

Curriculum of the Architectural Engineering Program

The curriculum leading to the degree of Bachelor of Science in Architectural Engineering requires **135 Credit Hours** and is organized as follows:

	No. of Courses	No. of Credit Hrs.	Issues	Weight %
University Requirements	6	12 credit hours	Islamic, humanities, and skills courses	8.9%
College Requirements	11	33 credit hours	Math, Basic Science, and Fundamental Engineering	24.5%
Requirements from CE	6	15 credit hours	Advance courses related to building design	11.1%
Department Requirements	32	75 credit hours	Compulsory core courses	55.5%
Total	55 Course	135 Credit Hrs.		100%

1. General University Requirements

All students in the College of Engineering at Najran University are required to take 12 Credit Hours of course work as detailed in the following Table:

Level	Code No.	Course Title	Credit Hours			Pre-Requisite	
			Th	La	To		
Semester 3	201 ARAB-2	Language Skills	2	(2	0	0)	Preparatory Year
Semester 4	111 IC-2	Introduction to Islamic Culture	2	(2	0	0)	
Semester 6	112 IC-2	Islamic Culture (2)	2	(2	0	0)	
Semester 7	113 IC-2	Islamic Culture (3)	2	(2	0	0)	
Semester 8	202 ARAB-2	Arabic Writing	2	(2	0	0)	
Semester 9	114 IC-2	Islamic Culture (4)	2	(2	0	0)	
Total Credit Hours			12				

2. College of Engineering Requirements:

Thirty three (33) credit hours of Basic Sciences, Fundamental Engineering courses, and Communication Skills must be taken by all students in the program of Architectural engineering as college requirement. These courses are listed in the following table:

Level	Code No.	Course Title	Credit Hours			Pre-Requisite	
			Th	La	To		
Semester 3	101 CHEM-3	General Chemistry	3	(3	0	1)	Preparatory Year
	106 MATH-3	Introduction to Integral Calculus	3	(3	0	1)	
	104 PHYS-4	Principles of Physics	4	(3	2	0)	
Semester 4	107 MATH-3	Algebra and Analytical Geometry	3	(3	0	1)	104 PHYS-4
	105 PHYS-4	Advanced Physics	4	(3	2	0)	
Semester 5	203 MATH-3	Advance Calculus	3	(3	0	1)	106 MATH-3
Semester 6	204 MATH-3	Differential Equations	3	(3	0	1)	203 MATH-3
Semester 7	254 MATH-3	Numerical Methods	3	(3	0	1)	204 MATH-3
Semester 8	306 GE-2	Engineering Economics	2	(2	0	0)	203 MATH-3
Semester 9	324 STAT-3	Probabilities and Engineering Statistics	3	(3	0	0)	204 MATH-3
Semester 10	407 GE-2	Management of Engineering Projects	2	(2	0	0)	306 GE-2
Total Credit Hours			33				

3. Required Courses from Civil Engineering Department

Fifteen credit hours of advance building engineering courses must be taken by all students in the program of Architectural engineering as shared courses with civil engineering program. These courses are listed in the following table:

Level	Code No.	Course Title	Credit Hours			Pre-Requisite	
			Th	La	To		
Semester 5	342 CE-3	Properties and Testing of Materials	3	(3	0	0)	
Semester 7	261 CE-3	Surveying (1)	3	(2	2	0)	
Semester 8	371 CE-3	Sanitary Engineering	3	(3	0	0)	373 ARE-2
Semester 9	351 CE-3	Reinforced Concrete Design (1)	3	(3	0	1)	272 ARE-3
Semester 10	355 CE-3	Steel Structure	3	(3	0	1)	272 ARE-3
Total Credit Hours			15				

4. Architectural Engineering Courses

Seventy five credit hours of architectural engineering core courses must be taken by all students in the program. These courses are listed in the following table:

