Course Description

DESIGN
Design is addressed as a tool of research and investigation. Architecture faculty and students explore a range of design investigations, expand knowledge, and confront the challenges of the contemporary built environment. The design area of study functions as the central focus of instruction where all knowledge and skills acquired in other courses converge. Students will learn to probe and carry an in-depth research and reformulation of the problems and issues through the design process. Spatial relationship with the context, sustenance, consideration of the materiality, techniques of fabrication and construction, and representation of ideas through different media always form an integral part of any studio. In opposition to the conventional practice, the format of the studio is lecture intensive and driven by innovation in the response to real questions addressing social and environmental challenges. The creative, collaborative atmosphere of the faculty is supplemented by its advanced information infrastructure, media-enriched presentation spaces, vast library resources, and open access to fabrication technologies, enabling architecture students to develop, discuss, exchange, and materialize ideas through a comprehensive range of platforms and media.

Required Courses

ARCH 201 Basic Design I (5 cr.)
Required for first year, fall term
Design as investigation process: This course is geared for both students of Architecture and Interior Design. Based on the studio format, a sequence of projects is tailored to progressively develop the central skills of observation, research, analytic thinking, and representation, with emphasis on the inventive and intelligent expression of ideas. Students explore ‘ways of seeing’: understanding and interpreting objects/places/events from their environment and learning to look beyond the obvious and visible into the unseen and often ‘absurd’ qualities of things.

ARCH 202 Basic Design II (6 cr.)
Required for first year, spring term
Prerequisites (ARCH 201)
A design studio focused on the development of analytical and technical skills for perceiving, understanding, and manipulating spatial definitions and relationships. This course combines architectural basics and concepts by developing student knowledge on new perspectives and introducing the requirements of human beings, their life and the environment, in addition to the methods of interpretation into architectural entities.

ARCH 301 Architectural Design I (6 cr.)
Required for second year, fall term
Prerequisites (ARCH 202)
A design studio focused on the development of analytical and technical skills for perceiving, understanding, and manipulating spatial definitions and relationships, in addition to essential elements of form and space and the principles of their design.

**ARCH 302 Architectural Design II (6 cr.)**
Required for second year, spring term
Prerequisites (ARCH 301)
This course is one of four advanced level design studios taken by third and fourth year students together. Each is devoted to a specific theme and methodology. Collectively, the courses expose the student to a diversity of architectural issues, techniques and approaches to architecture design. The main purpose of this course is to develop the students’ visualization and technical skills in what pertains to the quantitative and functional aspects of design problems, and aid them in evolving solutions based on the aesthetic and expressive values. This involves the study of the perceptual and spatial characteristics of geometric solids and volumes, while utilizing these various modifications to best suite basic architectural spatial solutions.

**ARCH 401 Architectural Design III (6 cr.)**
Required for third year, fall term
Prerequisites (ARCH 302)
This course introduces students to new problems in design. It strengthens their knowledge in designing multifunction projects and equips them with profound knowledge about solving problems in design process like: site slope, parking and other issues. This is achieved through design methods, principles, and models making.

**ARCH 402 Architectural Design IV (6 cr.)**
Required for third year, spring term
Prerequisites (ARCH 401)
This course is one of four advanced level design studios taken by third and fourth year students together. Each is devoted to a specific theme and methodology. Collectively, the courses expose the student to a diversity of architectural issues, techniques and approaches to architecture design. The main purpose of this course is to introduce students to design multi-function buildings with special emphases on circulation and three-dimensional images. This is achieved through design principles and developing models.

**ARCH 412 Design for Execution (3 cr.)**
Required for third year, spring term
Prerequisites (ARCH 310)
A combined Lecture and Studio course consisting of: implementation of architectural design project in construction and detail plans considering technical requirements. The course covers overview plan, site plan, stories, sections and elevations, wall sections, staircase details, door list, window list, other project related details.

**ARCH 501 Architectural Design V (6 cr.)**
Required for fourth year, fall term
Prerequisites (ARCH 402)
This course is one of four advanced level design studios taken by third and fourth year students together. Each is devoted to a specific theme and methodology. Collectively, the courses expose the student to a diversity of architectural issues, techniques and approaches to architecture design. The main purpose of this course is to introduce students to the design of public buildings such as, offices, hotels, and hospitals, while taking into consideration the impact on community health and the environment. Furthermore, modern technology in the work is tackled, including electrical, mechanical, and acoustic.

ARCH 502 Architectural Design VI (6 cr.)
Required for fourth year, spring term
Prerequisites (ARCH 501)
This course is one of four advanced level design studios taken by third and fourth year students together. Each is devoted to a specific theme and methodology. Collectively, the courses expose the student to a diversity of architectural issues, techniques and approaches to architecture design.

