Section-6

B.Sc.
Architectural Engineering & Building Technology (ABT)

Based on Credit hour system

September 2009

1. INTRODUCTION

Architectural Engineering (AE) at Cairo University, is dedicated to advancing the understanding, value, and quality of visual culture and the built, natural, and social environments through excellent and distinctive teaching, research, and creative endeavors. Grounded in a unique multi-disciplinary structure, AE is a diverse, collegial learning community of faculty, students, and staff. We seek to enhance the lives of individuals and communities through endeavors that stem from intellectual curiosity, critical thinking, and broad inquiry, rooted in the inter-relatedness of theory, history, and practice linked with the engineering sciences and the global technology. AE seeks to provide a well-rounded education, not only through the university and its many offerings and opportunities, but within the various programs. We seek to develop not only future introspective practitioners, but also critical thinkers who will eventually be in significant leadership positions in the profession. Our students and faculty believe that it is extremely important to be intellectually prepared to address issues of national and international importance in a meaningful and responsible manner.

With modern technological advancements, construction is rapidly becoming one of the most difficult and complex businesses to endeavor. Statistics indicate that the manpower involved in that Building industry sector represents over 11% of the total Egyptian workforce. The architectural sector is considered one of the largest industries in Egypt, and in the world as well. This can be revealed from its share in the total National Gross Income which approaches about 8%.

This new program of "Architectural Engineering and Building Technology-ABT" will train the students in a number of streams to examine the art of architecture and the science and technology within side of the architecture engineering profession to be considered a multidisciplinary field that integrates architecture, engineering, technology and management of people and physical resources. As such, ABT graduates would be able to carry out successful design and to develop, construct and operate residential, commercial and public properties.

2. PROGRAM MISSION

To achieve this goal, the ABT program focuses on providing a comprehensive and holistic approach to learning. Architectural Engineering at Cairo University is situated to address the critical environmental and building design issues needed in the 21st Century. We are committed to providing education in architecture science and technology that stresses exploration of critical issues in a learning environment that is conducive to meaningful inquiry and creativity.

The mission of the program is to pursue architecture as a humanistic and professional discipline, which synthesizes art and science through intellectual rigor, aesthetic judgment, and technical understanding. The program achieves its mission through teaching, scholarship, creative work, research, and service, and commits itself to the highest ideals of the profession and culture of architecture.

In support of this mission, the program will affirm the following values.

Excellence

Supporting and celebrating a culture that promotes rigor, encourages risk-taking, and challenges standards in creating, composing, and presenting ideas.

Open Discourse
Fostering the open exchange and critique of ideas in an environment that welcomes a diversity of views.
Inclusiveness
Actively encouraging the presence and participation in the School of individuals with differing backgrounds, experience, and world-views.
Cooperation
Working together in shared efforts to teach, learn, understand, and create.
Inter-Disciplinary Experience
Engaging multiple disciplines to expand our perspectives and enrich our teaching, research, and creative practice.
Responsibility
Recognizing our accountability for the impact of our actions on environmental, social, and cultural systems.

Thus, ABT mission is based upon the conviction that architecture is first, reflective of the diverse, changing goals, values, and resources of society; and second, that architects have various and vital roles in interpreting and determining the status, values, conditions, and direction of society, its culture and quality of life.
Furthermore, the graduates of the program (who possess special skills and capabilities) would be highly demanded in the region due to the following factors:

- Program specialty and its scarcity in the region.
- Booming in the construction sector.
- Dealing with international construction companies and Architectural firms which deal with international forms of practice.

The above-mentioned reasons clarify the importance and the feasibility of the ABT Program on both national, regional and international levels for both private and public sectors.

