

Curriculum Structure and Study Plan

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

I. General Education Requirements (50 CRHs)

1. Mathematics & Statistics (18 CRHs)
2. Basic Sciences (12 CRHs)
3. Humanities (20 CRHs)

II. Core Requirements (73 CRHs)

1. Architectural Engineering Courses (71 CRHs)
2. College of Engineering Courses (22 CRHs)
3. Technical Electives (9 CRHs)
4. Summer Internship (0 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 213	Differential Equations	3	3	0	0	MAT 112	MAT 212
MAT 212	Linear Algebra	3	3	0	0	MAT 112	
MAT 224	Numerical Methods	3	3	0	0	MAT 212, CSC 112 or equivalent	

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 (73 CRHs)

1. Architecture Engineering Courses (71 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab/Studio	Tu t		
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 S	Architectural Design I Studio	3	0	6	0	ARE 120	
ARE 202 S	Architectural Design II Studio	3	0	6	0	ARE 201	
ARE 220	Construction Drawing (CAD)	2	2	0	0	ARE 120	
ARE 220 S	Construction Drawing (CAD) Studio	2	0	4	0	ARE 120	ARE 220
ARE 231	Building Materials and Construction Technology	3	3	0	0	ME 201 ME 203	
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 312	Environment, Economics and Policy	3	3	0	0	ARE 297	
ARE 313	Electrical Installations	3	3	0	0	EE 207	
ARE 315	Lighting Systems and Applications	3	3	0	0	PHU 124	
ARE321	Structural Mechanics	3	3	0	0	ARE 231	

ARE321 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 110	
ARE 355	Quantity Surveying	3	3	0	0	ARE 220	
ARE 405	Structural Analysis	3	3	0	0	ARE 321	
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 450	Introduction to Geotechnical Engineering	3	3	0	0	ME 201 ARE 231	
ARE 450 L	Introduction to Geotechnical Engineering LAB	1	0	2	0	ME 201 ARE 231	ARE 450
ARE 465	Management Principles in Building Engineering	3	3	0	0	ARE 409	
ARE 490 S	Architectural Engineering Capstone Project	4	0	8	2	Dept. Approval	

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	1	CHM 102	
ME 201 L	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	EE 307
ME 206	Thermal Fluids Engineering I	3	3	0	1	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	ME206	
ARE 460	Waste Management in Buildings	3	3	0	0	CHM102	
ARE 470	Building Automation and Control	3	3	0	0	EE207	
ARE 475	Building Energy Management	3	3	0	0	EE207	
ARE 455	Sustainable Buildings	3	3	0	0	ARE 312	
ARE 314	Architectural Design III	2	2	0	0	ARE 202	
ARE 314 S	Architectural Design III Studio	1	0	2	0		ARE 314
ARE 435	Undergraduate Research in Architectural Engineering	3	0	6	0	Dept. Approval	
ARE 444	Reinforced Concrete Design	2	2	0	0	ARE231, ME203	ARE 405

ARE 444 L	Reinforced Concrete Design Lab	1	0	2	0	ARE231, ME203	ARE 405, ARE 444
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4. Summer Internship (0 CRHs)

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

4-Year Curriculum: 152 Credit Hours Total

<i>1st Year</i>			
F a l	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 103 L	Mechanics and Waves for Engineers Lab	1 (0-2-0)
	SE 100	Programming for Engineers	3 (3-0-0)
	SE 100 L	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)
Total			18
S p r	Course Code	Course-Title	CRHs
	ENG 112	Freshman English II	3 (3-0-0)
	MAT 112	Calculus II	3 (3-0-2)
	PHU 124	Electromagnetism and Optics for Engineers	3 (3-0-1)

in g	PHU 124 L	Electromagnetism and Optics for Engineers Lab	1 (0-2-0)
	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 (3-0-1)
	ME 201 L	Materials Science and Engineering	1 (0-2-0)
Total			20
<i>2nd Year</i>			
F a l	Course Code	Course-Title	CRHs
	MAT 211	Calculus III	3 (3-0-0)
	EE 207	Foundations of Electrical Engineering	3 (3-2-1)
	EE 207 L	Foundations of Electrical Engineering LAB	1 (0-2-0)
	ARE 201 S	Architectural Design I Studio	3 (0-6-0)
	ME 203	Applied Mechanics: Statics and Dynamics I	3(3-0-1)
	MAT 213	Differential Equations	3 (3-0-0)
	MAT 212	Linear Algebra	3 (3-0-0)
Total			19
S p r i n g	Course Code	Course-Title	CRHs
	ARE 220	Construction Drawing (CAD)	2 (2-0-0)
	ARE 220 S	Construction Drawing (CAD) Studio	2 (0-4-0)
	ME 206	Thermal Fluids Engineering I	3 (3-0-1)
	ME 206 L	Thermal Fluids Engineering I LAB	1 (0-2-0)
	ARE 297	Architecture and Buildings	3 (3-0-0)