Level	Code No.	Course Title	Credit Hours			Pre-Requisite	
			Th	La	To		
Semester 3	121 ARE-2	Architectural Drawing and Presentation	2	(0	4	1)	Preparatory Year
	122 ARE-1	Free Hand Sketching	1	(0	2	1)	
	111 ARE-3	Basic Architectural Design Studio	3	(1	4	1)	
Semester 4	112 ARE-3	Architectural Design Studio (1)	3	(0	6	2)	111 ARE-3
	123 ARE-2	Shadow and Perspective	2	(1	2	1)	121 ARE-2
	131 ARE-2	History of Architecture	2	(2	0	0)	
	141 ARE-2	Building Construction (1)	2	(1	2	1)	121 ARE-2
Semester 5	213 ARE-3	Architectural Design Studio (2)	3	(0	6	2)	112 ARE-3
	233 ARE-2	Theory of Architecture (1)	2	(2	0	0)	
	242 ARE-2	Building Construction (2)	2	(1	2	1)	141 ARE-2

	281 ARE-2	Drawing by Computer (1)	2	(1	2	1)	121 ARE-2
	271 ARE-3	Engineering Mechanics	3	(3	0	0)	106 MATH-3
Semester 6	214 ARE-3	Architectural Design Studio (3)	3	(0	6	2)	213 ARE-3
	222 CE-3	Geotechnical Engineering	3	(3	0	0)	
	234 ARE-2	Theory of Architecture (2)	2	(2	0	0)	233 ARE-2
	272 ARE-3	Structural Mechanics	3	(3	0	0)	106 MATH-3
	282 ARE-2	Drawing by Computer (2)	2	(1	2	1)	281 ARE-2
Semester 7	315 ARE-3	Architectural Design Studio (4)	3	(0	6	2)	214 ARE-3
	343 ARE-2	Working Drawings	2	(0	4	1)	242 ARE-2
	351 ARE-2	Urban Planning	2	(1	2	1)	
	373 ARE-2	Thermo- and Fluid Mechanics	2	(2	0	0)	105 PHYS-4
Semester 8	316 ARE-3	Architectural Design Studio (5)	3	(0	6	2)	315 ARE-3
	332 ARE-2	History of Islamic Architecture	2	(2	0	0)	131 ARE-2
	344 ARE-2	Working Drawing designs	2	(0	4	2)	343 ARE-2
	348 ARE-2	Electrical Systems in Buildings	2	(2	0	1)	105 PHYS-4
	353 ARE-2	Climatic Design	2	(2	0	1)	105 PHYS-4
Training	391 ARE-0	Field Training	0				Completion of 90 Credit Hours
Semester 9	446 ARE-2	Mechanical installations in buildings	2	(1	2	0)	373 ARE-2
	447 ARE-2	Illumination and Acoustics	2	(2	0	1)	348 ARE-2
	452 ARE-2	Housing	2	(1	2	0)	351 ARE-2
	491 ARE-2	Graduation Project (1)	2	(0	4	0)	316 ARE-3
Semester 10	461 ARE-2	Contracts, Quantities and Specifications	2	(1	2	1)	344 ARE-2
	463 ARE-1	Professional Practice of Architecture	1	(1	0	0)	
	492 ARE-4	Graduation Project (2)	4	(0	8	0)	491 ARE-2
Total Credit Hours			75				

COURSE DESCRIPTION

1. General College Courses

This section contains the descriptions of the fundamental engineering courses that are required by the College of Engineering. Each course has its own code, the number of credit hours and a brief description.

101 CHEM-3 (General Chemistry)

3 Credit Hours

Stoichiometry Chemical Arithmetic. Gaseous state- The liquid state – Solutions- properties of the combined solutions- Chemical equilibrium- Introduction to organic chemistry: History of organic chemistry, Chemistry of carbons, homologes series, functional groups, Hydrocarbons.

106 MATH-3 (Introduction to Integral Calculus)

3 Credit Hours

Integration: indefinite integral (definition, geometric meaning, basic properties). Techniques of integral: integration by parts, trigonometric substitutions, partial fractions, quadratic expressions...etc . Integration of certain classes of trigonometric functions. Definite integral: Riemann integral- Upper and lower sums, geometric meaning of definite integral, some properties of definite integral. Intermediate value theorem for integrals. Fundamental theorem of Calculus. Applications of the definite integral: area, volume, work, arc length. Approximations by the Trapezoidal and Simpson rules.

104 PHYS-4 (Principles of Physics)

4 Credit Hours

Vectors, Newton's Laws of Motion, Work and Energy, properties of mater, and their flow, principles of heat, Static and Dynamic electricity, Sound and Optics.

