Architectural Engineering Department

History:

the Department of Architectural Engineering was established in the Faculty of Engineering, King Abdulaziz University, Rabigh Campus in 1439/1440 AH.

Graduation requirements:

In order to qualify for a B.Sc. degree in Architectural Engineering:

- A student must successfully complete 155 credit hours with an overall GPA of 2.75 out of 5 or better while satisfying the curriculum requirements of his program of specialization.
- Each student is also required to complete one summer training of 10 weeks in industry under the supervision of a faculty member.
- The typical study period is five years (10 semesters) and the credit units are distributed as follows:

University Requirements	26
Faculty Requirements	44
Program Compulsory Requirements	67
Program Elective Requirements	12
Free Courses (from outside Faculty)	6

Department admission requirement (general conditions)

Conditions of specialization for a student are classified as follow:

- Completion at least 50 total credit hours (two semesters) at the end of the semester during which he applies for specialization.
- Passing the first and second levels of English language courses ELI 101 and ELI 102.
- The number of students must not exceed 30% of the total successful students and is done by determining the minimum GPA for students annually.

Department requirements – credit hours of compulsory courses

(67 credit hours for compulsory courses)

Course code and number	Course Title	Credit Hours*	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	pre-requisites
EEN 100	Electrical Circuits (I)	3	6	(2,2,2)	PHYS 202
EEN 100: Electrical Circuits Electric quantities and circuit elements; Kirchhoff's laws; Mesh and node analyses; Sinusoidal steady-state analysis using phasors; Network theorem and transformations. Three-phase circuits.					
MEN 130	Basic Workshop	1	4	(0,3,1)	---
MEN 130 Basic Workshop I Introduction to principles of production, Engineering materials, Measurements, Standards Specifications, Foundry, Metal forming (forging, extrusion, drawing, press work, rolling, wire drawing), Sheet metal work, Welding, metal cutting and machine tools (sawing, drilling, turning, milling, shaping, slotting, grinding), Fitting, Industrial safety, Production management and production planning.					
CEN 201	Statics	3	4	(3,0,1)	PHYS 281
CEN 201: Statics General principles of statics; Force vectors (2D & 3D); Equilibrium of a particle (2D & 3D); Force system resultants (2D & 3D); Equilibrium of a rigid body (2D); Structural analysis (Trusses-2D); Center of gravity and centroid of a body; Moments of inertia; Friction					
AREN 200	Computer App. in Buildings Design	3	5	(1,4,0)	AREN 220
AREN 200 Computer Applications in Buildings Design To introduces students to industry standard software packages and its application in architecture. Focus is on enabling skill acquisition in the use of Building Information Modeling (BIM) mainly Revit. Course introduces 2D drafting and 3D modeling using Revit, and modeling, rendering and animation using 3D Studio Max and Sketch up. Image processing and Post production programs may also be explored					
AREN 210	History and theory of Architecture	3	3	(3,0,0)	---
AREN 210 History and Theory of Architecture This course examines contemporary world architecture from its roots in early twentieth century modernism in America and Europe and on through its global expansion into various regions of the world, including the Arab world. The course reviews the impact of regional forms and traditions on early modern architecture, and surveys later modernist proposals for a 'universal' or 'international' architecture. The course reviews regional and local reactions to these formulations through the analysis of examples of 20th and 21st century architecture, theory, and criticism that question this global agenda and attempt to negotiate the tensions between global ideals and local conditions.					
AREN 220	Introduction to Architecture and Environmental Design	3	5	(1,4,0)	---
AREN 220 Introduction to Architecture and Environmental Design Designed to introduce students to ideas, principles, and methods of solving architectural problems in a studio setting. Through a graduated sequence of exercises culminating in a major semester project, students explore the architectural concepts of space, form, function, and technology. Instruction is via highly personalized critiques of individual student					

work by assigned department faculty members, as well as periodic reviews of the group by invited faculty and guest critics. The grade is based on the overall performance in the studio with special emphasis on the quality of a major studio project.

AREN 231	Architectural Building Materials	3	4	(2,2,0)	---

AREN 231 Architectural Building Materials

This course provides an introductory overview of the various materials used in construction. After receiving an introduction into fundamental principles of structural, physical and long-term performance, students learn about material and product manufacturing techniques and how they relate to mechanical and non-mechanical properties of the various materials. Common construction methods are introduced and building details are explored.