3. EDUCATIONAL OBJECTIVES

One of the main goals of the Faculty of Engineering, Cairo University, is to cope with the new advances in the field of building construction industry as it is one of the most prominent fields in industry world wide. Along this line, Cairo University considers the development of the proposed program one of its top urgent plans.
Architectural education in this program will be based upon the premise that to be an architect in today's complex and fast-changing, global society, one must have knowledge in a variety of areas beyond the profession. Recognizing the diversity of roles that are now emerging in the profession, graduates should also have a well-developed focus in which they can initiate their career.
Based upon these premises, it is believed that the ABT professional degree must be attained in concert with advanced studies; thus, the professional degree is the graduate degree. Understanding that our program is a continuum of studies which meets the UIA requirements for the professional degree and additional advanced studies in architecture, the ABT program is to:

1- Provide the students with a solid base of knowledge and understanding of the liberal arts, sciences and technology in architecture; with an

advanced professional education focusing on the field of Building Technology.

2- Develop the appropriate intellectual skills that provide the student with the detailed understanding and analytic tools to recognize the accountability for the impact of his/her actions as an architect on the environmental, social, and cultural systems.
3- Actively engage the student of architecture in a setting of multiple disciplines to expand his/her perspectives and enrich skills for: self-learning, research, and creative practice in this interdisciplinary experience.
4- Provide students with the practical and professional skills necessary for employment to work in a team work together with peers in shared efforts to learn, understand, interact and create and to support a culture that promotes and encourages risk-taking and challenges standards in creating, composing and presenting ideas in the field of Architecture and Building Technology.
5- Develop general and transferable skills necessary to expand the student perspective and actively encourage his/her presence and participation in a school of individuals and afterwards in the field of profession with differing backgrounds, experience, world-views and the impart professional attitudes and ethics enabling the graduates to work in multi-disciplinary teams and interact properly in the professional environment

4. PROPOSED STUDENT ENROLLMENT

The ABT Program is planned to start with a maximum of 75 students in the sophomore year. This number may increase in the future as the program proves itself and market demand calls for that. Hence the total number of students will probably reach 375 students by the end of the fifth year. The program will accept National, Arab and Foreign students.

5. PROGRAM DESCRIPTION

To achieve the above mentioned goal, a four years curriculum following the Freshman year in the faculty of engineering is proposed. The curriculum is planned to qualify undergraduates over the four years to have a firm grasp of the subject upon graduation and be capable of effectively participating in almost all architectural projects/activities. To build such a necessary background, the curriculum is planed to cover the fundamental and advanced subjects in architectural design and architectural science and technology.

As the curriculum is based on credit hours, a total of 180 hrs should be completed by the student; about 36 credit hours of those are in the freshman year. After this first academic year, student starts to be exposed to fundamental architectural engineering courses pertinent to history and theories of architecture, architectural design skills courses, design computing and to building construction and technology courses. Furthermore, above the compulsory courses, the student is allowed to

choose also between a numbers of Interdisciplinary elective courses to enhance his/her interest in specialty courses.

5.1 Curriculum Overview

The curriculum consists of courses In Humanities, Basic Science, Basic Engineering Science, and Applied Engineering. Sample Courses in each category are presented as follows:

5.1.1 Humanities

- English Language
- Humanities and Engineering
- Communication Skills
- Seminar
- Management
- Introduction to Law

5.1.2 Basic Sciences:

- Mathematics
- Physics
- Mechanics
- Chemistry
- Engineering Economics

5.1.3 Basic Engineering Sciences

- Basic Architectural Design
- Mechanical & Electrical Systems
- Engineering Statistics
- Special Construction Structure
- Soil Mechanics & Foundations
- Structural Analysis
- Building Construction

5.1.4 Applied Engineering Sciences

- History & Theory of Architecture
- Architectural Design Skills
- Architectural Design
- Visual Arts
- Building Construction
- Building Technology
- Design Computing
- Energy in Buildings
- Environmental Design

5.2. University Requirements

The main purpose of a university education is not only to prepare students for successful careers but also to provide them with the knowledge and skills to develop a rational and successful personal identity. Moreover, Cairo University helps

students to gain an appreciative understanding of the natural and cultural environments in which they live and their roles in the society and community services.
A University requirement of 24 credits (13.3% of the total 180 credits), spread over 12 courses is common to all credit hour programs. All courses in the university requirement are compulsory. The university requirements' courses are shown in Table 1.

