Bachelor of Mechanical Engineering

College of Engineering and Advanced Computing

Effective: Fall 2024 with a track & a minor

(Applicable to students admitted in Fall 2024 or after)

Revised: Sep 13 2024

Curriculum Structure and Study Plan

The Bachelor of Mechanical Engineering curriculum is composed of **134** Credit Hours (CRHs) divided as follows:

I. General Education Requirements (50 CRHs)
1. Mathematics & Statistics (21 CRHs)
2. Basic Sciences (12 CRHs)
3. Humanities (17 CRHs)

II. Core Requirements (84 CRHs)
1. Mechanical Engineering Courses (64 CRHs)
2. College of Engineering Courses (11 CRHs)
3. Technical Electives (9 CRHs)
4. Summer Internship (0 CRHs)

I. General Education Requirements (50 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	0		
MAT 112	Calculus II	3	3	0	0	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	
MAT 213	Differential Equations	3	3	0	0	MAT 112	MAT 212
STA 212	Probability and Statistics for Engineers	3	3	0	0	MAT 112	

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	0		
CHM 102 L	Introduction to Chemistry Lab	1	0	2	0		CHEM 102
PHU 103	Mechanics and Waves for Engineers	3	3	0	0		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	0	PHU 103, MAT 101	
PHU 124 L	Electromagnetism and Optics for Engineers Lab	1	0	2	0	PHU 103, MAT 101	PHU 124

3. Hhumanities (17 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ENG 101	University Writing	3	3	0	0		
_ _ _ _ _ _	General Education Elective I	2	2	0	0		
ENG 222	Technical Writing	3	3	0	0	ENG 101	
ISL 101	Islamic Studies I	2	2	0	0		
ARB 101	Arabic Language I	2	2	0	0		
_ _ _ _ _	General Education Elective	2	2	0	0	ARB 101	
ENG _ _ _	English Elective	3	3	0	0		

II. Core Requirements (84 CRHs)

1. Mechanical Engineering Courses (64 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	0	CHM 102	
ME 201 L	Materials Science and Engineering Lab	1	0	2	0		ME 201
ME 203	Applied Mechanics I: Statics	3	3	0	0	PHU 103, MAT 112	
ME 205	Introduction to Computer Aided Design	3	3	0	0		
ME 208	Mechanics of Materials I	3	3	0	0	ME 201, ME 203	
ME 208 L	Mechanics of Materials I Lab	1	0	2	0		ME 208
ME 216	Fluid Mechanics	3	3	0	0	PHU 103	
ME 216L	Fluid Mechanics Lab	1	0	2	0		ME 216
ME 305	Manufacturing and Workshop Training	3	3	0	0	ME 201	
ME 305 L	Manufacturing and Workshop Training Lab	1	0	2	0		ME 305
ME 306	Instrumentation and Control Engineering	3	3	0	0	EE 207	
ME 306 L	Instrumentation and Control Engineering Lab	1	0	2	0		ME 306
ME 308	Advanced Manufacturing Processes	3	3	0	0	ME 305	

ME 308 L	Advanced Manufacturing Processes Lab	1	0	2	0		ME 308
ME 310	Mechanical Component Design	3	3	0	0	ME 311, ME 312	
ME 310 L	Mechanical Component Design Lab	1	0	2	0		ME 310
ME 311	Applied Mechanics II: Dynamics	3	3	0	0	ME 203	
ME 312	Mechanics of Materials II	3	3	0	0	ME 208	
ME 312 L	Mechanics of Materials II Lab	1	0	2	0		ME 312
ME 315	Machine Design	3	3	0	0	ME 208	
ME 316	Engineering Thermodynamics	3	3	0	0	ME 216	
ME 317	Heat and Mass Transfer	3	3	0	0	ME 216	
ME 317 L	Heat and Mass Transfer Lab	1	0	2	0		ME 317
ME 403	Finite Element Methods	3	3	0	0	ME 311, ME 312	
ME 403 L	Finite Element Methods Lab	1	0	2	0		ME 403
ME 407	Heating, Ventilation, and Air-Conditioning	3	3	0	0	(ME 316 & ME 317) or (ME 206)	
ME 495	Mechanical Engineering Capstone Project I	3	0	6	0	ME 317, ME 310	
ME 496	Mechanical Engineering Capstone Project II	3	0	6	0	ME 495	