AREN 332	Building Construction Systems	3	4	(2,2,0)	AREN 231

AREN 332 Building Construction Systems

This course aims at understanding alternative structural systems, relevant construction systems, building components, vertical and horizontal circulation elements, building construction process and techniques, as well as coordination in building design and construction. Principles of working drawing preparation, technical installation symbols and terminology; introduction to computer-aided drafting tools

AREN 340	Surveying for Arch Engineering	2	3	(1,2,0)	MATH 202

AREN 340 Surveying for Architectural Engineering

The main purpose of the surveying course is to enable the student to: Describe surveying fundamentals and errors, Use different techniques for surveying observations, such as distance, elevations, and angles. Demonstrate unknown surveying parameters, and map projections. Measure area and volume from ground data and maps. Calculate simple circular curve and stakeout by deflection angles. Perform experimental works, analysis and interpretation of data. Employ basics of measuring from photographs (Photogrammetry). Employ basics of the geographic information system (GIS).

CEN 240	Structural Analysis (1)	3	4	(3,0,1)	CEN 201

CEN 240: Structural Analysis (1)

Basic principles. Analysis of statically determinate trusses, beams, frames, arches, suspension cables. Influence lines for statically determinate structures. Deflection of structures. Buckling of columns.

MEN 250	Fluid Mechanics (1)	3	5	(2,2,1)	MATH 202 PHYS 281

MEN 250 Fluid Mechanics (1)

Concepts and definitions, Fluid statics, Forces on submerged surfaces and bodies, Non–viscous flow, Conservation of mass, momentum and energy equations, Bernoulli's equation. Dimensional analysis, the Pi–theorem, and similarity, Pipe flow, Losses in conduit flow, Laminar and turbulent flow, Laboratory.

MEN 260	Thermodynamic (1)	3	5	(2,2,1)	MATH 202 PHYS 281

MEN 260 Thermodynamics (1)

Concepts and definitions, Energy, heat and work, Energy Transfer, Properties of pure substances, Ideal gases, Mixture of gases, Phase change, First law of thermodynamics, Specific heats and enthalpy, Application to first law on closed system and control volume, Second law of Thermodynamics, Entropy, Principle of increase of entropy and definition of isentropic efficiency, Availability and reversibility, Some power and refrigeration cycles including Rankine and vapor compression cycles, Laboratory.

AREN 321	Architectural Design Studio (1)	3	6	(0,6,0)	AREN 220

AREN 322	Architectural Design Studio (2)	3	6	(0,6,0)	AREN 321

AREN 322 Architectural Design Studio (2)

This course develops a comprehensive design process with focus on systems design and integration of a mixed-use building, issues of technology, ecology and energy. Exercises focus on the design of building systems and components, building structural design, building codes, design for safety in buildings, architectural expression, integration strategies and applications involving the mechanical, electrical, energy, and building management systems.

AREN 333	Working Drawings	3	5	(1,4,0)	AREN 332

AREN 333 Working Drawings

This course will focus on the principles, concepts, and use of complex graphic tools utilized in the field of architecture, structural systems, Mechanical and Electrical systems, and construction trades. Emphasis is placed on the application of CAD tools in the creation of site plan layout, floor plans, foundation plans, basic roof design, section and details, and elevation drawings. Mathematics, science, and visual design concepts are reinforced.

AREN 350	Mechanical & Electrical Systems for Buildings	3	3	(3,0,0)	MEN 367 EEN 101

AREN 350 Mechanical and Electrical Systems for Buildings

The objective of this course is to introduce the main components of the mechanical and electrical systems in buildings and how do they interact with each other and influence the overall performance of the building and its impact on the environment. Students will be engaged in discussing several building codes and standards in topics related to mechanical and electrical systems for buildings. In particular, national and international standards will be considered to observe the basic design concepts of building systems to meet the requirements of a safe, comfortable and healthy building.

CEN 342	Reinforced Concrete Design (1)	3	4	(3,0,1)	CEN 240

CEN 342: Reinforced Concrete Design (1)

Introduction to properties of concrete and reinforcing steel; Behavior of reinforced concrete under flexure and shear; Introduction to ACI-Code; Types of loads and their factors; Ultimate strength method of design; Analysis and design of singly and doubly reinforced sections; Analysis and design of T-section; Design of beams against shear forces; Development length; Design of solid one-way slab, two-way slab, cantilever slab; Design of short columns.