Table 1: Common University Core Courses (24 Credits)

GEN N001	Humanities and Engineering	2
GEN N002	English Language	2
GEN N004	Introduction to Computers	2
GEN N101	Technical Writing	2
GEN N102	Fundamentals of Management	2
GEN N201	Communication and presentation skills	2
GEN N204	Accounting	2
GEN N210	Risk Management and Environment	2
GEN N221	Economics	2
GEN N301	Ethics and Legislation	2
GEN N326	Marketing	2
GEN N327	Selections of Life Long Skills	2
Total University Core Credits		24
% of 180 Credits		13.3%

5.3. College Requirements

College requirements provide students with the knowledge and skills that are essential to develop a successful engineer. A college core that is common to all credit hour programs is implemented. This unified college core contains two types of course work. The first category of college core courses includes courses of basic knowledge essential to all engineering graduates such as Mathematics, Physics, Mechanics, Graphics and Design, Manufacturing, Chemistry. The second category includes course work that all students are required to undertake in order to develop certain intended learning outcomes common to all engineering graduates. These include: Seminar work, Industrial Training, Graduation Project. The common college core consists of 45 compulsory credits representing 25% of the total credits hours of the degree. A list of common college core courses is shown in Table 2.
It is worth noting that the program contains other college core courses that are common with some other – but not all – credit hour programs. For example, there is a considerable commonality between the CEM program and the ABT program; Architectural Engineering and Building Technology; as will be discussed later.

Table 2: Common College Core Courses (45 Credits)

GEN N003	Basic Engineering Design	2
MTH N001	Algebra and Analytic Geometry	3
MTH N002	Calculus I	3
MTH N003	Calculus II	3
MEC N001	Mechanics-1	2
MEC N002	Mechanics-2	2
PHY N001	Mechanics, Waves and thermodynamics	3
PHY N002	Electricity and Magnetism	3
CHE N001	Chemistry	3
MDP N001	Engineering Graphics	3
MDP N002	Fundamentals of Manufacturing Engineering	3
MTH N102	Multivariable calculus and Linear Algebra	3
MTH N203	Probability and Statistics	3
ABT N280	Seminar-1	1
ABT N281	Industrial Training-1	1
ABT N380	Seminar-2	1
ABT N381	Industrial Training-2	2
ABT N480	Graduation Project-1	1
ABT N481	Graduation Project-2	3
Total Common College Core Credits		45
% of 180 Credits		25.0%

5.4 Major Core Requirements

The ABT is a program under the umbrella of Architectural Engineering Department with its five specialties; architectural Studies, building technology, environmental planning and design, urban design & city planning. Architectural Engineering core requirements contain 58 credits (32.2 % from the total credits hours). These courses are designed to provide the student with the core of architectural engineering Sciences. Table 3 shows a list of the Architectural Engineering core courses.

Table (3) Architectural Engineering Core Courses (58 Credits)

ARC N101	Introduction to the History and Theory of Architecture	2
ARC N102	History of Structure in Architecture	2
ARC N103	Architecture & Humanities	2
ARC N104	Architectural Design Skills I	3
ARC N105	Introduction to Building Construction and Technology	2
ARC N106	Introduction to CAD Systems	2
ARC N107	Architectural Design Skills II	3
ARC N108	Visual Perception and Art	2
ARC N109	Introduction to Design Computing	2
		Lev.1=20
ARC N202	Building Construction I: Construction Documents	2
ARC N203	Urban Design and Landscape	2
ARC N205	Building Technologies II	3
ARC N206	Architectural Design: Level I	3
ARC N207	Architectural Design: Level II	3
ARC N208	Site Planning and Development	2
ARC N209	Building Technologies III	2
		Lev.2=17
ARC N301	Architectural Design: Level III	4
ARC N302	Building Construction II: Finishing Materials and Detailing	3
ARC N303	Smart Building Information Systems	3
ARC N305	Building Construction III	4
		Lev.3=14
ARC N401	Architectural Design IV	4
ARC N405	Building Economics	3
		Lev.4=7
Total Major Core Credits		58
% of 180 Credits		32.2%

5.5 Specialty Requirements

The program offers specialty in Architectural Building Technology (32 cr. Hrs.) with a 17.8 % of total Cr. H. Focuses on areas of Building Technology, Smart Buildings, Environmental Design, Automation of building Industry and digital Design. Table 4 shows a list of the Architectural Engineering specialties courses.