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 100 L	Programming for Engineers Lab	1	0	2	0	-	SE 100
IE 315	Engineering Economy and Cost Analysis	3	3	0	0	STA 212	
EE 207	Foundations of Electrical Engineering	3	3	0	0	PHU 124	MAT 213
EE 207 L	Foundations of Electrical Engineering Lab	1	0	2	0		MAT 213

3. Technical Electives* (9 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 314	Vibration and Damping	3	3	0	0	ME 311	
ME 400	Special Topics in Mechanical Engineering	3	3	0	0	Department approval	
ME 401	Computational Fluid Dynamics and Heat Transfer	3	3	0	0	ME 317	
ME 405	Engineering Safety and Risk Analysis	3	3	0	0	STA 212	
ME 406	Mechatronics	3	3	0	0	ME 306	
ME 410	Energy Conversion and Cogeneration Systems	3	3	0	0	ME 316	
ME 412	Renewable Energy Systems	3	3	0	0	ME 316	
ME 414	Introduction to Compressible Flow Turbomachinery	3	3	0	0	ME 316	
ME 415	Incompressible Flow Machines	3	3	0	0	ME 216	

ME 416	Automotive Engineering	3	3	0	0	ME 317	
ME 418	Water Desalination	3	3	0	0	ME 317	
ME 419	Product Design and Development	3	3	0	0	ME 308	
ME 420	Advanced Visualization and Simulation	3	3	0	0	ME 308	
ME 422	Corrosion Engineering	3	3	0	0	ME 316	
ME 435	Undergraduate Research in Mechanical Engineering	3	0	6	0	Department Approval. A GPA of at least 3.0/4.0, and a signed research contract	

*Electives are offered subject to availability of academics in the department with relevant expertise.

4. Summer Internship (0 CRHs)

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

Typical Study Plan-Mechanical Engineering Program

4*-Year Curriculum:** ***134 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**
	CHM 102	**Introduction to Chemistry**	**3 (3-0-0)**
	CHM 102 L	**Introduction to Chemistry Lab**	**1 (0-2-0)**
	MAT 101	**Calculus I**	**3 (3-0-0)**
	PHU 103	**Mechanics and Waves for Engineers**	**3 (3-0-0)**
	PHU 103 L	**Mechanics and Waves for Engineers Lab**	**1 (0-2-0)**
	ENG 101	**University Writing**	**3 (3-0-0)**
	ARB 101	**Arabic Language I**	**2 (3-0-0)**
		Total	**16**
Spring	**Course Code**	**Course-Title**	**CRHs**
	SE 100	**Programming for Engineers**	**3 (3-0-0)**
	SE 100 L	**Programming for Engineers Lab**	**1 (0-2-0)**
	ME 201	**Materials Science and Engineering**	**3 (3-0-0)**
	ME 201 L	**Materials Science and Engineering Lab**	**1 (0-2-0)**
	MAT 112	**Calculus II**	**3 (3-0-0)**
	PHU 124	**Electromagnetism and Optics for Engineers**	**3 (3-0-0)**
	PHU 124 L	**Electromagnetism and Optics for Engineers Lab**	**1 (0-2-0)**
	ISL 101	**Islamic Studies I**	**2 (3-0-0)**
		Total	**17**

2nd Year			
Fall	Course Code	Course-Title	CRHs
	ME 203	Applied Mechanics I: Statics	3 (3-0-0)
	ME 205	Introduction to Computer Aided Design	3 (3-0-0)
	ME 305	Manufacturing and Workshop Training	3 (3-0-0)
	ME 305 L	Manufacturing and Workshop Training Lab	1 (0-2-0)
	MAT 211	Calculus III	3 (3-0-0)
	MAT 212	Linear Algebra	3 (3-0-0)
	MAT 213	Differential Equations	3 (3-0-0)
		Total	19
Spring	Course Code	Course-Title	CRHs
	ME 208	Mechanics of Materials I	3 (3-0-0)
	ME 208 L	Mechanics of Materials I Lab	1 (0-2-0)
	ME 216	Fluid Mechanics	3 (3-0-0)
	ME 216 L	Fluid Mechanics Lab	1 (0-2-0)
	EE 207	Foundations of Electrical Engineering	3 (3-0-0)
	EE 207 L	Foundations of Electrical Engineering Lab	1 (0-2-0)
	MAT 224	Numerical Methods	3 (3-0-0)
	STA 212	Probability and Statistics for Engineers	3 (3-0-0)
		Total	18

