جامعة الفيصل
Alfaisal University

كلية الهندسة والحوسبة المتقدمة
College of Engineering and Advanced Computing

Bachelor of Architectural Engineering

College of Engineering and Advanced Computing, Alfaisal University

Effective: Fall 2024

Curriculum Structure and Study Plan

The Bachelor of Architectural Engineering curriculum is composed of **152** Credit Hours (CRHs) divided as follows:

I. General Education Requirements (47 CRHs)

1. Mathematics & Statistics (18 CRHs)
2. Basic Sciences (12 CRHs)
3. Humanities (17 CRHs)

II. Core Requirements (105 CRHs)

1. Architectural Engineering Courses (74 CRHs)
2. College of Engineering Courses (22 CRHs)
3. Technical Electives (9 CRHs)
4. Summer Internship (0 CRHs)

I. General Education Requirements (47 CRHs)

1. Mathematics & Statistics (18 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 213	Differential Equations	3	3	0	0	MAT 112	MAT 212
MAT 224	Numerical Methods	3	3	0	0	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 (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		
ENG_ _ _	English Elective	3	3	0	0		
ENG 222	Technical Writing	3	3	0	0	ENG 101	
ISL 101	Islamic Studies I	2	2	0	0		
_ _ _ _ _ _	General Education Elective I	2	2	0	0		
ARB 101	Arabic Language I	2	2	0	0		
_ _ _ _ _ _	General Education Elective II	2	2	0	0		

I. Core Requirements (105 CRHs)

1. Architecture Engineering Courses (74 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab/ Studio	Tut		
ARE 110	Architectural History and Theories	3	3	0	0		
ARE 120	Drafting and Drawing	1	1	0	0		
ARE 120 S	Drafting and Drawing Studio	2	0	4	0		ARE 120
ARE 201	Architectural Design I	3	0	6	0	ARE 120	
ARE 202	Architectural Design II	3	0	6	0	ARE 201	
ARE 220	Construction Drawing (CAD)	2	2	0	0	ARE 120, ARE 232	
ARE 220 S	Construction Drawing (CAD) Studio	2	0	4	0	ARE 120, ARE 232	ARE 220
ARE 231	Building Materials and Construction Technology	3	3	0	0	ME 201	
ARE 231 L	Building Materials and Construction Technology Lab	1	0	2	0	ME 201	ARE 231
ARE 232	Building Construction	3	3	0	0	ME 201	
ARE 297	Architecture and Buildings	3	3	0	0	ARE 110	
ARE 303	Interior Design	2	2	0	0	ARE 202	

ARE 303 S	Interior Design Studio	1	0	2	0	ARE 202	ARE 303
ARE 311	Building Acoustics	3	3	0	0	ME 206	
ARE 313	Electrical Installations	3	3	0	0	EE 207	
ARE 315	Lighting Systems and Applications	3	3	0	0	PHU 124	
ARE 321	Structural Mechanics	3	3	0	0	ARE 231	
ARE 321 L	Structural Mechanics Lab	1	0	2	0	ARE 231	ARE321
ARE 332	Building Services Engineering	3	3	0	0	ME 206	
ARE 332 L	Building Services Engineering Lab	1	0	2	0	ME 206	ARE 332
ARE 341	The Built Environment	3	3	0	0	ARE 297	
ARE 355	Quantity Surveying	3	3	0	0	ARE 220	
ARE 405	Structural Analysis	3	3	0	0	ARE 321	
ARE 406	Fundamentals of Reinforced Concrete Design	3	3	0	0	ARE 405, ME 206	
ARE 409	Project Management and Economics	3	3	0	0	ARE 355	
ARE 410	Contracts and Liability for Buildings and Construction	3	3	0	0	ARE 355	
ARE 412	Environmental Management and Policy	3	3	0	0	ARE 341	
ARE 465	Management Principles in Building Engineering	3	3	0	0	ARE 409	
ARE 491	Architectural Engineering Capstone Project I	2	0	4	0	ARE 202, ARE 332, ARE 313, ARE 315, ME 407	
ARE 492	Architectural Engineering Capstone Project II	2	0	4	0	ARE 491	

