites: CHM 102
Co-requisites: ME 201

ME 203 Applied Mechanics: Statics and Dynamics I 3 (3-0-1)
The course teaches the equilibrium of systems of forces in statically determinate structures, including deformation and displacement diagrams, work and potential energy and the principle of virtual work. The course reviews momentum and energy principles, covering Newtonian mechanics.
Pre-requisites: PHU 103 & MAT 112
Co-requisites: none

ME 205 Introduction to Computer Aided Design 3(3-0-0)
The course teaches computer-aided design of mechanical systems, and includes the preliminary design, analysis, and documentation of a mechanical system. This will include first and third angle projections, solid modeling and the use of commercially available CAD software.
Pre-requisites: none
Co-requisites: none

ME 206 Thermal Fluids Engineering I 3 (3-0-1)
The course teaches thermodynamics, pressure, temperature, heat and work, properties of pure materials, first law, closed and open system, second law, heat engines and cycles, including fluid mechanics, conservation laws, boundary layers, laminar and turbulent flows, pipe flows, incompressible one-dimensional flow, external flows, ideal flows, compressible flows, heat transfer, conduction, convection and radiation.
Pre-requisites: PHU 103
Co-requisites: ME 206L

ME 206L Thermal Fluids Engineering I Lab 1 (0-2-0)

Laboratory experiments dealing with thermodynamics, pressure, temperature, heat and work, properties of pure materials, first law, closed and open system, second law, heat engines and cycles, including fluid mechanics, conservation laws, boundary layers, laminar and turbulent flows, pipe flows, incompressible one-dimensional flow, external flows, ideal flows, compressible flows, heat transfer, conduction, convection and radiation.

Pre-requisites: PHU 103

Co-requisites: ME 206

ME 208 Mechanics of Materials I 3 (3-0-1)

The course teaches materials and structures, including analysis of beam bending, buckling and torsion, material and structural failure, structural design considerations, stress, strain, heating effects, two-dimensional plane stress and plane strain problems, torsion theory for arbitrary sections.

Pre-requisites: ME 201

Co-requisites: ME 208L

ME 208 L Mechanics of Materials I Lab 1 (0-2-0)

Laboratory experiments dealing with materials and structures, beam bending, buckling and torsion, material and structural failure, stress, strain, and heating effects.

Pre-requisites: ME 201

Co-requisites: ME 208

ME 305 Manufacturing and Workshop Training 3 (3-0-0)

The course teaches an overview of modern manufacturing technology, materials and their manufacturing characteristics, Casting, Mould design Tools and fixtures, Cutting machine tools (turning, milling, drilling, broaching etc., abrasive machining processes), Joining, assembly, Manufacturing costs, design for manufacturing, Welding, EDM, Laser Machining, Industrial Manufacturing processes (metal forming, forging, extrusion, rolling), Metrology, Inspection methods and quality control.

Pre-requisites: ME 201

Co-requisites: ME 305L

ME 305L Manufacturing and Workshop Training Lab 1 (0-2-0)

Laboratory experiments dealing with modern manufacturing technology, materials and their manufacturing characteristics, Casting, Mould design Tools and fixtures, Cutting machine tools (turning, milling, drilling, broaching etc., abrasive machining processes), Joining, assembly, Manufacturing costs, design for manufacturing, Welding, EDM, Laser Machining, Industrial Manufacturing processes (metal forming, forging, extrusion, rolling), Metrology, Inspection methods and quality control.

Pre-requisites: ME 201

Co-requisites: ME 305

ME 306 Instrumentation and Control Engineering 3 (3-0-0)

The course teaches an introduction to the design of feedback control systems. Topics include the properties of feedback systems, time-domain and frequency-domain performance measures, stability and degree of stability, the root locus method, Nyquist criterion, frequency-domain design, and state space methods. These concepts will be applied to a variety of mechanical and aerospace systems throughout the course.

Pre-requisites: EE207

Co-requisites: ME 306L

ME 306L Instrumentation and Control Engineering Lab 1 (0-2-0)

Laboratory experiments dealing with feedback control systems, time-domain and frequency-domain performance measures, stability and degree of stability, the root locus method, Nyquist criterion, frequency-domain design, and state space methods.