ARCH 601 Final Year Project I (6 cr.)
Required for fifth year, fall term
Prerequisites (ARCH 502)
This course is the first component of the students’ year-long design study of an architecture issue of their choice. The design study must be of a professional caliber that entitles students to graduate as professional architects ready to join the Lebanese Order of Engineers and Architects and practice in the real world. During this course, the students must develop a design Statement and Proposal and must submit a Book which synthesizes their semester’s progress. The design study continues during the Spring term and is considered to be fulfilled by the completion of ARCH 602.

ARCH 602 Final Year Project II (6 cr.)
Required for fifth year, spring term
Prerequisites (ARCH 601)
This course is the second component of the students’ year-long design study of an architecture issue of their choice. The design study must be of a professional caliber that entitles students to graduate as professional architects ready to join the Lebanese Order of Engineers and Architects and practice in the real world. During this course, the students are expected to integrate and synthesize acquired knowledge and skills, and to develop both the theoretical/critical and practical components of the research and design project proposed in ARCH 601.

COMPUTATION DESIGN AND FABRICATION
One of our program’s missions is to explore and elaborate on the concept of “Responsive Architecture” through an exploration of computation, media technology, robotics and digital fabrication in order to
create interactive and ubiquitous architectures through a synthesis of the digital and physical worlds. This study area offers the theoretical and practical hard skills necessary to fulfill this program’s mission and empowers our graduating students to meet the global job market demand in contemporary architectural design offices.

Students will be endowed with a new understanding of digital technologies and their application within the built environment. All of the required and elective courses offered within this area are in a form of studio and/or lab courses. The sequence progresses from hand-driven visualization to 2-D & 3-D digital visualization methods, to finally computation analysis and design. The latter aspect dovetails with digital fabrication in the material science and fabrication study area.

In addition to the required courses, all students of Architecture are required to take a minimum of one elective course from this study area.

**Required Courses**

**ARCH 203 Architectural Communications I (6 cr.)**
Required for first year, fall term
This course is an introduction to the basic language of visualization and conceptual reading/representation of architecture and the built environment offering a shared inventory and basic framework upon which to build subsequent studies. The course stresses on the relationship between the idea (the graphic depiction), the media, materials, and technique through its two structural parts: the non-measurable freehand representation that exposes the students to a number of media (pencil, charcoal, ink, and coloring) and representational tools and the measurable where students learn and apply the principles of descriptive geometry to illustrate and communicate design ideas. This includes orthographic drawing, axonometric projection, architectural diagramming, vignette sketching, and physical modeling. While the assignments are designed to contribute to an integration of these two parts, they culminate in an analytic project whereby students shall be asked to communicate the varied conceptual characteristics of an architectural project of their selection.

**ARCH 204 Architectural Communications II (3 cr.)**
Required for first year, spring term
Prerequisites (ARCH 203)
Developing on its prerequisite (ARCH 203), this course exposes the students to the intersection of solids, sun behavior and ways to react to it through different orientations and contextual conditions, and the construction of shades and shadows that is in itself based on the principles of planar intersections and their application in perspective drawings. Models and drawings will continue to form the necessary investigative tools for communication and as generative instruments of formal, spatial, and tectonic discovery. All exercises are designed to enhance the ability to visualize architectural form and volume three-dimensionally and provide tools that reinforce and inform the design process.

**ARCH 300 Computer Aided Design I (3 cr.)**
Required for second year, summer term
Prerequisites (ARCH 204)
This course is an introduction to and overview of concepts of Computer Aided Design in lectures and exercise form. It enables the students to execute various 2-D digital architectural drawings. The course will comprise basic computer aided drafting skills using the latest release of CAD software including: file management, Cartesian coordinates system, drawing setup, drawing aids, layer usage, drawing 2D geometric shapes, editing objects, array, text applications, dimensions and dimension variables, paper space and viewports, templates, external references, and printing/plotting. In addition to the rendering capacities of CAD software, students will be exposed to additional vector based and raster based rendering software.

ARCH 303 Computer Aided Design II (3 cr.)
Required for second year, fall term
Prerequisites (ARCH 300)
The course provides the continuation of the training in CAD programs. It introduces students to additional specific programs that allow students to simulate entire design projects through computer-based programs, such as Sketch-up and AutoCAD 3D for solid and surface modeling.