3rd Year			
Fall	Course Code	Course-Title	CRHs
	ME 311	Applied Mechanics II: Dynamics	3 (3-0-0)
	ME 312	Mechanics of Materials II	3 (3-0-0)
	ME 312 L	Mechanics of Materials II Lab	1 (0-2-0)
	ME 315	Machine Design	3 (3-0-0)
	ME 316	Engineering Thermodynamics	3 (3-0-0)
	ENG 222	Technical Writing	3 (3-0-0)
		Total	16
Spring	Course Code	Course-Title	CRHs
	ME 306	Instrumentation and Control Engineering	3 (3-0-0)
	ME 306 L	Instrumentation and Control Engineering Lab	1 (0-2-0)
	ME 308	Advanced Manufacturing Processes	3 (3-0-0)
	ME 308 L	Advanced Manufacturing Processes Lab	1 (0-2-0)
	ME 310	Mechanical Component Design	3 (3-0-0)
	ME 310 L	Mechanical Component Design Lab	1 (0-2-0)
	ME 317	Heat and Mass Transfer	3 (3-0-0)
	ME 317 L	Heat and Mass Transfer Lab	1 (0-2-0)
	IE 315	Engineering Economy and Cost Analysis	3 (3-0-0)
		Total	19
Summer	Course Code	Course-Title	CRHs
	ME 390	Mechanical Engineering Summer Internship	0 (0-0-0)
		Total	0

4th Year			
Fall	**Course Code**	**Course-Title**	**CRHs**
	ME 403	**Finite Element Methods**	**3 (3-0-0)**
	ME 403 L	**Finite Element Methods Lab**	**1 (0-2-0)**
	ME 407	**Heating, Ventilation, and Air-Conditioning**	**3 (3-0-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
	ME 495	**Mechanical Engineering Capstone Project I**	**3 (0-6-0)**
	ENG _ _ _	**English Elective**	**2 (2-0-0)**
		Total	**15**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ME 496	**Mechanical Engineering Capstone Project II**	**3 (0-6-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
	_ _ _ _ _	**General Education Elective**	**2 (2-0-0)**
	_ _ _ _ _	**General Education Elective**	**2 (2-0-0)**
		Total	**13**

Mechanical Engineering Track: Digital Design and Manufacturing

ME students have the option to select electives in the fourth year according to their desired academic objective in consultation with their academic advisor. Regular, non-track students select any three of the offered ME electives in the fourth year. ME students also have the option to follow the Digital Design and Manufacturing track in the program. Irrespective of whether a student opts for the Digital Design and Manufacturing track or not, the total credits for electives must be 9 CRHs. All offered technical electives are available for regular non-track students, whether they opt for the track or not.

In summary, all ME students follow the same curriculum and take the same required courses, with the difference being the designation of the electives in the fourth year.

A regular non-track student would have the following electives distribution in the fourth year.

4th Year Electives			
Fall	**Course Code**	**Course-Title**	**CRHs**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**3**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**6**

Per standing policy, and with the approval of the department chair, a student may opt to take one of the 3 CRH technical electives from another engineering program.

Digital Design and Manufacturing track (for ME and IE students only)

The industrial and information revolutions made tremendous impact on manufacturing and communication systems of today. Technologies developed in those revolutions are fusing into a new industrial revolution now known as Industry 4.0 where digital information is inherent in manufacturing activities. Industry 4.0 changes the way products are designed and manufactured today and will revolutionize product development in future.

ME department, in conjunction with the Industrial Engineering (IE) department, offers the Digital Design and Manufacturing track to prepare students for Industry 4.0. Students opting for this track will gain focused knowledge by taking electives offered by ME and IE departments in this interdisciplinary area.

Course Requirements for Digital Design and Manufacturing track

Students must complete the following (6 CRHs) core courses:

- ME 308 Advanced Manufacturing Processes (3 CRHs)
- IE 315 Engineering Economy and Cost Analysis (3 CRHs)

In addition, students will need to complete three courses (9 CRHs) from the list below:

- ME 419 Product Design and Development (3 CRHs) (Usually offered in Fall semester)
- ME 420 Advanced Visualization and Simulation (3 CRHs) (Usually offered in Spring semester)
- IE 455 Data Mining and Application in Engineering (3 CRHs)
- IE 460 Industrial IoT (3 CRHs)

A student opting for the Digital Design and Manufacturing track can take two and one electives in the Fall and Spring semesters, respectively or vice versa as in the following electives distribution in the fourth year.