Pre-requisites: EE207

Co-requisites: ME 306

ME 307 Thermal Fluids Engineering II 3 (3-0-1)

The course teaches applications of thermodynamics, heat transfer and fluid mechanics to the design and analysis of energy systems. Topics include energy analysis, power and refrigeration cycles, studies of laminar and turbulent flow including heat transfer in free and forced convection, in channels, and over surfaces, heat transfer, including fins, forced and free convection, boiling and condensation, radiation heat transfer, heat exchangers, multi-mode heat transfer, compressible flows in pipes, ducts, divergent and convergent flows, sonic and supersonic flows.

Pre-requisites: ME 207

Co-requisites: ME 307L

ME 307L Thermal Fluids Engineering II Lab 1 (0-2-0)

Laboratory experiments dealing with applications of thermodynamics, heat transfer and fluid mechanics to the design and analysis of energy systems. This includes energy analysis, studies of laminar and turbulent flow, heat transfer in free and forced convection, in channels, and over surfaces, fins, forced and free convection, boiling and condensation, radiation heat transfer, heat exchangers, compressible flows in pipes, ducts, divergent and convergent flows, sonic and supersonic flows.

Pre-requisites: ME 207

Co-requisites: ME 307

ME 312 Mechanics of Materials II 3 (3-0-1)

The course teaches an introduction to mechanical behaviour of engineering materials and the use of materials in mechanical design. The course emphasizes the fundamentals of mechanical behaviour of isotropic and anisotropic materials, as well as design with materials, including elasticity, plasticity, limit analysis, fatigue, fracture, creep, three-dimensional stress and strain problems and the selection of materials for engineering design.

Pre-requisites: ME 208

Co-requisites: ME 312L

ME 312L Mechanics of Materials II Lab 1 (0-2-0)

Laboratory experiments dealing with mechanical behaviour of engineering materials and the use of materials in mechanical design. The course emphasizes the fundamentals of mechanical behaviour of isotropic and anisotropic materials, as well as design with materials, including elasticity, plasticity, limit analysis, fatigue, fracture, creep, three-dimensional stress and strain problems and the selection of materials for engineering design.

Pre-requisites: ME 208

Co-requisites: ME 312

ME 308 Advanced Manufacturing Processes 3 (3-0-0)

The course teaches the integration of design, engineering and management disciplines and practices for analysis and design of manufacturing enterprises. The course emphasizes the physics and stochastic nature of manufacturing processes and systems, and their effects on quality, rate, cost and flexibility, process physics and control, design for manufacturing and manufacturing systems and a team project where the students design and build elements using mass-production methods to produce a product in quantity.

Pre-requisites: ME 305

Co-requisites: ME 308L

ME 308L Advanced Manufacturing Processes Lab 1 (0-2-0)

Laboratory experiments dealing with integration of design, engineering and management disciplines and practices for analysis and design of manufacturing enterprises, the physics and stochastic nature of manufacturing processes and systems, and their effects on quality, rate, cost and flexibility, process physics and control, design for manufacturing and manufacturing systems and a team project where the students design and build elements using mass-production methods to produce a product in quantity.

Pre-requisites: ME 305

Co-requisites: ME 308

ME 310 Aircraft /Machine Design with Project 3 (3-0-0)

The course teaches the creative design process via the application of physical laws and learning to complete projects on schedule. Topics include synthesis, analysis, design robustness, machine elements, manufacturability, idea generation, estimation, concept selection, visual thinking, communication, design and analysis, design for manufacturing, professional responsibilities and ethics. The students are expected to build a working model of an aircraft (or any other product for mechanical engineering students) as part of a team.

Pre-requisites: ME 312 & ME 311

Co-requisites: ME 310L

ME 310L Aircraft /Machine Design with Project Lab 1(3-0-0)

Laboratory experiments dealing with the creative design process via the application of physical laws and learning to complete projects on schedule, synthesis, analysis, design robustness, machine elements, manufacturability, idea generation, estimation, concept selection, visual thinking, communication, design and analysis, design for manufacturing, professional responsibilities and ethics. The students are expected to build a working model of an aircraft (or any other product for mechanical engineering students) as part of a team.