AREN 351	Principles of HVAC	3	3	(3,0,0)	AREN 350

AREN 351 Principles of HVAC

The overall objective of this course is to prepare students for professional practice in the area of mechanical systems design. Students will gain the necessary skills to deal with different design problems related to heating, ventilation and air-conditioning systems using both hand calculations and computer programs. Low-energy HVAC systems will be discussed to emphasize the significant role of efficient HVAC systems when designing sustainable buildings.

AREN 360	Building Illumination/Acoustics	3	4	(2,2,0)	AREN 350

AREN 360 Building Illumination/Acoustics

This course aims at understanding the physical properties of sound and light and their impact on the design of building systems; introduction to illumination, Daylighting, lighting fixtures and lighting systems in buildings; building's design requirements of illumination; and Lighting calculation methods and measurement techniques. Acoustical design of building spaces and noise control; methods of treatment and selection of appropriate finishing materials to fulfill standard specifications of internal acoustical and lighting environments. Introduction of architectural acoustics calculations and measurement techniques.

AREN 390	Summer Training	2	30	(0,0,30)	Complete 110 Credit

AREN 390 Summer Training

The main purpose of the Summer Training course is to enable the student to: Describe the concepts of the training purpose and the expected outcomes of the training activity. Recognize the concepts of professional organizational structure and

breakdown a work environment into its units and work functions. Estimate the time required to accomplish a given task and to figure out the important tasks in a project affecting the outcome of the project. Furthermore, describe the concepts of the principles of engineering practices related to AE specializations.					
AREN 480	Design for Sustainability: LEED Lab	3	3	(3,0,0)	AREN 322
AREN 480 Design for Sustainability:LEED Lab This course is designed to enable students in using engineering principles in developing innovative strategies to positively influence the human life, the planet's environment, and the productivity of engineering infrastructure. Specifically, the course will provide students with an understanding of the principles of design and construction of green structures applying LEED rating systems. Moreover, this course focuses on strategies and metrics for "greening" existing buildings, LEED Laboratory will specifically explore the criteria and documentation needed to evaluate and certify buildings in the LEED for Existing Buildings: Operations and Maintenance v4 rating system					
AREN 370	Const. Project. Manag.	3	4	(2,2,0)	AREN 332
AREN 499	Senior Project	4	8	(0,8,0)	Complete 300 level courses
AREN499 B.Sc. Senior Project This course aims at tackling engineering projects dealing with design, prototyping, testing and implementation of different engineering solutions to typical engineering problems.					
IEN 481	Intro to Entrepreneurship	1	3	(1,0,2)	IEN 202
IEN 481 Introduction to Entrepreneurship Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, protecting, staffing, leading, growing, and harvesting. Basic framework for understanding the process of entrepreneurship, principles of management and related techniques in decision making, planning, marketing, and financial control. Exercises in practical ideas about launching own enterprises. Classroom lectures are combined.					
Total		67	131	(40,51,40)	

Courses Description "Compulsory Courses":

1- EEN 100: Electrical Circuits

Electric quantities and circuit elements; Kirchhoff's laws; Mesh and node analyses; Sinusoidal steady-state analysis using phasors; Network theorem and transformations. Three-phase circuits.

2- MEN 130 Basic Workshop I

Introduction to principles of production, Engineering materials, Measurements, Standards Specifications, Foundry, Metal forming (forging, extrusion, drawing, press work, rolling, wire drawing), Sheet metal work, Welding, metal cutting and machine tools (sawing, drilling, turning, milling, shaping, slotting, grinding), Fitting, Industrial safety, Production management and production planning.