4th Year Electives			
Fall	**Course Code**	**Course-Title**	**CRHs**
	IE 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**3**
Spring	**Course Code**	**Course-Title**	**CRHs**
	IE 4**	**Technical Elective**	**3 (3-0-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**6**

OR

4th Year Electives			
Fall	**Course Code**	**Course-Title**	**CRHs**
	IE 4**	**Technical Elective**	**3 (3-0-0)**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**6**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ME 4**	**Technical Elective**	**3 (3-0-0)**
		Total	**3**

Minor in Mechanical Engineering (for IE students)

ME department offers a minor in Mechanical Engineering which is open to IE students only. Students opting for this minor will gain concentrated knowledge by taking advanced ME courses.

Course Requirements for Digital Design and Manufacturing track

IE students taking the minor are expected to take additional 15 CRHs on top of their existing IE study plan courses from the following list of existing ME courses:

- ME 307 Thermal Fluids Engineering II (3 CRHs).
- ME 307 L Thermal Fluids Engineering II Lab (1 CRH).
- ME 310 Mechanical Component Design (3 CRHs).
- ME 310 L Mechanical Component Design Lab (1 CRH).
- ME 311 Applied Mechanics II: Dynamics (3 CRHs).
- ME 312 Mechanics of Materials II (3 CRHs).
- ME 312 L Mechanics of Materials II Lab (1 CRH).
- ME 315 Machine Design (3 CRHs).
- ME 407 Heating, Ventilation, and Air-Conditioning (3 CRHs).

General Guidelines

1. The student must complete a total of additional 15 CRHs from IE department
2. Entry Point: Nominally before or at end of Year 2 (sophomore-level) to allow for sufficient time to complete all the courses.
3. The student must have a minimum GPA of 3.25. Admission to the minor is subject to the approval of the ME and IE departments.
4. The student should complete the main degree requirements before starting the minor.
5. Any of the pre-approved courses can be taken whenever the course is offered by IE department and subject to prevailing academic regulations.
6. Lab courses cannot be taken on their own. A Lab course has to be taken with or after the corresponding course has been taken.
7. Completion of a minor program is posted on the transcript alongside the main major. Minor programs are not noted on diplomas.

Course Descriptions

Descriptions of Mechanical Engineering courses are given below. 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 (3-0-0)
This course provides an overview of the principles of materials science and engineering that are essential to an engineer. The broad areas covered are structure of crystalline solids, mechanical behavior of commonly encountered engineering materials and phase transformations. Students will encounter the inter-relationship between processing, structure and performance and how this affects design and materials selection in engineering practice.
Pre-requisites: CHM 102
Co-requisites: none

ME 201 L Materials Science and Engineering Lab 1 (0-2-0)
This is a laboratory course in which students conduct experiments to reinforce concepts of materials science and engineering such as microstructure, structure-property relationships, and mechanical properties such as stress, strain and toughness.
Pre-requisites: none
Co-requisites: ME 201

ME 203 Applied Mechanics I: Statics 3 (3-0-0)
The course teaches fundamentals of forces and moments in 2 dimensions and 3 dimensions, moment about a point and about an axis, equivalent force systems, vector operations as well as 2D and 3D equilibrium of particles and rigid bodies. It also discusses free body diagrams, center of mass, analysis of beams, trusses, frames and machines, and dry friction.
Pre-requisites: PHU 103, MAT 112
Co-requisites: none

ME 205 Introduction to Computer Aided Design 3 (3-0-0)
This course is an introduction to engineering drawing and computer aided design (CAD). It is taught using a commercially available CAD software. It covers principles of orthographic projection, geometric constructions, isometric drawing and auxiliary views, as well as interpretation of solids and patterns of sheet materials. It also covers sectioning and sectional views, dimensioning principles, limits and fits and tolerance, drawing special devices and features, geometrical dimensioning and tolerances.
Pre-requisites: none
Co-requisites: none