ARCH 304 Computational Design Methods and Technologies (3 cr.)
Required for second year, spring term
Prerequisites (ARCH 303)
During this course, students shall be exposed to the latest technological and theoretical developments, empirical research findings, educational case studies, pedagogical theories, design reflections, and future trends related to the world of computation design and fabrication. Students will be critically informed how applying research and pedagogical outcomes and reflections in the field have influenced and will continue to transform design into the future. Issues that will be investigated are: generative and parametric design systems, digital fabrication, building information modeling (BIM), collaborative virtual environment, and virtual and augmented reality systems.

Elective Courses

ARCH 403 Computer Modeling and Animation (3 cr.)
Prerequisites (ARCH 303)
This course expands on the skills learned to cover new applications for surface and solid modeling, as well as rendering, material library, and applications of light, leading to the development of complete project renderings and realistic walk-throughs. In addition, the course introduces techniques for computer animation such as key-framing, procedural methods, motion capture, and simulation. We will focus primarily on architecture animation, but will also discuss animation of cloth and natural
phenomena. Recent research results will be considered as well as basic techniques. The course also includes a brief overview of story-boarding and scene composition.

ARCH 404 LISP & Other Programming Environments (3 cr.)
Prerequisites (ARCH 303)
The intent of this course is not to train students in a particular CAD program or design view but to prepare them for the difficult task of designing and changing CAD programs for their personal use or to needs specified by other architects. In this respect, using programming tools, one can “transcend the factory set limitations of current 3D software. The emphasis of this course will be on principles. All exercises have the purpose of illustrating one particular aspect of design computing. Accordingly, the course shall mainly cover LISP as a computer programming language. Students shall learn the symbols and various operations that define the vocabulary of the programming language and the way its syntax specifies the valid patterns. In addition, students shall be exposed to VisualScheme, an interactive programming environment that accompanies the architect from the learning phases to the advanced uses and that can be explored in pedagogic, research, and industry settings.

ARCH 503 Parametric Design (3 cr.)
Prerequisites (ARCH 303)
This design and technology seminar provides a foundation for understanding and using of parametric design in architecture as well for other design practices and fields. Through learning the language of “Parametric Design,” its history and development, and computational techniques students can expect to develop fundamental knowledge of the importance for designing with parametric tools. Students shall develop an expertise with parametric techniques to suit their own design intentions and practices. The associative parametric designs and strategies are achieved through learning the foundational all through the advanced tools, techniques, and methods. By establishing the concepts and skills required to think, design, and prototype projects using associative parametric design technologies students will gain facility, precision and control for taking their designs from concept to implementation.

HISTORY AND THEORY
This study area explores the relationship between design, history, and theory through a broad range of courses in which the analysis of buildings, cities, landscapes, and texts supports the articulation and criticism of fundamental concepts, methods, and issues. Historical and contemporary projects and writings are studied in context and as part of the theoretical discourse of architecture. Accordingly, this study area investigates subjects that deal with the history of architecture and art, as well as the theoretical and political presuppositions informing that history. Offerings range in content and method. Some are motivated by questions derived from the problems of contemporary practice. Others investigate a body of historical material in ways that develop analytical skills applicable to a wide range of topics raising questions concerned with understanding the built environment – how it is created, what it means to the people who make it, what it tells us about history, how it responds to ideas,
desires, and needs of people living at a particular time, and how at the end of the day, it informs our
design as a scholarly work.

In this respect, the set of courses (both required and optional) forming the body of this study area
locates architecture within social, ideological, creative, political, material and technological, theoretical
and urban processes. In doing so, it explores the boundaries of what might be regarded as legitimate
architectural objects of study, and the effects of different modes of historical interpretations upon the
discipline and beyond.

In this perspective, we explore the material aspects of architecture (structure, design, technology, etc.),
the intellectual, philosophical, and social conditions that bring it into being, as well as the significant
issues in current disciplinary thinking. Our courses cover a vast number of topics, from prehistoric grave
mounds to contemporary issues and themes. The second year of study includes a broad survey of a
world history of architecture, art, and the city (Arch 307 & 308). The rich history of Tripoli takes a special
attention in this track. This study area is approached from an interdisciplinary perspective.

The student will not only develop an understanding of how the built environment has been shaped in
the past and is being shaped now, but also the forces that will shape it in the future. Through the
rigorous application of research and analysis, students will study spatial design in the broadest context
examining the environmental, social, cultural, economic, political, technical and aesthetic influences on
the design process as well as on the "finished product" itself.

In addition to the required courses, all students of Architecture are required to take a minimum of one
elective course from this study area.

- The main general outcomes of this track are:
  - Understand how designs are the result of the cultural, social and economic context in which they are
    conceived and produced
  - Formulate solid research questions
  - Apply scientific research methods that will help any historical and/or theoretical investigation
  - Write sound papers

Apply design as a research method in the investigation of historical buildings/artifacts.

