King Saud University
College of Architecture & Planning
Department of Architecture and Building Sciences

Course Description
ARCH 460 (Design – 5) 5 credit hours

I. Objectives:

1) To understand, implement and integrate the various Engineering Systems for buildings such as Structural, Mechanical, Electrical, Sanitary and other supporting systems.
2) Assist students to choose engineering systems which are feasible and properly integrated with the functions of the buildings.
3) To apply and incorporate all Engineering systems in the Architectural Design of the project.

II. Course Description:

This course addresses broad-based technical system inclusion in architectural design. The intent is to provide the information and procedures necessary to incorporate building code constraints, structure, HVAC, lighting, plumbing and electricity into the concept sketch level of architectural design formation. The information provided is geared for concept formation purposes only. *[For design development and contract documents the designer must use traditional engineering procedures].*

Information provided by the instructors help students develop the requirements that surround an architectural program. The intent is for the student to collect constraint information concerning technical system integration in order to be prepared for the ensuing design process.

A major part of the studio instruction is based upon providing description of the major components of the technical systems (*that students have been exposed to in other related courses*) that are necessary for an architectural design to be built, accompanied by rule-of-thumb sizing and layout information and procedures. Therefore, it is required to reduce complex engineering and building code information to simple formal and spatial approximations that can be readily incorporated into initial design explorations.

Technical integration can, thus, be conceived as a cooperative game played between the designer's logical and intuitive minds. It is the combination of rule systems explored through logic, and chance provided by the creative leaps of the intuitive mind, that ultimately creates harmonious form.

Typically, a medium to large-size project is to be designed to incorporate technical information into design. Examples include:

- car show room, agency and service facilities
- art museum
- indoor sports facility
- industrial plant
- poly-clinics

Student has to present his project with complete drawings and study models for pre-final presentation to course instructors.

At the end of the semester, student has to present his final project both graphically and orally, with complete and exhaustive technical report in the presence of a jury from the Department of Architecture as well as practicing architectural engineers.

III. Evaluation of student work:

	Grades
Project program, site studies, and case studies	*10*
Design Sketch for initial architectural design concept	*05*
Interim Jury: Architectural design and structural concept	*20*
Design Sketch for Mechanical System (HVAC)	*05*
Design Sketch for Electrical and Sanitary systems	*05*
Pre-final Jury..	*20*
Final Jury ..	*35*

IV. Proposed Project: Pharmaceutical Plant

Course Instructors: Prof. Dr. Ossama A. Abdou, Dr. Mohammad Bahobail.
Eng. Mohammad Kaleemullah, Eng. Kamal Naser

ARCH 460 (Design – 5)

Time: Sunday 10 am to 4.00 pm and Wed 10 am to 4.00 pm
A student has to work and complete all his work during the semester in the studio only.

PROGRAM

Students are to choose a real project from the proposed projects in this course of Architectural Design Studio 5 for this semester. (This semester the proposed project is only one due to small number of students). Each student is required to present all Architecture drawings incorporating all engineering systems properly including Structural, Mechanical, Sanitary, Electrical and other supporting systems (Fire Fighting systems, etc.) well studied so that it integrates with each other without affecting the other systems negatively specially the Architecture design.

This course is different from other design courses offered in the curriculum, as this course concentrates basically on the application of various engineering systems required for a project. Projects have to be more professionally designed as if they were implemented in reality. The

drawings are required to be professional and presenting all building systems without violating each other. The drawings should reflect all the necessary information needed to facilitate proper design of the building such as site analysis, building program, circulation aspects, etc., including construction elements along with the expression of the material standards currently in practice.

In this semester the proposed project is as follows:

PHARMACEUTICAL FACTORY

Requirements:

Students are to follow the program according to a predefined schedule undertaking several stages as mentioned in the time table. Students have to submit their work for each stage within a prescribed time to avoid any delay for which he is penalized.

Project stages

Stage I: site visit

Visit of exiting pharmaceutical plant for students to familiarize themselves with the nature of such a building type and obtain necessary information pertaining to the project. Students are encouraged to discuss details with officials of the organization regarding the functioning of the factory. Students to record their visit(s) with notes, diagrams and photos. Outcome of the visit(s) to be posted in the design studio for common use among students.

Stage II: Preparation of Building Program, Case Studies and Site Analyses:

1. Students are to form separate study groups to thoroughly investigate the design problem. One group is assigned the task to study similar projects (case studies); another to come-up with an efficient building program based on proper literature review, site visits and consultation with design professionals. A third group is to

look for feasible sites for the project and perform a complete site analysis for each proposed site.