ME 206 Thermal Fluids Engineering I 3 (3-0-0)
The course teaches basic concepts of thermodynamics, energy, energy transfer, and general energy analysis, properties of pure substances, energy analysis for closed systems, mass and energy analysis of control systems, first law of thermodynamics, properties of fluids, fluid statics, bernoulli and energy equations, mechanisms of heat transfer, steady heat conduction, and radiation heat transfer.
Pre-requisites: PHU 103
Co-requisites: none

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

This is a laboratory course in which students perform 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: none

Co-requisites: ME 206

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

The course teaches mechanics of deformable bodies. Topics covered include concepts of stress and strain, classification of materials behavior, stress-strain relations, generalized Hook's law. It also covers applications to engineering problems: members under axial loads, torsion of circular rods and tubes, bending and shear stresses in beams, combined stresses in beams and transformations of stresses.

Pre-requisites: ME 201, ME 203

Co-requisites: none

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: none

Co-requisites: ME 208

ME 216 Fluid Mechanics 3 (3-0-0)

Fluid Mechanics course addresses the basic principles of fluid statics and dynamics including practical examples of the fluid devices and systems, solving techniques, and industrial applications. The course teaches introduction and basic concepts, properties of fluids, pressure distribution and fluid statics, fluid kinematics, integral analysis of fluid flow, Bernoulli and energy equations, momentum analysis of flow systems, dimensional analysis and modeling, internal flow, external flow: drag and lift, differential analysis of fluid flow, compressible flow, and open-channel flow.

Pre-requisites: PHU 103

Co-requisites: none

ME 216 L Fluid Mechanics Lab 1 (0-2-0)

Fluid Mechanics Lab course teaches experiments which address the basic principles of fluid statics and fluid dynamics. These experiments include: buoyancy force, hydrostatic pressure, pressure-volume relationship for gases, energy equation applied on pump system, pipe frictional losses laminar & turbulent flow, pressure-temperature relationship for water, velocity profile for laminar & turbulent flows for air, drag force for objects with different projected are and surface profile, pumps connected in parallel and series, jet force, energy balance calculations, and losses in bends and fittings experiments.

Pre-requisites: none

Co-requisites: ME 216

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

This course introduces students to principles of modern manufacturing practice. It covers essential processes used in modern small and large scale manufacturing operations. Manufacturing processes covered include casting processes, metal forming processes, joining processes and machining. Cost of production, design for manufacturing, use of tools, dies and fixtures, and methods of inspection and quality control will be discussed whenever appropriate.

Pre-requisites: ME 201

Co-requisites: none

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

This is a laboratory course in which students perform various manufacturing processes while also developing consideration for safety and impact on the environment. Students will participate in hands-on work related to welding processes of various joints, making screw threads using different hand tools. Student will also use portable machines to perform machining processes on metals with turning, milling, grinding etc. This lab will also cover concepts of allowance, tolerance, clearance, limits & fits, quality control within the manufacturing standards.

Pre-requisites: none

Co-requisites: ME 305

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

The course addresses the basic principles of modern instrumentation and control systems, including examples of the latest devices, techniques and applications. The course teaches measurement systems, instrumentation system elements, measurement methods, industrial automation, control systems, process controllers, correction elements, PLC systems, and system models.

Pre-requisites: EE 207

Co-requisites: none

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

The lab covers experimentations on engineering systems to evaluate the performance of the gauges and sensor and perform control applications using different types of control systems.

Pre-requisites: none

Co-requisites: ME 306

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

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 206

Co-requisites: none

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

This is a laboratory course comprising a series of 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: none

Co-requisites: ME 307

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. Topics include process physics and control, design for manufacturing and manufacturing systems.

Pre-requisites: ME 305

Co-requisites: none

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

This laboratory-based course focusses on rapid prototyping technology and CNC technology. The lab will inform students on the use of 3D printing technology and 3D scanners. Students will participate in creating digital designs and turning them into tangible products. Students will also be exposed to machine language codes as well as CAD and CAM technologies such as conversion, using commercial software, of 2D and 3D CAD drawing geometry directly into toolpath information used to drive CNC turning and milling machines including the tool set-up, machine controller program, and its post-processor.

Pre-requisites: none

Co-requisites: ME 308

ME 310 Mechanical Component Design 3 (3-0-0)

The objective of this course is to introduce students to mechanical design process through application of physical laws. At the end of the course students will be able to undertake design of mechanical parts including stress analysis while considering engineering constraints. Topics covered include idea generation, analysis, design for manufacturing, machine elements, concept selection, design and analysis, professional responsibility and ethics.