	ARE 231	Building Materials and Construction Technology	3 (3-0-0)
	ARE 202 S	Architectural Design II Studio	3 (0-6-0)
	ARB 101	Arabic Language I	2 (2-0-0)
Total			19
<i>3rd Year</i>			
Fa ll	Course Code	Course-Title	CRHs
	ISL 101	Islamic Studies I	2 (2-0-0)
	ARE 303	Interior Design	2 (2-0-0)
	ARE 303 S	Interior Design Studio	1 (0-2-0)
	ARE 341	The Built Environment	3 (3-0-0)
		Elective I*	3 (TBD per selected elective)
	ME 407	Heating, Ventilation, and Air-Conditioning	3 (3-0-0)
	ARE 312	Environment, Economics and Policy	3 (3-0-0)
	ARE 355	Quantity Surveying	3 (3-0-0)
Total			20
Sp ri ng	Course Code	Course-Title	CRHs
	ARE 332	Building Services Engineering	3 (3-0-0)
	ARE 332 L	Building Services Engineering Lab	1 (0-2-0)
	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 311	Building Acoustics	3 (3-0-0)
	PHL 101A	Engineering Ethics	3 (3-0-0)
Total			20

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

4th Year

F a l l	Course Code	Course-Title	CRHs
	ARE 409	Project Management and Economics	3 (3-0-0)
	ARE 450	Introduction to Geotechnical Engineering	3 (3-0-0)
	ARE 450 L	Introduction to Geotechnical Engineering Lab	1 (0-2-0)
	ARE 405	Structural Analysis	3 (3-0-0)
	ARE 410	Contracts and Liabilities for Buildings and Construction	3 (3-0-0)
		Elective II*	3 (TBD per selected elective)
	ENG 222	Technical Writing	3 (3-0-0)
Total			19
	Course Code	Course-Title	CRHs
	ARE 465	Management Principles in Building Engineering	3 (3-0-0)

S p r i n g	ISL 112	Islamic Studies II	2 (2-0-0)
		Elective III*	3 (TBD per selected elective)
	ARE 490 S	Architectural Engineering Capstone Project	4 (0-8-0)
	ARB 102	Arabic Language II	2 (2-0-0)
	MAT 224	Numerical Methods	3 (3-0-0)
Total			17

Technical Electives

Course Code	Course Name	CRHs	Pre-Requisite Course Code
ARE 302	Indoor air quality Engineering	3(3-0-0)	ME206
ARE 460	Waste Management in Buildings	3 (3-0-0)	CHM102
ARE 470	Building Automation and Control	3 (3-0-0)	EE207
ARE 475	Building Energy Management	3 (3-0-0)	EE207
ARE 455	Sustainable Buildings	3 (3-0-0)	ARE 312
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 435 S	Undergraduate Research in Architectural Engineering	3 (0-6-0)	Dept. Approval
ARE 444	Reinforced Concrete Design	2 (2-0-0)	ARE231, ME203
ARE 444 L	Reinforced Concrete Design Lab	1 (0-2-0)	ARE231, ME203

1. Course Descriptions

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 L 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 S Architectural Design I Studio 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 S Architectural Design II Studio 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

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

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 & ME 203

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.

Co-requisites: ARE321

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

ARE341 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 110

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)

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 490 Studio Architectural 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. 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: Dept. Approval

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 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: Dep. 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: Dep. Approval.

Co-requisites: ARE 435

**ARE444 Reinforced Concrete Design
2 (0-2-0)**

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: ARE 231; ME 203

Co-Requisites: ARE 405

**ARE 444 L Reinforced Concrete Design Lab 1
(0-2-0)**

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: ARE 231; ME 203

Co-Requisites: ARE 405; **ARE 444**

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 312

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: CHM 102

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: EE 207

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: EE 207

Co-requisites: none