Pre-requisites: ME 312 & ME 311

Co-requisites: ME 310

ME 311 Applied Mechanics: Statics and Dynamics II 3 (3-0-1)

The course teaches force-momentum formulation for systems of particles and rigid bodies in planar motion. Topics include work-energy concepts, linearization of equations of motion, the use of various systems of coordinates, including Cartesian, polar and intrinsic coordinate systems, a review of Newton's Laws, applications to orbit calculations and rocket equations, linear stability analysis of mechanical systems, including introduction to natural modes, eigenvalues, damping effects and the use of Bode plots.

Pre-requisites: ME 203

Co-requisites: none

ME 314 Vibration and Damping 3 (3-0-1)

The course teaches the modelling techniques for degree of freedom systems, including the application of Newton's second law to vibrating systems, the concept of damping and the response of systems to harmonic inputs.

Pre-requisites: ME 311

Co-requisites: none

ME 315 Machine Design 3 (3-0-1)

This course teaches the function, design and performance of mechanical elements commonly used by mechanical engineers, including sets of elements, such as bearings, pumps, gears and transmissions, Students will develop skills in designing and analyzing performance capabilities of these elements as they relate to part geometry, material choice, and loading and environmental conditions, and the lifecycle for representative elements will be derived. A term project will involve synthesizing a mechanical system for the creative design process, both in terms of its functionality and manufacturability.

Pre-requisites: ME 208

Co-requisites: none

ME 401 Computational Fluid Dynamics and Heat Transfer (CFD Modelling) 3 (3-0-1)

The course teaches the working principles of computational fluid dynamics and heat transfer and applies these concepts using commercially available software packages used in industry. Topics include the application, analysis and limitations of design evaluation using CFD approach. The course will equip students to model real engineering problems and correlate the working principles of fluid dynamics and heat transfer using numerical techniques.

Pre-requisites: ME 307

Co-requisites: ME 401L

ME 401L Computational Fluid Dynamics and Heat Transfer (CFD Modelling) Lab 1(0-2-0)

Laboratory experiments dealing with working principles of computational fluid dynamics and heat transfer and applies these concepts using commercially available software packages used in industry, the application, analysis and limitations of design evaluation using CFD approach. The course will equip students to model real engineering problems and correlate the working principles of fluid dynamics and heat transfer using numerical techniques.

Pre-requisites: ME 307

Co-requisites: ME 401

ME 403 Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling) 3 (3-0-1)

The course teaches the working principles of the non-linear finite element method (FEM) and applies the concepts involved using commercially available software packages used in industry. Topics include the application, analysis and limitations of design evaluation using FEM approach. The course will equip students to model real engineering problems and correlate the working principles of Mechanics and Dynamics using numerical methods.

Pre-requisites: ME 312 & ME 311

Co-requisites: ME 403L

ME 403L Finite Element Modelling for Dynamic and Structural Analysis (FEA Modelling) Lab 1(0-2-0)

Laboratory experiments dealing with the working principles of the non-linear finite element method (FEM) and applies the concepts involved using commercially available software packages used in industry, the application, analysis and limitations of design evaluation using FEM approach. The course will equip students to model real engineering problems and correlate the working principles of Mechanics and Dynamics using numerical methods.

Pre-requisites: ME 312 & ME 311

Co-requisites: ME 403

ME 405 Engineering Safety and Risk Analysis 3 (3-0-1)

The course will develop the understanding of the underlying causes of engineering disasters, their consequences and modern systems and safety procedures to prevent their recurrence. The course will emphasize the role engineering ethics in modern engineering

Pre-requisites: STA 212

Co-requisites: none

ME 406 Mechatronics 3 (3-0-0)

The course teaches the acquisition of the knowledge and skills required to design and control electromechanical systems. The basic material will be covered in classroom lectures and discussions. Much of the learning will take place in the laboratory where students will learn to build and operate representative electromechanical systems. The class includes a final project.

Pre-requisites: ME 306

Co-requisites: none

ME 407 Heating, Ventilation, and Air-Conditioning 3 (3-0-0)

The course teaches refrigeration and air conditioning, thermodynamics, psychrometry, fluid flow and heat transfer, refrigeration cycles, single and multi-stage refrigeration systems, vapour compression, adsorption and desorption systems, evaporative cooling systems, solar radiation, cooling and heating load calculation, air distribution and duct design, piping, ventilation and equipment selection.