3- CEN 201: Statics

General principles of statics; Force vectors (2D & 3D); Equilibrium of a particle (2D & 3D); Force system resultants (2D & 3D); Equilibrium of a rigid body (2D); Structural analysis (Trusses-2D); Center of gravity and centroid of a body; Moments of inertia; Friction

4- AREN 200 Computer Applications in Buildings Design

To introduces students to industry standard software packages and its application in architecture. Focus is on enabling skill acquisition in the use of Building Information Modeling (BIM) mainly Revit. Course introduces 2D drafting and 3D modeling using Revit, and modeling, rendering and animation using 3D Studio Max and Sketch up. Image processing and Post production programs may also be explored**.**

5- AREN 210 History and Theory of Architecture

This course examines contemporary world architecture from its roots in early twentieth century modernism in America and Europe and on through its global expansion into various regions of the world, including the Arab world. The course reviews the impact of regional forms and traditions on early modern architecture, and surveys later modernist proposals for a 'universal' or 'international' architecture. The course reviews regional and local reactions to these formulations through the analysis of examples of 20th and 21st century architecture, theory, and criticism that question this global agenda and attempt to negotiate the tensions between global ideals and local conditions.

6- AREN 220 Introduction to Architecture and Environmental Design

Designed to introduce students to ideas, principles, and methods of solving architectural problems in a studio setting. Through a graduated sequence of exercises culminating in a major semester project, students explore the architectural concepts of space, form, function, and technology. Instruction is via highly personalized critiques of individual student work by assigned department faculty members, as well as periodic reviews of the group by invited faculty and guest critics. The grade is based on the overall performance in the studio with special emphasis on the quality of a major studio project.

7- AREN 231 Architectural Building Materials

This course provides an introductory overview of the various materials used in construction. After receiving an introduction into fundamental principles of structural, physical and long-term performance, students learn about material and product manufacturing techniques and how they relate to mechanical and non-mechanical properties of the various materials. Common construction methods are introduced and building details are explored.

8- AREN 332 Building Construction Systems

This course aims at understanding alternative structural systems, relevant construction systems, building components, vertical and horizontal circulation elements, building construction process and techniques, as well as coordination in building design and construction. Principles of working drawing preparation, technical installation symbols and terminology; introduction to computer-aided drafting tools

9- AREN 340 Surveying for Architectural Engineering

The main purpose of the surveying course is to enable the student to: Describe surveying fundamentals and errors, Use different techniques for surveying observations, such as distance, elevations, and angles. Demonstrate unknown surveying parameters, and map projections. Measure area and volume from ground data and maps. Calculate simple circular curve and stakeout by deflection angles. Perform experimental works, analysis and interpretation of data. Employ basics of measuring

from photographs (Photogrammetry). Employ basics of the geographic information system (GIS).

10- CEN 240: Structural Analysis (1)

Basic principles. Analysis of statically determinate trusses, beams, frames, arches, suspension cables. Influence lines for statically determinate structures. Deflection of structures. Buckling of columns.

11- MEN 250 Fluid Mechanics (1)

Concepts and definitions, Fluid statics, Forces on submerged surfaces and bodies, Non–viscous flow, Conservation of mass, momentum and energy equations, Bernoulli's equation. Dimensional analysis, the Pi–theorem, and similarity, Pipe flow, Losses in conduit flow, Laminar and turbulent flow, Laboratory.

12- MEN 260 Thermodynamics (1)

Concepts and definitions, Energy, heat and work, Energy Transfer, Properties of pure substances, Ideal gases, Mixture of gases, Phase change, First law of thermodynamics, Specific heats and enthalpy, Application to first law on closed system and control volume, Second law of Thermodynamics, Entropy, Principle of increase of entropy and definition of isentropic efficiency, Availability and reversibility, Some power and refrigeration cycles including Rankine and vapor compression cycles, Laboratory.

13- AREN 322 Architectural Design Studio (2)

This course develops a comprehensive design process with focus on systems design and integration of a mixed-use building, issues of technology, ecology and energy. Exercises focus on the design of building systems and components, building structural design, building codes, design for safety in buildings, architectural expression, integration strategies and applications involving the mechanical, electrical, energy, and building management systems.

14- AREN 333 Working Drawings

This course will focus on the principles, concepts, and use of complex graphic tools utilized in the field of architecture, structural systems, Mechanical and Electrical systems, and construction trades. Emphasis is placed on the application of CAD tools in the creation of site plan layout, floor plans, foundation plans, basic roof design, section and details, and elevation drawings. Mathematics, science, and visual design concepts are reinforced.

15- AREN 350 Mechanical and Electrical Systems for Buildings

The objective of this course is to introduce the main components of the mechanical and electrical systems in buildings and how do they interact with each other and influence the overall performance of the building and its impact on the environment. Students will be engaged in discussing several building codes and standards in topics related to mechanical and electrical systems for buildings. In particular, national and international standards will be considered to observe the basic design concepts of building systems to meet the requirements of a safe, comfortable and healthy building.