2. College of Engineering Courses (22 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
EE 207	Foundations of Electrical Engineering	3	3	0	1	PHU 124	MAT 213
EE 207 L	Foundations of Electrical Engineering Lab	1	0	2	0	PHU 124	MAT 213, EE 207
ME 201	Materials Science and Engineering	3	3	0	0	CHM 102	
ME 201 L	Materials Science and Engineering Lab	1	0	2	0	CHM 102	ME 201
ME 203	Applied Mechanics I: Statics	3	3	0	0	PHU 103, MAT 112	
ME 206	Thermal Fluids Engineering I	3	3	0	0	PHU 103	
ME 206 L	Thermal Fluids Engineering I Lab	1	0	2	0	PHU 103	
ME 407	Heating, Ventilation, and Air-Conditioning	3	3	0	0	ME 206	

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		
ARE 302	Indoor Air Quality Engineering	3	3	0	0	ME 206	
ARE 314	Architectural Design III	2	2	0	0	ARE 202	
ARE 314 S	Architectural Design III Studio	1	0	2	0	ARE 202	ARE 314
ARE 400	Special Topics in Architectural Engineering	3	3	0	0	Department Approval	
ARE 435	Undergraduate Research in Architectural Engineering	3	0	6	0	Department Approval	
ARE 452	Soil Mechanics and Foundations	3	3	0	0	ARE 231	
ARE 455	Sustainable Buildings	3	3	0	0	ARE 341	
ARE 460	Waste Management in Buildings	3	3	0	0	ME 201	
ARE 470	Building Automation and Control	3	3	0	0	ARE 313	
ARE 475	Building Energy Management	3	3	0	0	ARE 313	
ARE 477	Smart Buildings	3	3	0	0	ARE 341	
ARE 480	Construction Economics and Finance	3	3	0	0	ARE 355	
ARE 482	Operation Analysis in Building Construction	3	3	0	0	ARE 355	
ARE 484	Construction Professional Practice	3	3	0	0	ARE 409	

4. Summer Internship (0 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)	Pre-Requisite Course Code	Co-Requisite Course Code
ARE 390	Architectural Engineering Summer Internship	0	Department approval	

Typical Study Plan-Architecture Engineering Program

4-Year Curriculum: ***152 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**
	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 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 (3-0-1)**
	PHU 103 L	**Mechanics and Waves for Engineers Lab**	**1 (0-2-0)**
	ENG 101	**University Writing**	**3 (3-0-0)**
		Total	**18**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ARE 110	**Architectural History and Theories**	**3 (3-0-0)**
	ARE 120	**Drafting and Drawing**	**1 (1-0-0)**
	ARE 120 S	**Drafting and Drawing Studio**	**2 (0-4-0)**
	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 (3-0-1)**
	PHU 124 L	**Electromagnetism and Optics for Engineers Lab**	**1 (0-2-0)**
	ENG_ _ _	**English Elective**	**3 (3-0-0)**
		Total	**20**

2nd Year			
Fall	Course Code	Course-Title	CRHs
	ARE 201	Architectural Design I	3 (0-6-0)
	ARE 231	Building Materials and Construction Technology	3 (3-0-0)
	ARE 231 L	Building Materials and Construction Technology Lab	1 (0-2-0)
	ARE 232	Building Construction	3 (3-0-0)
	EE 207	Foundations of Electrical Engineering	3 (3-0-1)
	EE 207 L	Foundations of Electrical Engineering Lab	1 (0-2-0)
	ME 203	Applied Mechanics I: Statics	3 (3-0-0)
	MAT 211	Calculus III	3 (3-0-0)
		Total	20
Spring	Course Code	Course-Title	CRHs
	ARE 202	Architectural Design II	3 (0-6-0)
	ARE 220	Construction Drawing (CAD)	2 (2-0-0)
	ARE 220 S	Construction Drawing (CAD) Studio	2 (0-4-0)
	ARE 297	Architecture and Buildings	3 (3-0-0)
	ME 206	Thermal Fluids Engineering I	3 (3-0-0)
	ME 206 L	Thermal Fluids Engineering I Lab	1 (0-2-0)
	ARB 101	Arabic Language I	2 (2-0-0)
	ENG 222	Technical Writing	3 (3-0-0)
		Total	19