107 MATH-3 (Algebra and Analytical Geometry)

3 Credit Hours

Systems of linear equations, matrices, types of matrices, algebraic of matrices, inverse of matrices, determinants, Cramer's rule. Vectors in two and three dimensions and properties of vectors, scalar (dot) and cross products. Distance formula, gradient (or slope), positive and negative slopes, Inclination, parallel and perpendicular lines, straight line general formula, perpendicular distance from a point to a line, the general formula of circle. Conic sections: the parabola, the ellipse, the hyperbola. Rectangular, polar and spherical coordinates; curves in polar coordinates. Equations of lines and planes in space, surfaces.

105 PHYS-4 (Advanced Physics)

4 Credit Hours

Atomic structure: electronics configuration, classification of elements, energy levels. Crystal structure: lattice, symmetry, space group, examples for simple structure. Electrical properties of materials and electricity: classification of materials. Magnetic properties of materials and magnetism. Thermal properties of materials: thermal energy, thermoelectric power (Seebeck Effect). Mechanical properties of matter (Young's modulus, tensile materials).

203 MATH-3 (Advance Calculus)

3 Credit Hours

Infinite Sequences, Infinite series, convergence and divergence of infinite series, integral test, ratio test, root test and comparison test. Conditional convergence and absolute convergence, alternating series test. Power Series, Taylor and Maclaurin series, Vector valued functions, their limits, continuity, derivatives, and integrals. Motion of particle in space, tangential and normal components of acceleration. Function in two or three variables, their limits, continuity, partial derivatives, chain Rule, directional derivatives, tangent planes and normal lines to equations, Extrema of Functions of Several Variables, Lagrange Multipliers, Double integral and its applications to area, volume, moments and center of mass. Double integrals in polar coordinates, triple integral in rectangular, cylindrical, and spherical coordinates and applications to volume, the moment and center of mass. Vector fields, line integrals, surface integrals, green's theorem, and the divergence theorem. Stoke's theorem.

204 MATH-3 (Differential Equations)

3 Credit Hours

Introduction and classification, solutions of first order differential equations and their applications, (Growth and decay problems and linear motion problems). Solutions of higher order linear differential equations and their applications (spring problem and projectile problems). Laplace transforms and its applications, linear systems of differential equations. Series solutions of differential equations. Fourier series.

254 MATH-3 (Numerical Methods)

3 Credit Hours

Types of errors, errors analysis. Numerical solutions of nonlinear equations of single variables: fixed point iteration method, bisection method, false position method, Newton-Raphson method, secant method. Numerical solutions of a system of linear equations: Gauss-Jordan iterative method. Gauss-Jordan iterative method with partial and complete pivoting. Interpolation: Lagrange interpolation formula, divided differences, Newton interpolation, Numerical differentiation. Numerical integration. Introduction to numerical solutions of ordinary differential equations.

306 GE-2 (Engineering Economics)

2 Credit Hours

Introduction to Engineering economics. Interest formulas and equivalence. Bases for comparison of alternatives. Decision making among alternatives. Evaluating replacement alternatives. Break even and minimum cost analysis. Cost accounting. Depreciation. Economic analysis of operations. Economic analysis of public projects. Basic management process approach, strategies and planning methods, project planning and scheduling, Bar chart, critical path methods, PERT method, resource leveling and allocation, time cost trade off. Construction and organizational approaches, leadership elements and decision making, computer applications.

324 STAT-3 (Probabilities and Engineering Statistics)

3 Credit Hours

Concepts of statistics and its applications in science and engineering, measure of central tendency, measure of dispersion, regression, correlation, and their applications. Concepts of probability and its applications in science and engineering, probability axioms, conditional probability, independent probability for events, some probability distributions and random variables: discrete and continuous

random variables, distributions for applications in engineering such as Poisson and Weibull distributions and other probability distributions are important for engineers, time series, computer applications using statistical software.

407 GE-2 (Management of Engineering Projects)

2 Credit Hours

Characteristics of Construction Industry; project delivery systems; the design and construction process; construction contracting; construction planning; project control, conceptual cost estimation; and Quality and Safety Management.

2. Special Courses from Civil Engineering Department

This section contains the descriptions of the shared courses with civil engineering program. Each course has its own code, the number of credit hours and a brief description.