Develop the signification for judging the merits of buildings or building projects. Such reasoned
judgments are an essential part of the architectural creative process.

**Required Courses**

**ARCH 307 World History of Architecture I (3 cr.)**

Required for second year, fall term

This course is a requirement course for second year architecture and interior design students. The same
course is also offered as an elective course for the remaining Faculties.
The World History of Architecture is approached from a different perspective of the conventional Euro-centric outlook to the study of the architecture production during the past eras. Accordingly, it offers an expansive geographical and historical spectrum- widening in this respect the scope of analysis across cultural diversity, time periods, and geographies. The students are expected to develop a holistic, contextualized and sensitive overview of architecture in relation to the following factors that continue to our time shape transformations and differences in the production of Architecture and its agents, namely: geography and the environment; social, economic, and cultural systems; and material and technology.

The scope of the course encompasses architecture from its early prehistoric beginnings to the 1400s (exclusive).

**ARCH 308 World History of Architecture II (3 cr.)**
Required for second year, spring term
Prerequisites (ARCH 307)

This course is a requirement course for second year architecture and interior design students. The same course is also offered as an elective course for the remaining Faculties.

The World History of Architecture is approached from a different perspective of the conventional Euro-centric outlook to the study of the architecture production during the past eras. Accordingly, it offers an expansive geographical and historical spectrum- widening in this respect the scope of analysis across cultural diversity, time periods, and geographies. The students are expected to develop a holistic, contextualized and sensitive overview of architecture in relation to the following factors that continue to our time shape transformations and differences in the production of Architecture and its agents, namely: geography and the environment; social, economic, and cultural systems; and material and technology.

Building on the previous course, the chronological narrative expands from the 1400s till the end of WWII.

**ARCH 407 Contemporary Architectural Theory (3 cr.)**
Required for third year, fall term
Prerequisites (ARCH 308)

Theory can be used as justification, as propaganda, as a guide for practice, as a set of principles, as a vehicle of thought, as a platform for debate, and as an architectural project in itself. This course considers the changing role of theory with respect to architectural, urban, and landscape practice over the course of the twentieth and twenty-first centuries, and aims to furnish students with a set of questions, techniques, and tools for criticism and self-critique. Focusing on key figures, movements, and texts, this course provides an overview of the principal theories that have informed, animated, or destabilized recent architectural, urban, and landscape discourse.

**ARCH 408 Urban and City Planning (3 cr.)**
Required for third year, spring term
This is an intensive studio-oriented course that seeks to give students a real-world experience with city planning. By focusing on one physical area in the context of north of Lebanon, the course helps students learn about the entire gamut of city planning issues: physical building and street design issues, social and economic issues, environmental impacts, analysis methods, legal framework, city government, politics, and community dynamics. Backed by lectures, students are expected to work in the field and in the studio, undertaking a series of assignments that culminate in the preparation of a plan for the study area.

**ARCH 508 Principles of Sustainable Urban Development (3 cr.)**
Required for fourth year, spring term
Prerequisites (ARCH 408)
The course main objective is to impart upon students a profound understanding of urban development from a perspective of sustainability, simultaneously developing their knowledge set of principles and judgment in the field of sustainable urban design, transportation, infrastructure, and smart systems. Students are expected to develop a detailed understanding of how the opportunities and constraints offered by different contexts result in the adaptation and redefinition of sustainability as a continually developing and contested concept. Through case studies, students shall learn to critically assess the possibilities and challenges of sustainability that face the world's cities today as they relate to environmental/ecological, economic, technological, institutional, legal, and social behavioral parameters. Questions of urbanism vs sprawl, urban policies vs master planning, linear vs cyclical systems, ubiquitous vs conventional computation, dedicated vs on-demand service, collective vs individual service, amongst other contemporary issues that couple sustainable urban development shall be addressed in the context of analysis of the case studies.

**Elective Courses**

**ARCH 318 Forms in Architecture (3 cr.)**
Prerequisites (ARCH 308)
This course treats architecture as an end in itself- to serve neither as a history nor as a theory but as a pragmatic “theory of the project,”- a comprehensive guide and reflection upon a generic repertoire of ideas in architecture found both in practice and academia. Students are expected to gain an understanding of a range of phenomenon that have been encountered in our building/design culture over a wide span of time. The study of form in Architecture shall be grounded in the philosophical thought of Rudolph Arnheim, Ernst Cassirer, Husserl, Heidegger, Gaston Bachelard, Michel Serres and Merleau Ponty. Space, spatial concepts and their interpretation (depth, density, interpenetration, assembly and composition, along with Loos’ Raumplan and Le Corbusier’s plan libre), tectonic expressive character of building materials (stone, concrete, brick, wood, glass, and steel), light and shadow, and the conditions of “re-vetment” shall form the material of this theory of the project under investigation. Students are expected to submit a term paper undertaking a project for analysis and presentation at the end of the semester.