Pre-requisites: ME 311, ME 312

Co-requisites: none

ME 310 L Mechanical Component Design Lab 1 (3-0-0)

This course focuses on the process of mechanical components design through team-oriented projects involving the design of a mechanical device or product, application of CAD and finite element analysis of some of its components. 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.

Pre-requisites: none

Co-requisites: ME 310

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

The course teaches the basic principles of kinematics and kinetics of particles and rigid bodies. It establishes and develops the analytical skills to solve dynamics problems based on application of basic principles such as Newton's laws of motion, concepts of work and energy as well as momentum.

Pre-requisites: ME 203

Co-requisites: none

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

This course is an introduction to mechanical behavior of engineering materials and the use of materials in mechanical design. The course emphasizes the fundamentals of mechanical behavior 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: none

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

The course focuses on experiments reinforcing concepts in mechanical behavior of engineering materials. Students will participate in experiments mechanical behavior especially creep, fatigue, fracture, torsion and other modes of deformation in materials.

Pre-requisites: none

Co-requisites: ME 312

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

The course teaches single-degree and multi-degree of freedom systems. Topics covered include undamped and damped free and forced vibrations, impulse and arbitrary force response vibration, absorbers and isolators, rotating machinery fault diagnosis, modal analysis and mode shapes.

Pre-requisites: ME 311

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

This course focuses on the design and selection of machine components such as shafts, non-permanent joints such as screws and bolts, permanent joints such as welding, in addition to the design of power transmission elements such as belts, chains and gears. Also students will be introduced to the basics of the mechanical design process, design methodologies and materials selection in mechanical design.

Pre-requisites: ME 208

Co-requisites: none

ME 316 Engineering Thermodynamics 3 (3-0-0)

The Engineering Thermodynamics course addresses the basic principles of thermodynamics including practical examples of the thermally driven devices and systems. Moreover, the course introduces different solving techniques for thermal-fluids industrial related applications. The course teaches introduction and basic concepts, energy, energy transfer, general energy analysis, properties of pure substances, energy analysis of closed systems, mass and energy analysis of control volumes, the second law of thermodynamics, entropy analysis, exergy analysis, gas power cycles, vapor and combined power cycles, refrigeration cycles, thermodynamic property relations, gas mixtures.

Pre-requisites: ME 216

Co-requisites: none

ME 317 Heat and Mass Transfer 3 (3-0-0)

The Heat and Mass Transfer course addresses the basic concepts and applications of heat and mass transfer in real life practices and industrial processes and systems. This includes practical examples of analysis and design of various engineering systems and devices. Furthermore, the course introduces the modeling and analysis methods as well as solving techniques related to thermal-fluids residential and industrial related applications. The course covers and teaches introduction and basic concepts, heat conduction equation, steady heat conduction, transient heat conduction, numerical methods in heat conduction, fundamentals of convection, external forced convection, internal forced convection, natural convection, boiling and condensation, heat exchangers, fundamentals of thermal radiation, radiation heat transfer, and mass transfer.

Pre-requisites: ME 216

Co-requisites: none

ME 317 L Heat and Mass Transfer Lab 1 (0-2-0)

The Heat and Mass Transfer Lab course teaches basic experiments related to heat and mass transfer. These experiments include: conduction heat transfer, heat transfer by natural convection, basics of radiation heat transfer, natural convection, forced convection, and boiling and condensation experiments.

Pre-requisites: none

Co-requisites: ME 317

ME 400 Special Topics in Mechanical Engineering 3 (3-0-0)

The course will focus on advanced topics and recent developments in one or more of areas: control and robotics, dynamic systems, fluid mechanics, materials science and engineering, solid mechanics and structures, thermal sciences or other areas in mechanical engineering.

Pre-requisites: Department Approval

Co-requisites: none

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

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 317

Co-requisites: none

ME 403 Finite Element Elements 3 (3-0-0)

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 311, ME 312

Co-requisites: none

ME 403 L Finite Element Elements Lab 1 (0-2-0)

This course aims to introduce the theory and practical applications of finite element analysis by incorporating computer implementation using commercial software such as ANSYS.