16- CEN 342: Reinforced Concrete Design (1)

Introduction to properties of concrete and reinforcing steel; Behavior of reinforced concrete under flexure and shear; Introduction to ACI-Code; Types of loads and their

factors; Ultimate strength method of design; Analysis and design of singly and doubly reinforced sections; Analysis and design of T-section; Design of beams against shear forces; Development length; Design of solid one-way slab, two-way slab, cantilever slab; Design of short columns.

17- AREN 351 Principles of HVAC

The overall objective of this course is to prepare students for professional practice in the area of mechanical systems design. Students will gain the necessary skills to deal with different design problems related to heating, ventilation and air-conditioning systems using both hand calculations and computer programs. Low-energy HVAC systems will be discussed to emphasize the significant role of efficient HVAC systems when designing sustainable buildings.

18- AREN 360 Building Illumination/Acoustics

This course aims at understanding the physical properties of sound and light and their impact on the design of building systems; introduction to illumination, Daylighting, lighting fixtures and lighting systems in buildings; building's design requirements of illumination; and Lighting calculation methods and measurement techniques. Acoustical design of building spaces and noise control; methods of treatment and selection of appropriate finishing materials to fulfill standard specifications of internal acoustical and lighting environments. Introduction of architectural acoustics calculations and measurement techniques.

19- AREN 390 Summer Training

The main purpose of the Summer Training course is to enable the student to: Describe the concepts of the training purpose and the expected outcomes of the training activity. Recognize the concepts of professional organizational structure and breakdown a work environment into its units and work functions. Estimate the time required to accomplish a given task and to figure out the important tasks in a project affecting the outcome of the project. Furthermore, describe the concepts of the principles of engineering practices related to AE specializations.

20- AREN 480 Design for Sustainability:LEED Lab

This course is designed to enable students in using engineering principles in developing innovative strategies to positively influence the human life, the planet’s environment, and the productivity of engineering infrastructure. Specifically, the course will provide students with an understanding of the principles of design and construction of green structures applying LEED rating systems. Moreover, this course focuses on strategies and metrics for “greening” existing buildings, LEED Laboratory will specifically explore the criteria and documentation needed to evaluate and certify buildings in the LEED for Existing Buildings: Operations and Maintenance v4 rating system.

21- AREN 470 Construction Project Management

This course aims at understanding construction project management. Topics include: management process, objectives and performance in construction projects; contracting types, project supervision, risk management and working groups; quality control, time and cost control of construction projects; applications and exercises using computer programs.

22- AREN499 B.Sc. Senior Project

This course aims at tackling engineering projects dealing with design, prototyping, testing and implementation of different engineering solutions to typical engineering problems.

23- IEN 481 Introduction to Entrepreneurship

Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, protecting, staffing, leading, growing, and harvesting. Basic framework for understanding the process of entrepreneurship, principles of management and related techniques in decision making, planning, marketing, and financial control. Exercises in practical ideas about launching own enterprises. Classroom lectures are combined

Department requirements – credit hours of selective courses

(12 credit hours of selective courses)