**ARCH 517 Landscape Architecture (3 cr.)**
Prerequisites: senior standing
This course explores the basic knowledge about landscape design with its general philosophical and specific functional concepts. It tackles the historical development of landscape architecture, the geometric and naturalistic forms of design, and the principles of organization that lead to harmony, unity, and interest etc. The students utilize different techniques in addition to computer programs to execute selected projects.

ARCH 527 Basics of Climate Responsive Design (3 cr.)
Prerequisites: senior standing
This course deals with the thermal and environmental processes which affect buildings, and how the designer responds to or manipulates the thermal environment. It is necessary for the architect to understand these processes, the human response to them, and the necessary materials and tools. Four computer programs (developed at UCLA) are made accessible to aid student learning in each module of the course, and also to support architectural design decision making once they get out into practice: Climate Consultant, OPAQUE, SOLAR-2, & HEED (Home Energy Efficient Design). All these programs can be downloaded (at no cost) from www.energy-design-tools.aud.ucla.edu.

The Course is designed in ten modules. At the end of the sequence each student will have created all the pieces they need for the design of a small single-zone building, usually some type of residential project. The form of the building will have evolved week by week from the issues covered in each module. At the end of the sequence each student will have developed their own set of design criteria against which their final building design can be evaluated. Students can work in any climate. The ten modules are: Climate Analysis, Design Guidelines, Sun Motion, Design of Sun Controls, Natural Ventilation, Heat Flow through Opaque Elements, Overall Performance: Heat Gain and Loss, Passive Heating and Cooling, Final Energy Conserving Design, & Final Design Evaluation.
Each problem set is structured into a set of learning objectives and the student is shown how to address each, often with the aid of one of the computerized Energy Design Tools.

ARCH 518 Cities, Planning and Urban Life (3 cr.)
Prerequisites (ARCH 408)
This course is a study of the actual planning processes, issues and problems, urban and regional zoning, and demographical projections, with comparative studies of regional, or international, and planning building on case studies. Accordingly, it provides a broad introduction to social science theories and analysis methods and uses case studies along the semester to examine how people, communities, and governments plan a city. Comparative analysis helps bring a broader assessment to the issues in question. This course focuses on describing, explaining, and ultimately understanding cities and regions using cities. The city is unique, yet exemplifies many of the qualities and conflicts that make urban areas interesting. To analyze the structure and development of the city and its region the course draws upon theories and methods of several social science disciplines including economics, geography, political science, anthropology, and sociology. Specific topics presented and discussed in this course are drawn from urban history; urban sociology; economics of urban and regional growth; urban and regional structure; urban form and function; urban government and politics; and the planning profession.
The overall objective of the course is to stimulate thinking about the complexity, role, values, and problems of urban and regional systems, and to raise awareness about the importance of planning and designing for quality urban environments.

**ARCH 528 Architecture Heritage of Tripoli (3 cr.)**
Prerequisites (ARCH307)
Focusing on the city of Tripoli, the course shall approach the city in parallel to Arab cities as well as to cities sited on the Mediterranean. It shall cover the following themes:
1- The city and the urban fabric through history: Tripoli through historical eras (architecture, planning, social and economic transformations).
2- Contemporary realities: urban growth and its impact on the heritage and historical fabric.
3- Architectural landmarks in the city
4- Management of heritage preservation and the difficulties faced
5- Visions and prospects of exploring its future: Development of urban policy and the role of the city between globalization and local assets

**ARCH 537 Architecture of the Islamic World (3 cr.)**
Prerequisites (ARCH 307)
The course approach is similar to courses ARCH 306 & ARCH 307 with a main focus on the architectural production over the periods from the Prophet Mohamad’s hijra to Madinah reaching the Ottoman period.

**ARCH 617 Theories of Urban Design (3 cr.)**
Prerequisites (ARCH 408)
This course examines the 20th century built environment from individual buildings to large-scale urban designs. Taking the Modern Movement as the century’s central architectural and urban design event, the course considers how the theory and practice of modernism both evolved and departed from 19th century movements, created new building techniques and technologies, radically reorganized urban forms and functions, dramatically redefined the role of architect and planner, and was subsequently rejected and resurrected. The forms, functions, and meanings of architecture and urban design are examined within their artistic, social, political, and economic contexts.