Table (4) List of Specialty Core Courses (32 Credits)

ARC N204	Engineering Thermal and Aerodynamics	2
*** N***	**Elective I**	2
ARC N304	Fundamentals of Energy in Buildings	3
*** N***	**Elective II**	3
*** N***	**Elective III**	2
ARC N402	Computational Design I: Theory and Applications	4
ARC N404	Knowledge Based Systems	3
ARC N406	The New Practitioner: Dialogue, Tools & Techniques	4
*** N***	**Elective IV**	3
*** N***	**Elective V**	3
*** N***	**Elective VI**	3
Total Architectural Specialty Core Credits		32
% of 180 Credits		17.8%

5.6. Interdisciplinary Engineering Courses

ABT program requires that students complete a number of Interdisciplinary Engineering courses that serves the specialty of Architectural Building Technology. These courses are worth 21 credits (i.e. about 11.7 % of the total degree credits). These courses focus on areas of Building Technology, Building Construction, Civil Engineering, and Automation of building Industry, as given in Table (5) below.

Table (5) List of Interdisciplinary Engineering Courses (21 Credits)

STR N101	Structural Analysis-1	3
STR N102	Structural Analysis-2	3
STR N103	Engineering Materials	3
STR N104	Mechanics of Materials	3
INT N127	Electro Mechanical Systems	2
PBW N302	Soil Mechanics and Foundation	3
STR N201	Fundamentals of Reinforced Concrete Design	2
STR N302	Steel structures Design I	2
Total Credits of Interdisciplinary Engineering Courses		21
% of 180 Credits		11.7%

Complete data of all courses is given in Section (5) covering program details and courses contents are provided in Section (6) below.

5.7. Conformity to Requirements

Classification and categorization of courses against the guidelines provided by the Supreme Council of Universities is provided in Table (6) below. The classification is based upon the "Simple study Plan and Program Details" given in Section-5 below. The categorization is also shown for the five student standings:

- **Freshman**: a student who has not completed 36 credits
- **Sophomore**: a student who completed more than 36 credits but less than 72 credits
- **Junior**: a student who completed more than 72 credits but less than 108 credits
- **Senior-1**: a student who completed more than 108 credits but less than 144 credits
- **Senior-2**: a student who completed more than 144 credits but less than 180 credits

Table 6: Conformity to Supreme Council Guidelines

	Architectural Engineering & Building Technology						
Category	**Freshman**	**Sophomore**	**Junior**	**Senior I**	**Senior II**	**Tot. cr. Hr.**	**%**
Human Sciences	4	0	5	2	0	11	6.1
Basic Sciences	31	4	2	6	2	45	25.0
Engineering Science	1	14	8	7	4	34	18.9
ARC Major	0	20	17	14	7	58	32.2
Specialty	0	0	4	8	20	32	17.8
Total	36	38	36	37	33	180	100
University Requirements	6	4	8	6	0	24	13.3
College Requirements	30	3	4	2	6	45	25.0
Major Requirements	0	20	17	14	7	58	32.2
Specialty requirements	0	0	4	8	20	32	17.8
Interdisciplinary Courses	0	11	0	7	0	21	11.7
Total	36	38	36	37	33	180	100

5.8. Sample Study Plan and Program Details

Table (7) presents a sample study plan spread over 10 main semesters. Since the program is credit hours based curriculum, it should be noted that student does not have to take the courses during the semester indicated as long as prerequisites of a particular course are satisfied. The curriculum gives the student the opportunity to select courses from six elective groups of courses; which represent about 10% of the total credits of the degree. Students in the Architectural Engineering & Building

Technology program are also encouraged to participate in research through independent study projects. Moreover, the curriculum gives the students the opportunity to interact with the architectural, urban sector and government agencies through two practical training summer courses. In addition, students will be exposed to large architectural projects in their practical training and graduation projects.

Due to adoption of 2-3 contact hours♣ for each one hour of tutorials or laboratory work, the total number of contact hours of the degree is 322 contact hours. This point is considered to be very positive from educational point of view.