Course code and number	Course Title	Credit Hours*	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	pre-requisites
AREN 485	Energy Efficiency & Renewable Energy App. for Buildings	3	3	(3,0,0)	AREN 350
AREN 485 Energy Efficiency & Renewable Energy Applications for Buildings This course is designed to introduce students to emerging renewable energy technologies and sustainable building design practices. Both the practical applications and underlying theories will be addressed. Topics will include: The Construction/Engineering Design & Implementation Process, Green Building Practices especially those related to Energy Efficiency, Solar photovoltaic (PV),Wind Turbines, Solar Energy and other forms of renewable energy.					
AREN 423	Advanced Architectural Design Studio	3	6	(0,6,0)	AREN 322
AREN 423 Advanced Architectural Design Studio This course introduces students to theory of building systems integration, and systems-based approach to the design process. Students are engaged in an integrated engineering design process of a small-scale project with a real-life design problem. Students use building simulation tools to analyze and propose for integrated performance of building systems. Through design projects, students explore emerging directions in engineering design, along with emerging directions and tools for engineering design.					
AREN 491	Select. Topic in architectural engineering	3	-	(-,-,-)	---
AREN 491 Special Topic in Architectural Engineering The main purpose of the Special topic in Architectural Engineering course is to enable the student to: Recognize the worth of enhancing knowledge in the field of architectural engineering. Describe the importance of specializing in latest architectural engineering topics. Explain the value of specializing in a particular selected topic. Summarize the specific needs and requirements of selected types of architectural engineering topics.					
CEN 443	Design of Steel Structures	3	3	(3,0,0)	CEN 340
CEN 443: Design of Steel Structures Properties of steel. Types of loads. Philosophy of load resistance factor design (LRFD) method. Analysis and design of tension and compression members. Axially loaded columns. Base plate. Design of beams in flexure and shear. Beams with cover plates. Unsymmetrical bending. Deflection. Design of beams-column. Bolted and welded connections					
AREN 482	Building Performance Analysis	3	4	(2,2,0)	AREN 350
AREN 482 Building Performance Analysis The primary focus of this course is the study of the thermal, luminous and acoustic behavior of buildings. The course examines the basic scientific principles underlying these phenomena and introduces students to a range of technologies and analysis techniques for designing comfortable indoor environments. Students will be challenged to apply these techniques and explore the role energy and light can play in shaping architecture.					
AREN 471	Codes, Contracts and Specifications	3	3	(3,0,0)	---
AREN 471 Codes, Contracts and Specifications Students in this class will study the basic knowledge of construction contracts and specifications in architecture and engineering. Topics include law of contracts, torts, agency, the independent contractor, real property liens, partnerships					

and corporations. Also included are litigation, arbitration of disputes, labor laws in construction work, bidding procedures and specification writing.

AREN 484	Applications of BIM in Bldg. construction	3	4	(2,2,0)	AREN 322

AREN 484 Applications of Building Information Modeling in Building Construction

The aim of the course is to give students a practical, hands-on introduction to BIM and related computer-based techniques for the documentation and modelling of designed structures. The course will be focusing on the processes involved in developing a full 3D design object model, not for the purpose of visualization alone, but more importantly as a tool for understanding and documenting how a proposed building design fits together and how it will perform during use.

AREN 483	Life Cycle Assessment	3	3	(3,0,0)	---
CEN 471	GPS and GIS Applications	3	3	(3,0,0)	AREN 340

CEN 471 GPS and GIS Applications

Introduction to the basic for GPS and GIS applications; Geodesy: introduction, the ellipsoid and geoids, geodetic position , geoids undulation ,deflection of the vertical, geodetic coordinate system; Map Projection: projections used in state plane coordinate systems, UTM projection; GPS: overview of GPS, differential GPS, GPS static survey, GPS kinematic survey; GIS: introduction to GIS, GIS data sources and data format, creating GIS databases, GIS applications, use of surveying software such as GeoMedia and Leica Geo Office.

CEN 340	Structural Analysis (2)	3	4	(3,0,1)	CEN 240

CEN 340 Structural Analysis (2)

Analysis of statically indeterminate structures by method of consistent deformations; Method of slope-deflection and moment distribution; Influence lines for statically indeterminate structures; Approximate methods for analysis of multi-sections forms; Classical stiffness method of structural analysis; Direct stiffness method for trusses.

CEN 442	Reinforced Concrete Design (2)	3	3	(3,0,0)	CEN 342

CEN 442 Reinforced Concrete Design (2)

Review ACI 318- Code provisions; Design of paneled beams, Design of continuous beams; Design of one-way hollow blocks slab; Design of two-way hollow blocks slab; Design of flat slabs; Design of RC stairs; Design of sections under moment and normal force; Design of eccentrically loaded columns using interaction diagrams; Design of RC frame with reinforcement details.

AREN 481	Building Commissioning of Green Buildings	3	3	(3,0,0)	---

AREN 481 Building Commissioning of Green Buildings

This course will explore the fundamental principles of building commissioning process required for green buildings with focusing on Leadership in Energy and Environmental Design (LEED) buildings as building commissioning is an essential part of LEED certification and high performance buildings. Students will gain a comprehensive background in the area of building commission to support their knowledge and enhance their skills in the field of green building design and construction.