**ARCH 618 Urban Ecology and Cities of the Islamic World (3 cr.)**
Prerequisites (ARCH 408)
This course examines Islamic architecture and urban planning coped with environmental constraints in various areas and different climates and how to turn them into constructive design tools. It examines the environmental strategies behind the design of selected examples ranging in scale from the region, to the city, the house, the garden, and the single architectural element. It explores the social, cultural, symbolic, and psychological dimensions of environmental design as they developed over time to enrich, modify, or even obscure their functional origins.
ENGINEERING
The aim of this track is to equip our graduates with the following capabilities:

• Identify, formulate, and solve problems applying scientific and engineering principles and concepts.
• Use the techniques, skills, and modern engineering tools necessary for engineering practice.
• Demonstrate strong architectural, interior design, scientific and technical knowledge, coupled with a solid background in project methodology, building construction techniques and architectural design.
• Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
• Bridge theory and practice and integrate scientific and technological considerations into the design process.
• Integrate design and construction process creatively: Study and design a project to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability.
• Lead and collaborate with the team of engineers and project managers involved in the design and construction activities.
• Ready for post-graduate studies.

Required Courses

ARCH 205 Statics and Mechanics of Materials (3 cr.)
Required for second year, summer term
Prerequisites (MATH 110, PHYS 101)
This course seeks to develop informed intuition for structures by emphasizing underlying concepts and synergy of form and structure and encourage creative design integration. The course also aims to convey material sufficiently rigorous for effective communication with engineers, and analyzing of basic structures.

ARCH 305 Structural Mechanics and Analysis (3 cr.)
Required for second year, fall term
Prerequisites (ARCH 205)
This course is an introduction to column design and buckling; cable design; and physical properties of various materials used in construction: timber, steel, aluminum, copper and others. Deformation of structural elements under loads using moment area and conjugate beam method are also addressed. Indeterminate structures by approximate methods; design and selection of the structural elements according to loads applied with practical assignments: selection of materials and pre-dimensioning the structure elements.

ARCH 306 Building Structures and Seismic Design (3 cr.)
Required for second year, spring term
Prerequisites (ARCH 305)
This course seeks to develop students’ understanding of building structures and selection criteria for appropriate systems; in addition to integration of structures with architectural objectives; conceptual design of structures for gravity and lateral wind and seismic loads.

ARCH 405 Mechanical Design of Buildings (3 cr.)
Required for third year, fall term
This course represents an introduction to the mechanical installations in various building types. On the first hand, it deals with the Heating, Ventilation and Air-Conditioning (HVAC) systems, energy management systems and solar collectors. On the other hand, sanitary engineering issues such as water distribution, sanitary systems and rainwater drainage will be tackled.

ARCH 406 Electrical Design of Buildings (3 cr.)
Required for third year, spring term
This course addresses the fundamentals of electricity, voltage, generation and distribution of power HT and LT. It tackles also the preliminary analysis, estimation and design consideration of building electrical systems. It also highlights on the electrical requirements and distribution in buildings and the related execution problems.

Elective Courses

ARCH 515 Structural Technology I (3 cr.)
Prerequisites (ARCH 306)
This course tackles the basic principles of statics, strength, and stiffness. Students will study the basis behavior of beams and columns. The course seeks to develop a qualitative as well as quantitative understanding of structural analysis and serves as an introduction to Structural Technology II.

ARCH 516 Structural Technology II (3 cr.)
Prerequisites (ARCH 515)
This course tackles the study of gravity and lateral structural systems through case studies in steel, wood and concrete construction, and helps understand how the structures withstand forces. Students will develop the structure to support their own studio work, calculate loads, and design simple elements like beams and columns.

ARCH 525 Advanced Structures (3 cr.)
Prerequisites (ARCH 515)
This course seeks to develop students’ understanding of building structures and selection criteria for appropriate systems. Different systems, such as steel structures, wood structures and composite materials will be addressed.
ARCH 526 Sustainable Environmental Systems (3 cr.)
Prerequisites (ARCH 405 & 406)
This course tackles the impact of climate conditions on the design process, temperature control inside buildings, shade measuring design and its utilities for defining the appropriate amount of insulation and shades, types of heat isolation, wind direction, and ventilation surrounding the building.

ARCH 615 Acoustics (3 cr.)
Prerequisites Senior standing
This course is a survey of basic acoustical systems, theories, acoustic properties of different materials used in buildings and their consequences on noise reduction, as well as a study of the properties of acoustical spaces, such as theaters or concert halls.

ARCH 616 Environmental Engineering (3 cr.)
Prerequisites (ARCH 526)
This course seeks to teach students the fundamental concepts in environmental engineering dealing with water, air, and land pollution, and other areas such as ecology, global warming, environmental regulations, renewable and nonrenewable energy resources, and sustainability. The course also includes how an engineer should be environmentally responsible. Students will learn about architecture, passive design, environmental physics, environmental systems in buildings and the effective use of energy and materials.