3rd Year			
Fall	Course Code	Course-Title	CRHs
	ARE 303	Interior Design	2 (2-0-0)
	ARE 303 S	Interior Design Studio	1 (0-2-0)
	ARE 355	Quantity Surveying	3 (3-0-0)
	ARE 341	The Built Environment	3 (3-0-0)
	ME 407	Heating, Ventilation, and Air-Conditioning	3 (3-0-0)
	MAT 212	Liner Algebra	3 (3-0-0)
	MAT 213	Differential Equations	3 (3-0-0)
	ISL 101	Islamic Studies I	2 (2-0-0)
		Total	20
Spring	Course Code	Course-Title	CRHs
	ARE 311	Building Acoustics	3 (3-0-0)
	ARE 313	Electrical Installations	3 (3-0-0)
	ARE 315	Lighting Systems and Applications	3 (3-0-0)
	ARE 321	Structural Mechanics	3 (3-0-0)
	ARE 321 L	Structural Mechanics Lab	1 (0-2-0)
	ARE 332	Building Services Engineering	3 (3-0-0)
	ARE 332 L	Building Services Engineering Lab	1 (0-2-0)
		Total	17

	Course Code	Course-Title	CRHs
Summer	ARE 390	Architectural Engineering Summer Internship	0
		Total	0

4th Year			
Fall	Course Code	Course-Title	CRHs
	ARE 405	Structural Analysis	3 (3-0-0)
	ARE 409	Project Management and Economics	3 (3-0-0)
	ARE 410	Contracts and Liabilities for Buildings and Construction	3 (3-0-0)
	ARE 412	Environmental Management and Policy	3 (3-0-0)
	ARE 4**	Technical Elective	3 (3-0-0)
	ARE 4**	Technical Elective	3 (3-0-0)
	ARE 491	Architectural Engineering Capstone Project I	2 (0-4-0)
		Total	20
Spring	Course Code	Course-Title	CRHs
	ARE 406	Fundamentals of Reinforced Concrete Design	3 (3-0-0)
	ARE 465	Management Principles in Building Engineering	3 (3-0-0)
	ARE 492	Architectural Engineering Capstone Project II	2 (0-4-0)
	ARE 4**	Technical Elective	3 (3-0-0)
	MAT 224	Numerical Methods	3 (3-0-0)
	_ _ _ _ _ _	General Education Elective I	2 (2-0-0)
	_ _ _ _ _ _	General Education Elective II	2 (2-0-0)
		Total	18

Architectural Engineering Tracks:

I. Bachelor of Architectural Engineering – Construction Management Track

Construction management is primarily concerned with getting the project completed on time, budget and to the desired and stated specification. The course teaches the students how to manage and lead a construction project, using technical and leadership skills, within a multi-organizational team that work on a project's lifecycle. Construction Management looks at engineering management as a cohesive process, examining projects from initiation through to completion, directing, planning and scheduling and communication which are key for the project success. Students get grips with a wide range of project management tools and techniques that are commonly used in the industry. Students who successfully complete the course will have gained practical experience with project management, allowing them to excel within their current role or in the next job. The construction management course offers:

- Get a critical understanding of the social, economic and environmental issues commonly affecting construction problems and the practical means to address them. Practical case studies will be presented to examine how project sites are equipped, manned and managed. Site visits will also be part of the teaching activities.
- Gain experience with important project management tools, techniques and software.
- Become contractually familiar with laws surrounding construction, particularly construction contract law.
- Examine case studies and develop appropriate project management processes and strategies.
- Gain an understanding of financial planning (planned and earned values).

Track Course Requirements (15 CRHs):

In addition to completing the core courses **ARE 409 – Project Management and Economics and ARE 465 – Management Principles in Building Engineering**, students should complete the following three technical electives courses:

- ARE 480 Construction Economics and Finance. (Pre-requisite: ARE 355)
- ARE 482 Operation Analysis in Building Construction. (Pre-requisite: ARE 355)
- ARE 484 Construction Professional Practice. (Pre-requisite: ARE 409)

Track Plan:

4th Year			
Fall	**Course Code**	**Course-Title**	**CRHs**
	ARE 480	**Construction Economics and Finance**	**3 (3-0-0)**
	ARE 482	**Operation Analysis in Building Construction**	**3 (3-0-0)**
		Total	**3**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ARE 484	**Construction Professional Practice**	**3 (3-0-0)**
		Total	**9**

II. Bachelor of Architectural Engineering – Sustainable Development Track

Reducing building energy consumption through adaptative and sustainable design has become a basic criterion of architectural practice. The aim of this track is to deepen students' understanding and knowledge about basic principles and best practices of sustainability and high-performance buildings. Through this track, students will be able to develop problem-solving skills and market-driven solutions, which will help them become leaders in sustainable design and better serve their society. Emphasis will be placed on the analysis of the environmental impacts of buildings, and how we can mitigate these impacts through various and innovative design solutions/practices.