Pre-requisites: none

Co-requisites: ME 403

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

The course aims to introduce students to hazard identification, risk assessment, risk control in industrial or commercial workplace. The course will also equip students with knowledge on health, and safe work practices, recognition and elimination of health hazards, design material handling and emergency treatment for industrial accidents. Students are expected to understand different hazard identification and control methods and able to develop risk management systems.

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 introduces basic concepts of heating, ventilation, and air conditioning systems (HVAC). These include HVAC components and distribution systems, moist air properties and conditioning processes, indoor comfort conditions, heat transmission in building structures, calculation of heating loads, cooling load, duct design, fans and building air distribution, and the performance of refrigeration systems.

Pre-requisites: (ME 316 & ME 317) or (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 316

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 316

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 316

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 317

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

The course aims to introduce students to fundamentals of water desalination. The course provides an overview and classification of desalination techniques such as single and multiple effect evaporation, vapor compression, single and multi- stage flash distillation, reverse osmosis, hybrid processes. It will also cover potential topics such as resources and needs for desalination, dual purpose power and desalination plants, desalination powered by renewable energy sources. Other topics such as economic analysis and brine discharge management may also be presented.

Pre-requisites: ME 317

ME 419 Product Design and Development 3 (3-0-0)

This course will introduce students to thought frameworks, tools and methods for product design and development. The course will teach students a set of product development procedures that can be practiced in multidisciplinary teams. Topics include opportunity identification, product planning, identifying customer needs and specification, concept generation, selection and testing as well as designing of environment and manufacturing. The course will include projects-based assignments.

Pre-requisites: ME 308

Co-requisites: none

ME 420 Advanced Visualization and Simulation 3 (3-0-0)

This course will introduce students to use computer-aided packages in the product design and manufacturing process. Students will be exposed to CAD/CAE/CAM packages which are used in the industry to perform analysis and evaluate performance of engineering products and to optimize manufacturing processes. The course will be hands-on and will involve ample project-based activities along with lecture-based instructions.

Pre-requisites: ME 308

Co-requisites: none

ME 422 Corrosion Engineering 3 (3-0-0)

This is an introductory course on corrosion engineering. The course emphasizes fundamental concepts of corrosion and applies these concepts to corrosion control. The course will develop thermodynamic and kinetics framework of corrosion such as Nernst equation, electrode potentials, Pourbaix diagram, polarization, corrosion rates and passivity. Corrosion control and mitigation procedures such as materials selection, use of inhibitors and application of anodic and cathodic protection systems will be discussed.

Pre-requisites: ME 316

Co-requisites: none

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

This course introduces undergraduate students with junior or senior standing to research practice. Students will carry out research with clear objectives and goals under close supervision of a mechanical engineering faculty member. The objectives, expected research output and other expectations of the project will be clearly stated out in a contract agreed upon between the supervisor and the student before the course commences. The course is intended to equip students with research methodologies from literature review, research planning to analyzing collected data. As communicating technical information is essential in research practice, students in the course will write reports, make oral presentations and present posters pertaining to their research. Students are also highly encouraged to publicize their work from the course.

Pre-requisites: Department approval and cumulative GPA of at least 3.0/4.0

Co-requisites: none

ME 495 Mechanical Engineering Capstone Project I 3 (0-6-0)

The mechanical engineering curriculum culminates in a two-semester capstone sequence undertaken in a small team or, in case this is not possible, individually, under close supervision of a mechanical engineering faculty member. Students typically choose a project that aligns with their interest. The capstone project is the foundation of the student's engineering portfolio for application to industry or graduate school. In the first semester, students enroll in ME 495 during which student teams identify scope of the project, formulate specifications, develop conceptual solutions and designs, perform concept analysis and engineering analyses to arrive at a final prototype design.

Pre-requisites: ME 317, ME 310

Co-requisites: none

ME 496 Mechanical Engineering Capstone Project II 3 (0-6-0)

ME 496 is the second part of the two-semester capstone sequence. Students working individually or in a small team under supervision of an academic staff will be expected to continue and complete prior work initiated in ME 495. Student teams proceed with physical realization, validation and testing of their designs. Student teams are expected to deliver an engineered, validated and tested product or prototype. Scaled models may also be produced for projects involving large structures. While a successful outcome is expected, it is not required as the focus of capstone courses is on students' learning.

Pre-requisites: ME 495

Co-requisite