ARCH 625 Lighting Design (3 cr.)
Prerequisites (ARCH 406)
This course addresses the analysis of the basic electric concepts, with emphasis on energy management, electric ratings and capacity, and lighting systems and different lighting equipment, and methods for building electrical systems.

MATERIAL SCIENCE AND TECHNOLOGY
Civilization in general and architecture in particular advance through cycles of perpetual change in material and technologies. If Architecture is integration between art and science, there is nothing more intimately related to science in architecture than the science of material.

It is within such a frame of reference that our program approaches the education of our graduates in this study area: materials are the foundation of Architecture. If innovation in architecture is driven by responding to social and environmental challenges, an in-depth understanding of material and its related technologies as well as the capacity to reform these materials is key to this innovative response.
Accordingly this study area is expected to prepare our graduating architects and interior designers to pursue material innovation in their post-graduate studies on one hand and/or to meet the expectations of the construction industry both in Lebanon and the region.

In accordance with the above-mentioned directive, the purpose of this study area is to ensure that after completion of this track, the student has:

- deep knowledge of traditional and contemporary intelligent materials that are green and energy efficient through their properties & characteristics, potential defects and way to detect them, processes of fabrication, use and limitations of the technologies behind their production, manipulations as well as processes and detailing for assembly.
- ability to create architectural designs informed by an understanding of the technical requirements and aesthetic potential of the selected material and a sensitivity towards cost
- adequate knowledge of physical problems, technologies and of the function of buildings so as to provide them with internal conditions of comfort and protection against the climate
- ability to argue scientifically about the selection option of materials and methods of assembly and detailing
- understanding of the behavior of the material within its environment
- understanding of the scientific methods of investigation towards material innovation

An understanding of the field of innovation in material science and technologies that are associated with the profession is also part of the general skill outcomes of this study area. This develops the student's working life skills and promotes a career path with options to either work as an employee in the private or public sector or as an entrepreneur.

**Required Courses**

**ARCH 210 Introduction to Materials (3 cr.)**  
Required for first year, spring term

This course offers an introductory overview of the principle materials used in the construction industry of today. More specifically, the course gives a basic introduction to the properties of the five main classes of materials: metals, ceramics, glass, polymers, composites and natural materials with special focus on steel, concrete, brick, wood and plastic materials. Fundamental characteristics of these materials are explained along their structural, mechanical, and physical properties as well as along their behavior and long-term performance. During this course, students will learn about material and product manufacturing techniques and how they relate to their mechanical and non-mechanical properties. At the end of this course, students will gain a comparative knowledge of material properties and possible applications in architectural design and construction.

**ARCH 309 Building Construction I (3 cr.)**  
Required for second year, fall term  
Prerequisites (ARCH 210)
This course deals with the response of building envelopes to surrounding environmental factors; covering in detail the components of the envelope: floors, walls, doors, windows, and roofs of all types. This course is also an introduction to construction detailing. The aims of the course are for students to achieve an integrated knowledge of building construction, structural systems, material choices and energy transfer mechanisms and the ability to synthesize them into a coherent project that expresses architectural intentions. It also introduces students to the techniques of functional analysis of building performance including computer applications.

**ARCH 310 Building Construction II (3 cr.)**
Required for second year, spring term
Prerequisites (ARCH 309)
A combined Lecture and Studio course consisting of: recent building technologies, materials, finishing work and materials, and the methods, contents, and presentation of professional construction documents including execution drawings, details and schedules. Building components such as floors, roofs, walls, doors, windows, and stairs will be addressed.

**ARCH 409 Building Systems Technology (3 cr.)**
Required for third year, fall term
Prerequisites (ARCH 310)
This subject introduces students to the properties, behavior and testing of construction materials and the principles of heat, light and sound as they apply to building design. Students explore the important link between ecologically sustainable design and construction material choice during the design process. This includes an examination of the durability and life-cycle of construction materials and the embodied energy and energy efficiency of various design options and construction methods.

**ARCH 510 Material Science and Application in Architecture (3 cr.)**
Required for fourth year, spring term
Prerequisites (ARCH 409)
This course looks into architectural innovation within a context where design, composition and modes of production for scales from wearables to buildings have radically changed due to an increasing sophistication and pervasiveness of computationally driven design and fabrication technologies. During the semester, material systems are examined for the ability to act in a responsive manner, by instrumentalizing their native material composition as well as introducing technologies for sensing and geometric transformation. Students are expected to research in the way materials can be responsive to degrees of morphabality and in how their extra-systemic qualities are transformational when placed in different contexts or experienced in different manners. Collaborative project-based research prioritizes design through examination, ongoing iteration and calibration of experiments, both virtual and real.