Through three electives students will be equipped with knowledge related to creating sustinable building structures and using processes and systems that are environmentally responsible and resource-efficient. These courses will address a full range of issues associated with sustainable building including energy and water efficiency, materials, waste and stormwater management, and the building operational efficiency in relation to the use of advanced and smart technologies. There will be also a focus on principles of smart (IoT) and green building systems, and how the components of these two systems can integrate and interact with one another.

Track Course Requirements (15 CRHs):

In addition to completing the core courses **ARE 341 – The Built Environment and ARE 412 – Environmental Management and Policy**, students should complete the following three technical electives courses:

- ARE 455 Sustainable Buildings. (Pre-requisite: ARE 341)
- ARE 475 Building Energy Management. (Pre-requisite: ARE 313)
- ARE 477 Smart Buildings. (Pre-requisite: ARE 341)

Track Plan:

4th Year			
Fall	**Course Code**	**Course-Title**	**CRHs**
	ARE 455	**Sustainable Buildings**	**3 (3-0-0)**
	ARE 475	**Building Energy Management**	**3 (3-0-0)**
		Total	**3**
Spring	**Course Code**	**Course-Title**	**CRHs**
	ARE 477	**Smart Buildings**	**3 (3-0-0)**
		Total	**9**

Course Descriptions

In this section we give the course descriptions of Architectural 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

Core Courses

ARE 110 Architectural History and Theories 3 (3-0-0)
This course presents a survey of architectural styles of the past to the present time on the comparative methods. Emphasis includes the geographical, geological, climatic, religious, social and political influences.
Pre-requisites: none
Co-requisites: none

ARE 120 Drafting and Drawing 1 (1-0-0)
The course is designed for students with little drafting background. Course content includes careers in drafting/engineering, use of drafting equipment, drafting techniques, lettering, geometric construction, multi-view and isometric drawings, sectional and auxiliary views, and basic dimensioning.
Pre-requisites: none
Co-requisites: none

ARE 120 S Drafting and Drawing Lab 2 (0-4-0)
The course is designed for students with little drafting background. Course content includes careers in drafting/engineering, use of drafting equipment, drafting techniques, lettering, geometric construction, multi-view and isometric drawings, sectional and auxiliary views, and basic dimensioning.
Pre-requisites: none
Co-requisites: ARE 120

ARE 201 Architectural Design I 3 (0-6-0)
Students will study all the elements of architectural design and develop a sensitivity and awareness required for valid interpretations of design concepts. Students will design a small-scale architectural projects focusing on the notions of time and transformation in conceptual, structural, organizational and spatial terms. This distinct emphasis supports a unifying analytical and creative framework for increasingly complex architectural interventions. Analytical and experimental drawing techniques, including drawing plans, sections, elevations and perspectives, and model-making to inform and represent the transition from simple concepts into sophisticated and developed spatial designs.
Pre-requisites: ARE 120
Co-requisites: none

ARE 202 Architectural Design II 3 (0-6-0)
Students will complete commercial design study and advanced architectural design projects utilizing computer-aided design as well as traditional methods. Emphasis is placed on three-dimensional conceptualization, elements of design, site development, architectural history, color in design, computer generated 3D rendering, basic and advanced model building and time management skills.
Pre-requisites: ARE 201
Co-requisites: none

ARE 220 Construction Drawing (CAD) 2 (2-0-0)
The course teaches drawing and drafting and computer-aided design of architectural systems, and includes the preliminary design, analysis, and documentation of these systems. This will include first and third angle projections, solid modeling and the use of commercially available CAD software.
Pre-requisites: ARE 120, ARE 232
Co-requisites: none

ARE 220 S Construction Drawing (CAD) Studio 2 (0-4-0)
The course teaches drawing and drafting and computer-aided design of architectural systems, and includes the preliminary design, analysis, and documentation of these systems. This will include first and third angle projections, solid modeling and the use of commercially available CAD software.
Pre-requisites: ARE 120, ARE 232
Co-requisites: ARE 220

ARE 231 Building Materials and Construction Technology 3 (3-0-0)
This course introduces construction materials and construction technology. Topics include construction terminology, materials and their properties, manufacturing processes, construction techniques and technologies, and other related topics. Upon completion, students should be able to detail construction assemblies and identify construction materials and properties.
Pre-requisites: ME 201
Co-requisites: none