♣ In case of "Tutorial=2" in all ARC courses except for "Graduation Project-2", 1st tutorial=3 contact hours & 2nd tutorial=2 contact hours, making the ["Tutorial=2"= 3+2= 5 contact hours]

Table (7) Sample Study Plan

Freshman [36 credits]			**Credits**	**lecture**	**Tutorials**	**Contact hours**
		First Semester	Cr.	L	T	Cont.Hr.
1	GEN N001	Humanities and Engineering	2	2	0	2+0= 2
2	PHY N001	Mechanics, Waves and thermodynamics	3	2	1	2+3= 5
3	MTH N001	Algebra and Analytic Geometry	3	2	1	2+3= 5
4	MTH N002	Calculus I	3	2	1	2+3= 5
5	MEC N001	Mechanics-1	2	1	1	1+3= 4
6	MDP N001	Engineering Graphics	3	1	2	1+6= 7
7	CHE N001	Chemistry	3	2	1	2+3= 5
		Second Semester	19			33
8	GEN N002	English Language	2	1	1	1+3= 4
9	GEN N003	Basic Engineering Design	2	1	1	1+3= 4
10	GEN N004	Introduction to Computers	2	1	1	1+3= 4
11	MTH N003	Calculus II	3	2	1	2+3= 5
12	MEC N002	Mechanics-2	2	1	1	1+3= 4
13	MDP N002	Fundamentals of Manufacturing Engineering	3	2	1	2+3= 5
14	PHY N002	Electricity and Magnetism	3	2	1	2+3= 5
			17			31
		Total	36 cr.			64
Sophomore [38 credits]						
		First Semester	Cr.	L	T	Cont.Hr.
15	ARC N101	Introduction to the History and Theory of Architecture	2	1	1	1+3= 4
16	ARC N103	Architecture & Humanities	2	1	1	1+3= 4
17	ARC N104	Architectural Design Skills I	3	2	1	2+3= 5
18	ARC N105	Introduction to Building Construction & Technology	2	1	1	1+3= 4
19	ARC N106	Introduction to CAD Systems	2	1	1	1+3= 4
20	STR N101	Structural Analysis-1	3	2	1	2+3= 5
21	GEN N101	Technical Writing	2	1	1	1+3= 4
22	MTH N102	Multivariable Calculus and Linear Algebra	3	2	1	2+3= 5
		Second Semester	19			35
23	ARC N102	History of Structures in Architecture	2	1	1	1+3= 4
24	ARC N107	Architectural Design Skills II	3	2	1	2+3= 5
25	ARC N108	Visual Perception and Art	2	1	1	1+3= 4
26	ARC N109	Introduction to Design Computing	2	1	1	1+3= 4
27	INT N 127	Electro Mechanical Systems	2	1	1	1+3= 4
28	STR N102	Structural Analysis-2	3	2	1	2+3= 5
29	STR N103	Engineering Materials	3	2	1	2+3= 5
30	GEN N102	Management	2	2	0	2+0= 2
			19			33
		Total	38 cr.			66

Junior [36 credits]			Credits	lecture	Tutorials	Contact hours
		First Semester	Cr.	L	T	Cont.Hr.
31	ARC N202	Building Construction I: Construction Documents	2	1	1	1+3= 4
32	ARC N203	Urban Design and Landscape	2	1	1	1+3= 4
33	ARC N204	Engineering Thermal and Aerodynamics	2	1	1	1+3= 4
34	ARC N205	Building Technologies II	3	2	1	2+3= 5
35	ARC N206	Architectural Design: Level I	3	2	1	2+3= 5
36	STR N104	Mechanics of Materials	3	2	1	2+3= 5
37	GEN N201	Communication and Presentation Skills	2	1	1	1+3= 4
38	GEN N 221	Economics	2	1	1	1+3= 4
		Second Semester	19			35
39	ARC N207	Architectural Design: Level II	3	2	1	2+3= 5
40	ARC N208	Site Planning and Development	2	1	1	1+3= 4
41	ARC N209	Building Technologies III	2	1	1	1+3= 4
42	*** N***	Elective I	2	1	1	1+3= 4
43	MTH N203	Probability and Statistics	3	2	1	2+3= 5
44	GEN N 204	Accounting	2	1	1	1+3= 4
45	GEN N210	Risk Management	2	1	1	1+3= 4
46	ABT N280	Seminar -1	1	0	1	0+3= 3
			17			33
		Total	36 cr.			68