2. Findings of each group are shared by all the other groups.

Stage III: Architectural design and preparation of Architectural drawings

A) General site analysis consists of

   1) Express the shape of the site for the proposed project showing the dimensions and the mutual environmental impact of this project on the neighboring areas and buildings.
   2) Proposed Building layout at the site and limit their dimensions with proper arrangement of the openings around them.
   3) Study the climatic factors of the project and orientation of the blocks of the buildings and also arrangement of the blocks most suitable with respect to the traffic movement inside and outside the project.
   4) Proper utilization of the open spaces by providing green areas, islands and pedestrian walk ways and expected future extensions of the project.

B) Study of alternative architectural designs considering the functions of the project and economical aspects.

C) Study of the Architectural plans and blocks considering all proper technical aspects of Architectural drawings. Identification of all structural elements with a structural grid drawn properly and mark correct dimensions inside and outside the plans.

D) Proper study of the architectural sections showing all spaces and levels of the building in relation to different elements.

E) Study of the different architectural elevations for the project showing the finished building as built.

F) Study of complete detailing of various construction elements and their connections with other elements.

Stage IV. Preparation and presentation of structural drawings

A) Selection of proper structural system corresponding to the nature and function of the building to withstand all the expected loads.

B) Study the integration and feasibility of the structural system with Architectural design.

C) Provide all working drawing plans and sections by selecting proper grid lines, axes, levels and dimensions of all structural elements, depicting approximate sizes of structural elements.

E) Study of structural system for all floors with proper detailing of the points of concentration of different elements.

F) Study of structural sections consisting of all parts and elements of the building showing the transfer of vertical and lateral loads up to the level of foundations.

G) Study of joints between elements of the structural skeleton with three dimensional presentation.

H) Study of the foundations, footings, load bearing walls with practical solutions of expansion as well as settlement joints.

I) Study of structural details consisting of section with suitable scale to clearly show the structural system, connections and point of load concentration and details of footings.

Stage V: Mechanical system (HVAC)

B) Selection of proper system of ventilation and Air-Conditioning feasible to the type of the project.

C) HVAC system should be compatible with the selected Architectural and structural systems.

D) Selected units of the Air-Conditioning and its location should be well suited and justified. The distribution of ducts and diffusers should be according to the proper grid system covering all the spaces and floors in the building.

E) Corridors and other public spaces should receive sufficient fresh air with proper system of air supply and return air ducts shown clearly in the vertical and horizontal sections.

F) Select a part of the main building to show details of distribution of ducts and diffusers in the inverted ceiling plan.

Stage VI: Electrical (lighting) system

A) Selection of a proper lighting system for each space of the building according to their uses and functions compatible to all other systems without violating their designs.

B) Show the lighting provision in inverted ceiling plans and sections as shown in the Mechanical system.

C) Selection of special lighting system in case of emergency and fix their locations clearly in the plans.
D) Selection of proper lighting system outside the buildings such as parking, open and green areas.

Stage VII: Sanitary provisions

A) Provision of the water supply network and exit of the waste water using proper drainage system from W.Cs. , Kitchens, Cafeteria and Swimming pool etc. Provision of sufficient Man Holes wherever necessary.
B) Sufficient explanatory details using a scale 1:50 are to be drawn. Provision of water supply pipe lines, waste water ducts and rain water drains in horizontal and vertical directions is also shown.
C) Provision of roof slopes for proper drainage of the rain water.
D) Provision of cleaning system for the water used in swimming pools and fountains etc if present.

Stage VIII: Provision of other supporting systems

A) Provision of proper Fire Fighting and Safety systems.

1) Provision of a system which detects the Fire by providing smoke, flame and temperature detectors.
2) Provision of proper Fire Fighting system consisting of use of water, Halon gas and Carbon di-oxide.
3) Provision of a proper fire-fighting network drawn and marked on the key drawings without clashing with other systems used in the project.

B) Audio-visual systems:

1) Provide proper and clear Audio-visual systems in the auditoriums, lecture halls and prayer halls etc. Show them in the architectural plans and sections.
2) Provision of the audio system should be such that this does not affect or disturb adversely the outside areas.
3) Explain in the section and plans with all details clearly showing the studies and remedies taken care to solve the sound effects in the different buildings.

Stage IX: Presentation skills for the Final and Finished project.

A) Graphic Presentation

1) Select a suitable scale common to all drawing sheets.
2) Continuation order and serial numbering of the drawing sheets is very important for the presentation of the project.
3) Use of proper tools and accessories for expression and presentation of all the contents in the drawing sheets.
4) Statement of names of all spaces in plans and sections with a good and clean hand-writing for all drawing sheets.

B) Oral Presentation

1) Student expected to explain clearly and efficiently in presentation of his project. He has got to explain the project concept, solutions maintaining the order of continuation of topics and subjects.
2) He is expected to explain the comments of the jurists with his full capability to convince and satisfy them.