ARE 231 L Building Materials and Construction Technology Lab 1 (0-2-0)
This course provides an understanding of the basic properties of construction materials and presents current field and laboratory standards and testing requirements for these materials such as Normal Consistency & Setting Time of Cement Past; Fresh and hardened properties of Mortar; Sieve Analysis of Aggregate; Specific Gravity of Aggregate; Unit Weight of Aggregate; Fresh and Mechanical Properties of Concrete; Mechanical Properties of Steel; Tests on wood.
Pre-requisites: ME 201
Co-requisites: ARE 231.

ARE 232 Building Construction 3 (3-0-0)
This course introduces the student to the basics of building construction methods and techniques. It deals with the main elements and components of the building such as; site conditions, foundation systems, retaining walls, load bearing & masonry walls, skeleton R.C. structures, R.C. Footings, R.C. columns, R.C. floors & roofs, building insulation and protection, and staircases design, finishes and construction sequence.
Pre-requisites: ME 201
Co-requisites: none

ARE 297 Architecture and Buildings 3 (3-0-0)
This course presents an introductory study of the theory, history, principles and practice of architecture. It includes the basic principles of architectural analysis, criticism and aesthetic principles. It discusses the roles and responsibilities of the design professions, including interior design, landscape architecture, urban planning and engineering and how they relate to each other.
Pre-requisites: ARE 110
Co-requisites: none

ARE 303 Interior Design 2 (2-0-0)
The student will learn about design fundamentals as applied to the study and practice of interior design. Topics include color, space, form, light, furniture, windows, floors, and accessories. Class format includes illustrated lectures, discussions, and projects.
Pre-requisites: ARE 202
Co-requisites: none

ARE 303 S Interior Design Studio
1 (0-2-0)
The student will learn about design fundamentals as applied to the study and practice of interior design. Topics include color, space, form, light, furniture, windows, floors, and accessories. Class format includes illustrated lectures, discussions, and projects.
Pre-requisites: ARE 202
Co-requisites: ARE 303

ARE 311 Building Acoustics 3 (3-0-0)
In this course, students will study the acoustical environment of buildings, including basic theory with an emphasis on room acoustics and mechanical system noise and vibration. Principles and their applications to sound insulation and testing will also be presented and discussed together with relevant standards and regulations.
Pre-requisites: ME 206
Co-requisites: none

ARE 313 Electrical Installations 3 (3-0-0)
Electrical Installations abound in any building. The Architecture Engineer is expected to have knowledge of the design, variety and maintenance of these Electrical Installations. This course will give the student a foundation course in power generation, distribution and control with respect to electrical installations in buildings.
Pre-requisites: EE 207
Co-requisites: none

ARE 315 Lighting Systems and Applications 3 (3-0-0)
This is an introductory course to lighting systems, their designs and applications in buildings, for students who aspire to be architects, interior designers and building service engineers. It covers day-lighting, electric lighting and introduces the use of color.
Pre-requisites: PHU 124
Co-requisites: none

ARE 321 Structural Mechanics 3 (3-0-0)
This course covers the analysis of construction materials and structural components in buildings: uniform and non-uniform torsion of structural shapes, analysis of determinate and indeterminate beams (including elastic foundation conditions) by classical methods, finite difference equations, numerical integrations, series approximation, elastic stability of beams and frames, lateral stability of beams, beams-columns, analysis of frames including the effect of axial compression. It also introduces the concepts, theories and methodologies for structural design for buildings.
Pre-requisites: ARE 231
Co-requisites: none

ARE 321 L Structural Mechanics Lab 1 (0-2-0)
This course covers the analysis of construction materials and structural components in buildings: uniform and non-uniform torsion of structural shapes, analysis of determinate and indeterminate beams (including elastic foundation conditions) by classical methods, finite difference equations, numerical integrations, series approximation, elastic stability of beams and frames, lateral stability of beams, beams-columns, analysis of frames including the effect of axial compression. It also introduces the concepts, theories and methodologies for structural design for buildings.
Pre-requisites: ARE 231
Co-requisites: ARE 321

ARE 332 Building Services Engineering
3 (3-0-0)
This course will cover the principles of building services engineering, which consists of three major modules: fire safety engineering, piped and gas services engineering and vertical transportation systems in buildings.
Pre-requisites: ME 206
Co-requisites: none