342 CE-3 (Properties and Testing of Materials)

3 Credit Hours

Methods of sieve analysis, density, absorption, and abrasion of sand and concrete aggregates. Normal consistency, setting times, compressive and tensile strengths of cements. Design and testing of concrete mixes for required workability, compressive, tensile, flexure strength and modulus of elasticity at various ages. Strength tests: on concrete cores, using Schmidt hammer and ultrasonic waves. Tensile test for reinforcing steel, and calculation of elastic modulus. Tests on isotropic and anisotropic materials and use of dial and electrical strain gages. Finding the Brinell Hardness Number of various materials. Tension tests on ductile and brittle materials. Non-destructive testing on concrete.

261 CE-3 (Surveying (1))

3 Credit Hours

Introduction to the basic surveying theory and practice; Units of measurements and conversions; Error analysis; Distance measurements by taping; Leveling; Angle measurements; Traversing and traverse computations; Topographic surveying and mapping; Area and volume computations; Circular curves; Use of surveying software such as Wolfpack and Surfer.

371 CE-3 (Sanitary Engineering)

3 Credit Hours

Source of water supply; quantity of water and wastewater; quality of water supply; drinking water standard; water treatment system; coagulation-flocculation; sedimentation; filtration; disinfection; softening; iron and manganese removal; taste and odor removal; collection and distribution of water; characteristics of wastewater; effluent standard; wastewater collection; wastewater treatment processes.

351 CE-3 (Reinforced Concrete Design (1))

3 Credit Hours

Fundamentals and design theories based on ultimate strength design and elastic concept using ACI code. ACI Code requirements. Load factors. Analysis and design of reinforced concrete members subject to flexure, shear and diagonal tension in accordance to ACI strength method. Development length of reinforcement, deflection and crack controls in reinforced concrete members.

355 CE-3 (Steel Structure)

3 Credit Hours

Analysis and design of roof trusses. Design of tension and compression members, columns under eccentric loadings, column bases and footings. Design of beams, welded and bolted connections. Different loads on different steel bridges. Design of steel bridges beams using Influence lines.

3. Architectural Courses

121 ARE-2 (Architectural Drawing and Presentation)

2 Credit Hours

This course is concerned with architectural drawing techniques of different presentation methods including instrument used, types of line, drawing scales, architectural lettering, projections for different bodies, isometric drawings. However, the main concept of the course is to teach students the different symbols used by architects to recognize, indicate and represent architectural plans, elevations sections and architectural projects.

122 ARE-1 (Free Hand Sketching)

1 Credit Hour

This course seeks to develop the “thinking hand of the designer” through explorations in freehand sketching. Students will be introduced to freehand drawing conventions and techniques through weekly assignments and record their individual growth in a required sketchbook. Methods of representation will include narrative storyboard perspectives, conceptual diagramming, plan/section/elevation linkage, landform, site and planted form representation and axonometric projection. Sketching opportunities through in-class field-trips to contemporary houses of interest, one-on-one instruction and peer review discussion will structure the learning.

111 ARE-3 (Basic Architectural Design Studio)

3 Credit Hours

The course is an introduction to basic design and basic concepts of beauty in the context of architectural engineering. Through a series of studies and exercises students can learn, understand, analyse and apply basic principles and elements of design and architecture. Subsequently the student could express the function in a small-scale project.

131 ARE-2 (History of Architecture)

2 Credit Hours

The course covers prehistoric architecture, Egyptian, Mesopotamian, Roman, Greek. the era of Renaissance, as well as architecture of the twentieth century in Europe and North America.

123 ARE-2 (Shadow and Perspective)

2 Credit Hours

This course focuses on teaching the foundations and techniques of perspective and different kinds of angles and points of view and different foundations and techniques bring down the shade on the three-dimensional architectural drawings and applied through various exercises on the topics scheduled in the studio.

141 ARE-2 (Building Construction (1))

2 Credit Hours

The aim of this course is to teach the students the building construction stages, basic building components and the different structural systems, emphasis is to be placed on frame and load bearing

structures. Different types of staircases are to be studied in detail also working drawings for the mentioned topics are to be drawn.

112 ARE-3 (Architectural Design Studio (1))

3 Credit Hours

To design simple architectural schemes for example (Artist studio, a small housing unit) This scheme should cover all design aspects with emphasis on functional design.