*Elective Courses*

**ARCH 509 Technological processes and fabrication**
Prerequisites (ARCH 303)
This course builds on the convergence of architecture design with science and technology. It investigates the key role computation plays within complex design synthesis. Students are introduced to highly advanced coding, fabrication and robotic skills, aimed at computational and technological fluency. Simultaneously, students are exposed to larger theoretical underpinnings specifically tailored to their inquiries. This course will also introduce students to digital design and fabrication techniques within the context of contemporary art and design. Through a series of technical demonstrations, students will make connections between computer-aided-design / computer-aided-manufacturing (CAD/CAM) software, digital fabrication technologies and the physical world. Students will complete a series of projects exploring 3D modeling, CAD applications, 3D scanning technologies, and experimental approaches to digital model generation. Simultaneously, digital models will be made physical through additive and subtractive fabrication technologies including 3D printing, CNC milling, and laser cutting.

ARCH 519 Building Envelope (3 cr.)
Prerequisites (ARCH 409)
This course provides a practical introduction and application of building science fundamentals for the evaluation, design, and construction of durable and energy efficient buildings. The role of climate and the theory of heat flow, vapor flow, air flow, and the application of each principle to the evaluation of building envelope assemblies will be discussed. Best-practice assembly design and detailing fundamentals for above and below grade wall assemblies, roofs, and windows will be covered with examples and case studies. International energy code requirements for the building enclosure will also be introduced.

ARCH 520 Experimentation with Materials (3 cr.)
Prerequisites (ARCH 510)
This course provides a culminating experience for students approaching completion of the materials science and Technology track. Review and study of experiments are undertaken in a variety of areas from the investigations on building materials to corrosion science and elucidate the relationships among structure, processing, properties, and performance. The principles of materials selection in design are reviewed.

ARCH 619 Architectural Conservation (3 cr.)
Prerequisites (ARCH 310)
The course provides students with the required understanding of processes and tools to deal with the conservation of Architectural buildings. The development of materials and building techniques will be presented. The problems of contemporary building methods will also be addressed as case studies.

ARCH 620 Theories in Material Systems (3 cr.)
Prerequisites (ARCH 510)
A material system is an assembly where interactions of matter and energies compute form, driven by complex constraints and feedbacks from manufacturing, environment and human interaction. The
course covers constitutive relations for electro-magneto-mechanical materials. Fiber-optic sensor technology. Micro/macro analysis, including classical lamination theory, shear lag theory, concentric cylinder analysis, hexagonal models, and homogenization techniques as they apply to active materials. Active systems design, inch-worm, and bimorph.

PROJECT MANAGEMENT

Required Courses

ARCH 611 Project Management (3 cr.)
Required for fifth year, fall term
This course develops a foundation of concepts and solutions that supports the planning, scheduling, controlling, resource allocation, and performance measurement activities required for successful completion of a project.

Elective Courses

ARCH 511 Professional Practice (3 cr.)
This course will introduce the business aspects of the design practice, through the exploration of the financial, legal, and managerial aspects, contract negotiations, marketing design services, and managing of the client and contractor relationships, with an introduction to the economic and management principles of design projects, financing, cost-estimate and budgeting.

ARCH 621 Design Management in Real Estate Development (3 cr.)
This course provides a basic understanding of the importance of design in real estate development. Design is discussed at different scales of the built environment from industrial products and objects, to interiors, architecture, landscape architecture, and urban design. A special emphasis is placed on the role of the design process, as opposed to design products, in real estate project development, from initial needs assessment through project implementation.

LEGAL

Required Courses

ARCH 414 Building Codes and Laws (3 cr.)
Required for third year, spring semester
This course is a study of the local and regional building codes, with an introduction to other codes (USA, Europe, the Arab World) as comparative tools and an introduction to the local laws governing the building industry.

**OTHER**

*Elective Courses*

**ARCH 312 Intermediate Architectural Photography (3 cr.)**
The course provides students with understanding related to black & white and color photography. The course consists of a series of lectures explaining the technical aspects of cameras such as using light meters, apertures, different lenses, etc. Practical experience will ensure that students learn how to apply and manipulate these aspects during field trips. The students will be familiarized with the work of masters and will understand their different approaches through discussions in class.

**ARCH 512 Surveying (3 cr.)**
The course provides students with knowledge and some experience about measurement methods, surveying instruments, leveling, topographic surveying, triangulation, etc.