ARE 332 L Building Services Engineering Lab 1 (0-2-0)
This course will cover the principles of building services engineering, which consists of three major modules: fire safety engineering, piped and gas services engineering and vertical transportation systems in buildings.
Pre-requisites: ME 206
Co-requisites: ARE 332

ARE 341 The Built Environment 3 (3-0-0)
Through a series of modules dealing with different architectural issues and building types (Representation; Landscape; Dwelling; Commerce and Industry; Public Institutions; Sacred Spaces), students will be introduced to ideas and problems that affect the way in which the built environment has been and continues to be shaped in a variety of historical and cultural contexts. We will think broadly about how the spaces that people move through and inhabit in their daily lives shape and are shaped by human behavior, cultural identity, political experience, and the currents of historical circumstance. Contemporary buildings and projects will figure prominently as examples of how designers currently approach architectural, structural and urban problems. Local sites will serve as case-studies for the analysis of different aspects of the built environment. This class is taught in a seminar format with students evaluated on their class participation and assigned projects. Readings and projects will introduce students to a variety of techniques for analyzing and representing the built environment, providing the basic tools for subsequent architectural research and studies.
Pre-requisites: ARE 297
Co-requisites: none

ARE 355 Quantity Surveying 3 (3-0-0)
Students will acquire knowledge of and understand basic concepts of: accepted drawing conventions and formats; how to read and interpret architectural and engineering drawings; what constitutes a set of drawings and how to locate cross-references, etc; how building specifications are prepared and structured; the purpose of measurement and estimating in the construction industry; how to measure simple architectural and engineering structures using basic measurement techniques; how to effectively describe items that have been measured; what the purpose of Standard Method of Measurement of Building Work is and how to use it; what are the standard building trades and why they have been identified; the definitions of building elements; how common construction rates are built-up including the constituents of material, labor, plant, overheads and profit; the inclusiveness and/or exclusiveness of rates and prices.
Pre-requisites: ARE 220
Co-requisites: none

ARE 405 Structural Analysis 3 (3-0-0)
In this course students will study the methods of analysis for determinate and indeterminate structures under stationary and moving loads which include stability and determinacy of structures. They will also apply the basics of structural mechanics and design to analyze and optimize practical building structures using finite element analysis (FEA) software under various loading conditions.
Pre-requisites: ARE 321
Co-requisites: none

ARE 406 Fundamentals of Reinforced Concrete Design 3 (3-0-0)
In this course, students will gain the ability to design and proportion structural concrete members including slabs, beams, and columns for strength as well as serviceability and economy. A practical understanding of the structural design process will be developed along with a theoretical understanding of the mechanics and behavior of reinforced concrete. Additionally, different types of reinforced concrete systems will be introduced. Students will develop a thorough understanding of the behavior and design of reinforced concrete members and systems and will be able to apply and effectively use the latest industry standard of formulas, tables, design aids, and/or computer software in the design of reinforced concrete members.
Pre-Requisites: ME 203, ARE 405
Co-Requisites: none

ARE 409 Project Management and Economics 3 (3-0-0)
In this course students will learn to solve economic problems related to construction and engineering, through studying construction project management theories and techniques, characteristics of construction organizations, equipment, and methods. Using project management software and the project life-cycle model from construction project simulations, or real life projects, students will organize, plan, monitor and control a construction project. Students learn to delineate the unique cost control methods for construction productivity, job cost, labor records, and material and equipment purchases. Construction site safety is emphasized throughout the course.
Pre-requisites: ARE 355
Co-requisites: none

ARE 410 Contracts and Liabilities for Buildings and Construction 3 (3-0-0)
This course presents and discusses the legal aspects of engineering and construction contracts; contract formation, interpretation, rights and duties, and changes; legal liabilities and professional ethics of architects, engineers, and contractors. Upon completion of this course, students will be able to: (1) identify the elements of contract formation; (2) interpret contract clauses; (3) explain the rights and duties of the parties involved in design and construction; and (4) evaluate changes and their root causes. Students will also be able to objectively identify and analyze legal liabilities, ethical dilemmas, and the expected professional standard of architects, engineers, and contractors.
Pre-requisites: ARE 355
Co-requisites: none