234 ARE-2 (Theory of Architecture (1))

2 Credit Hours

To study the beginning of Architecture and it was developed, and the factors that influenced it. Emphasis is to be placed on building elements and the basic functional design of buildings. Application of functional design on building such as hotels, restaurants and office buildings

281 ARE-2 (Drawing by Computer (1))

2 Credit Hours

This course provides an introduction to Computer-Aided Design (CAD). The course introduces drafting concepts pertaining to CAD in general, and those that are particular to a selected drafting package. Throughout the course, the emphasis is placed on two-dimensional drawing techniques. The course is primarily based on developing and enhancing 2D computer modelling skills through hands-on experience.

242 ARE-2 (Building Construction (2))

2 Credit Hours

The aim of this course is to teach the students the complementary secondary building components (chosen important elements) and building finishing materials and the basic of their implementation. The theoretical lessons are to be supported by working drawings for two level frame structural building drawn by students.

213 ARE-3 (Architectural Design Studio (2))

3 Credit Hours

To design slightly complicated architectural schemes for example (intermediate school, health centre, technical institute---etc) This scheme should cover all design aspects with emphasis on architectural composition.

271 ARE-3 (Engineering Mechanics)

3 Credit Hours

Introduction to engineering mechanics, Vector operations, Force system resultant. Equilibrium of a practical, Equilibrium of rigid body, Equilibrium of a particle in two and three dimensions. Structural analysis including methods of joint and method of sections, Friction, Moment of inertia.

233 ARE-2 (Theory of Architecture (2))

2 Credit Hours

This course is concerned with Western architectural movements from the pre-modernism (19th century) through the modern movement, post modernism to the Late-Modernism architecture. This study will be conducted through the work of the high-tech and de-construction movements pioneers. The concept of sustainability and green buildings will be addressed.

282 ARE-2 (Drawing by Computer (2))

2 Credit Hours

This course covers the basics of 3D architectural modelling and presentation packages through sharing drawing files created by AutoCAD 3D with other presentation programs such as 3D Max/Rivet/SketchUp and Photoshop. Computer-Aided Design and its implementation skills to advanced 3D architectural concepts are covered through hands-on experience, including 3D modelling, rendering, and Image processing.

214 ARE-3 (Architectural Design Studio (3))

3 Credit Hours

To design moderately complicated architectural schemes for example (sport centre, factory with one production line....etc.) This scheme should cover all design aspects with emphasis on using wide span roofs.

272 ARE-3 (Structural Mechanics)

3 Credit Hours

Mechanical behaviour of the solid materials (e.g. Steel bars, purlins, beams) under different loads. The relationship between exerted loads and their reactions. Shear force and vectors operation. Friction laws, Material resistance, Twisting vectors. Flexibility curve and bending beams. Equilibrium laws. Equations of motion, Work and energy, Impulse momentum, and vibrations.

222 CE-3 (Geotechnical Engineering)

3 Credit Hours

Introduction to geotechnical engineering, soil formation, engineering properties of soils, stress distribution in soils, consolidation of soils, settlement of structures. Types and design of foundations and retaining structures.

351 ARE-2 (Urban Planning)

2 Credit Hours

The explanation of the theories, strategies, and regulations of the urban planning at the local, regional and national levels coupled by a practical exercise on an urban site within Najran city.

343 ARE-2 (Working Drawings)

2 Credit Hours

The explanation of the contents of working drawings and terminologies used. The preparation of the basic set of working drawings (architectural, sewage and waste disposal systems and sanitary fittings, and electromechanical) for a multi- story building.

315 ARE-3 (Architectural Design Studio (4))

3 Credit Hours

The design of an urban project and to design a complicated architectural scheme for example (civic centre, Commercial and residential complex...etc.) within the urban centre. This scheme should cover all design aspects with emphasis on the surrounding urban entities.

373 ARE-2 (Thermo- and Fluid Mechanics)

2 Credit Hours

An introduction of the basic concepts of thermo-fluid mechanics. Fluid properties, Nature of ideal and real fluid flow in pipes. The pressure and fluid statics in immersed surfaces. Analysis and design of pipe network and losses of pipe flow. Physical and thermo-physical properties of fluids. Testing the choice and performance of pumps.