- *Each one theoretical hour calculated as one credit hour
- *Each two or three practical hour calculated as one credit hour
- *There is no circumstance for training hour

Courses Description "Selective Courses":

1- **AREN 485 Energy Efficiency & Renewable Energy Applications for Buildings**

This course is designed to introduce students to emerging renewable energy technologies and sustainable building design practices. Both the practical applications and underlying theories will be addressed. Topics will include: The Construction/Engineering Design & Implementation Process, Green Building Practices especially those related to Energy Efficiency, Solar photovoltaic (PV),Wind Turbines, Solar Energy and other forms of renewable energy.

2- **AREN 423 Advanced Architectural Design Studio**

This course introduces students to theory of building systems integration, and systems-based approach to the design process. Students are engaged in an integrated engineering design process of a small-scale project with a real-life design problem. Students use building simulation tools to analyze and propose for integrated performance of building systems. Through design projects, students explore emerging directions in engineering design, along with emerging directions and tools for engineering design.

3- **AREN 491 Special Topic in Architectural Engineering**

The main purpose of the Special topic in Architectural Engineering course is to enable the student to: Recognize the worth of enhancing knowledge in the field of architectural engineering. Describe the importance of specializing in latest architectural engineering topics. Explain the value of specializing in a particular selected topic. Summarize the specific needs and requirements of selected types of architectural engineering topics.

4- **CEN 443: Design of Steel Structures**

Properties of steel. Types of loads. Philosophy of load resistance factor design (LRFD) method. Analysis and design of tension and compression members. Axially loaded columns. Base plate. Design of beams in flexure and shear. Beams with cover plates. Unsymmetrical bending. Deflection. Design of beams-column. Bolted and welded connections

5- **AREN 482 Building Performance Analysis**

The primary focus of this course is the study of the thermal, luminous and acoustic behavior of buildings. The course examines the basic scientific principles underlying these phenomena and introduces students to a range of technologies and analysis techniques for designing comfortable indoor environments. Students will be challenged to apply these techniques and explore the role energy and light can play in shaping architecture.

6- **AREN 471 Codes, Contracts and Specifications**

Students in this class will study the basic knowledge of construction contracts and specifications in architecture and engineering. Topics include law of contracts, torts, agency, the independent contractor, real property liens, partnerships and corporations. Also included are litigation, arbitration of disputes, labor laws in construction work, bidding procedures and specification writing.

7- AREN 484 Applications of Building Information Modeling in Building Construction

The aim of the course is to give students a practical, hands-on introduction to BIM and related computer-based techniques for the documentation and modelling of designed structures. The course will be focusing on the processes involved in developing a full 3D design object model, not for the purpose of visualization alone, but more importantly as a tool for understanding and documenting how a proposed building design fits together and how it will perform during use.

8- CEN 471 GPS and GIS Applications

Introduction to the basic for GPS and GIS applications; Geodesy: introduction, the ellipsoid and geoids, geodetic position , geoids undulation ,deflection of the vertical, geodetic coordinate system; Map Projection: projections used in state plane coordinate systems, UTM projection; GPS: overview of GPS, differential GPS, GPS static survey, GPS kinematic survey; GIS: introduction to GIS, GIS data sources and data format, creating GIS databases, GIS applications, use of surveying software such as GeoMedia and Leica Geo Office.

9- CEN 340 Structural Analysis (2)

Analysis of statically indeterminate structures by method of consistent deformations; Method of slope-deflection and moment distribution; Influence lines for statically indeterminate structures; Approximate methods for analysis of multi-sections forms; Classical stiffness method of structural analysis; Direct stiffness method for trusses.

10- CEN 442 Reinforced Concrete Design (2)

Review ACI 318- Code provisions; Design of paneled beams, Design of continuous beams; Design of one-way hollow blocks slab; Design of two-way hollow blocks slab; Design of flat slabs; Design of RC stairs; Design of sections under moment and normal force; Design of eccentrically loaded columns using interaction diagrams; Design of RC frame with reinforcement details.

11- AREN 481 Building Commissioning of Green Buildings

This course will explore the fundamental principles of building commissioning process required for green buildings with focusing on Leadership in Energy and Environmental Design (LEED) buildings as building commissioning is an essential part of LEED certification and high performance buildings. Students will gain a comprehensive background in the area of building commission to support their knowledge and enhance their skills in the field of green building design and construction