ARE 412 Environmental Management and Policy 3 (3-0-0)
The objective of this course is to develop an understanding of rational analysis, as well as decision making in issues concerning environmental economics and policy, taking into account the environmental impacts. Concept of externality of environmental impacts, market failure, social cost and benefit analysis, concept of environmental protection and policy instruments related to energy supply and consumption, environmental pollution control and abatement, case studies. Contemporary issues of environment at domestic, regional and international level: public participation and environmental concerns, acid rain, Montreal Protocol, UNFCCC and Kyoto Protocol.
Pre-requisites: ARE 341
Co-requisites: none

ARE 465 Management Principles in Building Engineering 3 (3-0-0)
This course presents the management principles for building engineering, which include financial management, human resources management and organization of business.
Pre-requisites: ARE 409
Co-requisites: none

ARE 491 Architectural Engineering Capstone Project I 2 (0-4-0)
The Capstone project is a two-semesters-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. Students will apply the engineering concepts covered in the courses learned so far to architectural engineering problems, including the design of building structural and services systems, with an emphasis on teamwork. The projects are also used to introduce the students to various practical aspects of construction and professional ethics.
Pre-requisites: ARE 202, ARE 332, ARE 313, ARE 315, ME 407
Co-requisites: none

ARE 492 Architectural Engineering Capstone Project II 2 (0-4-0)
The Capstone project is a two-semesters-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. Students will apply the engineering concepts covered in the courses learned so far to architectural engineering problems, including the design of building structural and services systems, with an emphasis on teamwork. The projects are also used to introduce the students to various practical aspects of construction and professional ethics.
Pre-requisites: ARE 491
Co-requisites: none

Elective Courses

ARE 302 Indoor Air Quality Engineering 3 (3-0-0)
This course is designed to provide a fundamental knowledge about Indoor Air Quality (IAQ) and provide information about IAQ standards and laws. Participants will also learn the basics about how to implement the IAQ solution and perform IAQ audit in buildings.
Pre-requisites: ME 206
Co-requisites: none

ARE 314 Architectural Design III 2 (2-0-0)
In Architectural Design III, students will be introduced to the dynamic relationship between buildings, streets, and public open spaces, which can create a functional, attractive and sustainable built environment. This course emphasizes sustainability through forms and functions, the integration between various arrangement of buildings and spaces, and the utilization of new technologies and systems in designing and constructing buildings. It is an interactive course that accentuates evidence-based design and research. Students will complete design proposals and schemes to redevelop an urban site in the city of Riyadh; involving different factors: economic, social, and environmental. The emphasis will be placed on fitting architectural forms into historical, and cultural contexts; enabling desirable activity patterns; conceptualizing built form; providing necessary infrastructure and service systems.
Pre-requisites: ARE 202
Co-requisites: none

ARE 314 S Architectural Design III Studio 1 (0-2-0)

The emphasis of this design component is to utilize hands-on analysis and problem solving techniques to create a better arrangement and design of the site under investigation. You will have the opportunity to apply what you have learned through lectures and field research into your design. The design of your final project should meet the requirements of the site, and the aspirations of its users.
Pre-requisites: ARE 202
Co-requisites: ARE 314

ARE 400 Special Topics in Architectural Engineering 3 (3-0-0)
This course provides instruction and experience in timely topics related to the Architectural Engineering field.
Pre-requisites: Department Approval
Co-requisites: none

ARE 435 Undergraduate Research in Architectural Engineering 0 (0-0-0)
In this course students will learn how to produce highly quality research about a novel topic mutually agreed between the instructor and the student related to the broad field of Architectural Engineering. The student and the faculty supervisor will complete and sign a research contract which includes a plan for the semester before the research begins. Students receive guidance and are mentored throughout the whole process. Students' progress is periodically assessed by the instructor and ultimately the students will produce a final report detailing their research results.
Pre-Requisites: Department Approval.
Co-requisites: none

ARE 435 S Undergraduate Research in Architectural Engineering Studio 3 (0-6-0)
In this course students will learn how to produce highly quality research about a novel topic mutually agreed between the instructor and the student related to the broad field of Architectural Engineering. The student and the faculty supervisor will complete and sign a research contract which includes a plan for the semester before the research begins. Students receive guidance and are mentored throughout the whole process. Students' progress is periodically assessed by the instructor and ultimately the students will produce a final report detailing their research results.
Pre-Requisites: Department Approval
Co-requisites: ARE 435