332 ARE-2 (History of Islamic Architecture)

2 Credit Hours

This course covers the following titles: Architecture in the era of Prophet Mohammad and the Caliphs, Architecture in the Umayyad and the Abbasid era, Architecture in Al Andalus, Architecture

in Fatimid Ayoubi, Architecture in Seljuk and Ottoman era, Architecture valuable Persia, Architecture in the Indian subcontinent, and the Architecture in the Eastern Asia.

353 ARE-2 (Climatic Design)

2 Credit Hours

This course explores aspects of climate relevant to building design and applies passive design concepts and methods to energy efficiency and environmentally responsible building design. Topics include climate and thermal comfort parameters, passive design strategies, energy systems, and environmental implications of building. Emphasizes practical applications for environmental and structural design with respect to the KSA hot arid climate.

344 ARE-2 (Working Drawing Designs)

2 Credit Hours

The preparation of designed working drawings for chosen architectural details of specific building.

316 ARE-3 (Architectural Design Studio (5))

3 Credit Hours

The design of a complicated architectural scheme for example (General or specialised 250-bed-Hospital, International Airport...etc.) This scheme should cover all design aspects with emphasis on the Landscape, the overall aesthetic values.

348 ARE-2 (Electrical Systems in Buildings)

2 Credit Hours

The aim of this course is to present basic principles of electricity and magnetism as necessary for an understanding of the application of electrical services in buildings; to introduce students to the applications of these principles to electrical distribution in buildings; to outline the principles of electric motors, transformers and switchboard design. The types and use of cables and enclosures in and around buildings; methods of assessment of loads and cable sizes; principles of operation of transformers and motors and the design of switchboards and earthing, emergency evacuation lighting and early warning information systems; and Anti-Lighting System. Also, this course introduces the fundamental principles of lighting design for interior and exterior applications; and a basic understanding of data transmission via copper wire and optical fiber.

391 ARE-0 (Field Training)

0 Credit Hours

Eight weeks training in a relevant industry under the supervision of a faculty member. Each student must submit a technical report about his achievements during the training in addition to fulfilling any other requirements as assigned by the department.

452 ARE-2 (Housing)

2 Credit Hours

The explanation of the housing variables. Housing issues ie: economic, socio-cultural, and environmental ones. Housing regulations, policies and strategies at the national and international levels. Also alternative applications for housing projects and rectification methods. This will be supported by a case study for an existing housing project.

447 ARE-2 (Illumination and Acoustics)

2 Credit Hours

This course contents of two parts. The first part covers: Concept of light, vision, and colour. Luminaries and lamps, Lighting system design procedures, calculation and measurement techniques, evaluation of interior lighting quality, and daylighting analysis and design. Therefore, the second part of this course covers: noise control criteria and regulations, instrumentation, noise sources, room acoustics, walls, barriers and enclosures, acoustical materials and structures, vibration, and noise control systems for buildings.

491 ARE-2 (Graduation Project (1))

2 Credit Hours

This is the **first** phase of the graduation project, during which students select to design one of the four technical services that are: structural system, air conditioning, electrical and lighting, and construction management and building construction system.

Each student/s is required to propose a topic and prepare a detailed, valuable dissertation with all the necessary illustrations. (proposal, literature review and methodology)

446 ARE-2 (Mechanical Installations in Buildings)

2 Credit Hours

Introduction to basic concepts, terminology and design methods for building mechanical systems. Thermal comfort, building thermal performance, and heating & cooling load calculation procedures.

Fire protection systems and smoke control. Water supply and distribution systems; Waste and drainage systems. Vertical transportation systems. Computer applications.

461 ARE-2 (Contracts, Quantities and Specifications)

2 Credit Hours

The different types of construction contracts, project preparation stages, measurement of quantities in all works, detailed description and specifications of all works need to accomplish the architectural job.

463 ARE-1 (Professional Practice of Architecture)

1 Credit Hours

This course contains the study of the different fields of the architectural engineering practice, professional ethics and the rules and the regulation that organize the profession.

492 ARE-4 (Graduation Project (2))

4 Credit Hours

This is the **second** phase of the graduation project, during which students select to design one of the four technical services that are: structural system, air conditioning, electrical and lighting, and construction management and building construction system. The selected service should be designed on the architectural technical design produced in GP1. Each student/s is required to prepare a detailed, valuable dissertation with all the necessary illustrations; (investigation, findings, discussion and conclusion)