Pre-requisites: ME 206

Co-requisites: none

ME 410 Energy Conversion and Cogeneration Systems 3 (3-0-0)

The course introduces various types of energy conversion and cogeneration systems. These include; advanced steam power plants, gas turbine power plants, nuclear power plants, co-generation and tri-generation, internal combustion engine, and renewable energy conversion systems. The student will learn how to do an analysis for any energy conversion system. Moreover, students will learn about the regeneration, binary, supercritical, and other advanced steam power cycles. In addition, this course teaches student how to design components of the power conversion system such as boilers, condensers, steam turbines, compressors, combustors, gas turbines, and others. The knowledge about the nuclear power plants and recent technologies is covered as well in this course. Furthermore, the course gives an introduction to the power generation using the new and renewable energy sources as well as energy storage and economy of energy.

Pre-requisites: ME 307

Co-requisites: none

ME 412 Renewable Energy Systems 3 (3-0-0)

The course gives an overview of renewable energy sources including biomass, hydroelectricity, geothermal, tidal, wave, wind and solar power. And it also presents the fundamentals of different renewable energy systems with a main focus on technologies with high development potential. Furthermore, it integrates maths, engineering, climate studies and economics, and enabling students to gain a broad understanding of renewable energy technologies and their potential.

Pre-requisites: ME 307

Co-requisites: none

ME 414 Introduction to Compressible Flow Turbomachinery 3 (3-0-0)

The course introduces various types of compressible flow turbomachineries and describes their fundamental working and design concepts. This includes; turbomachinery classification, apply dimensional analysis and similitude to turbomachines, basic governing equations for turbomachines, Euler equation, centrifugal compressors, axial flow compressors and fans, radial and axial flow turbines.

Pre-requisites: ME 307

Co-requisites: none

ME 416 Automotive Engineering 3 (3-0-0)

This course teaches the fundamentals of Internal Combustion engines, its classifications and applications, as well as deign and operating parameters. Topics include the thermodynamic analysis of fuel-air cycle, firing order, concept of combustion process in SI engines, Scavenging and design aspects of SI engines, supercharging and turbocharging, lubrication system, engine cooling system and engine heat transfer, fuel injection system in SI engines, Compression Ignition (CI) engines, conventional and non-conventional fuels in SI and CI engines.

Pre-requisites: ME 307

Co-requisites: none

ME 418 Water Desalination 3 (3-0-0)

Resources and need for desalination, Fundamentals of desalination, Overview and classification of desalination techniques, Single and multiple effect evaporation, Vapor compression, Single and Multi stage flash distillation, Reverse Osmosis, Hybrid processes, Dual Purpose Power and Desalination plants, Desalination powered by renewable energy sources, Economic analysis, Brine discharge management.

Pre-requisites: ME 307

Co-requisites: none

ME 435 Undergraduate Research in Mechanical Engineering 3 (0-6-0)

Students participate in supervised research with a faculty member. Supervised research can be: 1) independent research undertaken by the student (thesis, independent study), or 2) assistance on a faculty member's research project. Students must find a faculty member who is willing to supervise him/her as an assistant on an existing project or as the author of an individual project. The student and the faculty supervisor will complete and sign a research contract which will be turned in to the chair of the Industrial and Mechanical Engineering Department. Drafting the contract will allow the student to develop ideas about what should be accomplished and what the faculty supervisor's expectations are. All academic requirements are at the discretion of the supervising faculty member. Students should agree on a plan for the semester with the faculty mentor before the research begins. The plan should include academic requirements, the basis for grading the experience, and a plan for student/professor meetings for the semester. It is the student's responsibility to report progress and seek guidance when needed. Students are expected to be active and reliable participants in the research experience.

Pre-requisites: Department Approval

Co-requisites: none

ME 490 Mechanical Engineering Capstone Project 4(0-8-0)

The Capstone project is a semester-long design project, undertaken individually or in a small team, under a staff mentor. The project involves an introduction to the life cycle of a project from a technical and management perspective, and is based on extensive oral and written communication. The capstone project is typically the foundation of the student's engineering portfolio for application to industry or graduate school.

Pre-requisites: Department Approval

Co-requisites: none