ARE 452 Soil Mechanics and Foundations 3 (3-0-0)
The main objective of the course is to introduce students to the basic concepts of design and engineering of earth materials. After completion of the course, students should have a fundamental conceptual understanding of the mechanical behaviors of soils and rocks, which will provide them with the basic tools required in the solution of most geotechnical engineering problems.
Pre-requisites: ARE 231.
Co-requisites: none

ARE 455 Sustainable Buildings 3 (3-0-0)
This course presents the practice of creating building structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. It addresses the full range of issues associated with sustainable buildings, including energy consumption, use of materials, health, assessment methods and environment concerns. It discusses the issues through lectures, tutorials and case study reviews that identify how they are integrated into the design of buildings.
Pre-requisites: ARE 341
Co-requisites: none

ARE 460 Waste Management in Buildings 3 (3-0-0)
The course is designed to furnish the technical skills of future engineers responsible for the design, installation, operation and monitoring of public health and waste management systems required for the safe, comfortable and environmentally friendly operation of modern buildings.
Pre-requisites: ME 201
Co-requisites: none

ARE 470 Building Automation and Control 3 (3-0-0)
This course provides an integrated system approach to understanding building automation and control systems and their applications to building services. It covers the architecture, communication methods, and application software of modern building automation and control systems, and provides good working knowledge of how to specify, design, install, commission, operate, and maintain building automation and control systems. Application areas will include air-conditioning systems, fire detection and suppression systems, security systems, lighting systems, vertical transport systems and other essential building services. The lectures will be complemented by hands-on training sessions in labs.
Pre-requisites: ARE 313
Co-requisites: none

ARE 475 Building Energy Management 3 (3-0-0)

This course gives a rigorous treatment of issues related to the judicious use of energy in the design and use of buildings is provided. Energy-efficient building services systems and system control, energy-conscious building design, building energy analysis, auditing, building envelope, energy-efficient lighting design, energy management programs, energy sources and conservation, rate schedules, waste-heat recovery, passive solar heating/cooling and day-lighting.

Pre-requisites: ARE 313

Co-requisites: none

ARE 477 Smart Buildings 3 (3-0-0)

This course explores how a building's operational efficiency as well as occupants' productivity and safety can be improved through the use of advanced and smart technologies. Students will be introduced to principles of smart systems and green building systems, in addition to how these principles integrate and interact. Students will also learn the possibility and feasibility of utilizing the Internet of Things (IoT), especially in evaluating and transforming existing buildings into sustainable ones. Finally, students will work on a technical, hands-on projects where IoT and other technologies are used in monitoring and managing a building's sustainability variables.

Pre-requisites: ARE 341

Co-requisites: none

ARE 480 Construction Economics and Finance 3 (3-0-0)

The course provides a framework for understanding and interpreting the economic and financial issues in relation to the construction industry, construction firms, and construction projects. The course covers the economic theories of development and construction of built facilities and infrastructure and the roles of these processes in the general economy. Participants will benefit by gaining a better understanding of the conceptual frameworks of economic analysis that underly a variety of approaches to practical problems encountered in the construction process.

Pre-requisites: ARE 355

Co-requisites: none

ARE 482 Operation Analysis in Building Construction 3 (3-0-0)

The course provides students with an introduction to how to approach a construction project covering site set up, planning including the provision of different types of construction equipment and their application, equipment economics, productivity measures, probability theory and statistics, and performance improvement. This task will be linked to the master schedule and the financial planning too . The outcome will be a comprehensive plan for driving projects through completion based on scientific approach and optimum planning. The course primarily focuses on modeling and simulation of field operations using discrete event simulation, including the use of specialized software. Activity cycle diagrams will be used extensively to describe processes and their elements, activities, and resources. Verification and validation of simulation models will be discussed. Analytical skills gained from this course will allow students to better understand and design construction operations. Students will have the opportunity to meet construction managers and visit construction projects to get hands on experience.

Pre-requisites: ARE 355

Co-requisites: none

ARE 484 Construction Professional Practice 3 (3-0-0)

This course examines practice management and project management in the built environment professions, particularly in engineering and construction. Topics in practice management include: ethical practice; the character and operation of practices; legal requirements; cash flow and profitability; running a business; professional memberships and registration; risk and professional liability; and personal career planning. Topics in project management include: project stages; procurement and feasibility; statutory requirements; management of time, cost and quality; and contracts and contract administration in private and public realms. Alternative and innovative pathways through the profession are also considered.

Pre-requisites: ARE 409

Co-requisites: none