Senior-1 [37 credits]						
		First Semester	Cr.	L	T	Cont.Hr.
47	ABT N281	Industrial Training -1 [Summer]	1	0	1	0+3= 3
48	ARC N302	Building Construction II: Finishing Materials and Detailing	3	2	1	2+3= 5
49	ARC N303	Smart Building Information Systems	3	2	1	2+3= 5
50	STR N201	Fundamentals of Reinforced Concrete Design	2	1	1	1+3= 4
51	STR N302	Steel structure Design I	2	1	1	1+3= 4
52	GEN N301	Ethics, Law and Legislation	2	2	0	2+0= 2
53	GEN N327	Environment	2	2	0	2+0= 2
54	*** N***	Elective II	3	2	1	2+3= 5
		Second Semester	18			30
55	ARC N301	Architectural Design: Level III	4	2	2	2+5= 7
56	ARC N304	Fundamentals of Energy in Buildings	3	2	1	2+3= 5
57	ARC N305	Building Construction III	4	2	1	2+5= 7
58	PBW N302	Soil Mechanics and Foundation	3	2	1	2+3= 5
59	GEN N326	Marketing	2	2	0	2+0= 2
60	*** N***	Elective III	2	1	1	1+3= 4
61	ABT N380	Seminar -2	1	0	1	0+3= 3
			19			33
		Total	37cr.			63

Senior-2 [33 credits]			Credits	lecture	Tutorials	Contact hours
		First Semester	Cr.	L	T	Cont.Hr.
62	ABT N381	Industrial Training -2 [Summer]	2	0	2	0+5= 5
63	ARC N401	Architectural Design IV	4	2	2	2+5= 7
64	ARC N402	Computational Design I: Theory and Applications	4	2	2	2+5= 7
65	ARC N404	Knowledge Based Systems	3	2	1	2+3= 5
66	ARC N405	Building Economics	3	2	1	2+3= 5
67	ABT N480	Graduation Project-1	1	0	1	0+3= 3
		Second Semester	17			32
68	ARC N406	The New Practitioner: Dialogue, Tools & Techniques	4	2	2	2+5= 7
69	ABT N481	Graduation Project-2	3	1	2	1+6= 7
70	*** N***	Elective IV	3	2	1	2+3= 5
71	*** N***	Elective V	3	2	1	2+3= 5
72	*** N***	Elective VI	3	2	1	2+3= 5
			16			29
		Total	33			61
		Total Contact				**322 cont.**
		Total Credits	**180 cr.**			

Note: Electives are chosen from Courses listed in Table (8) below.

Table (8) List of Elective Courses

Course # 42	**Elective I Level 200**	**2**
MEP N206	Analysis and Design of Heating, Ventilating, and Air Conditioning Systems	2
ARC N230	Special Problems in Building Construction	2
Course # 54	**Elective II Level 300**	**3**
ARC N330	Ecologies of Construction	3
ARC N331	Architectural Acoustics & Day Lighting	3
Course # 60	**Elective III Level 300**	**2**
ARC N332	History of Islamic Architecture	2
ARC N333	Structuring Low-Income Housing Projects in Developing Countries	2
Course # 70	**Elective V Level 400**	**3**
ARC N430	Interior Design and Modern Art	3
ARC N431	Building Technologies IV: Energy in Building Design	3
Course # 71	**Elective VI Level 400**	**3**
ARC N432	Independent Studies: Smart Building Information Systems	3
ARC N433	Introduction to Shape Grammars I	3
Course # 72	**Elective VII Level 400**	**3**
ARC N434	Geometric Modeling	3
ARC N435	Independent Studies – Advanced Building Systems Integration	3

6. COURSE CONTENTS

UNIVERSITY CORE COURSES	
GEN N004	**Introduction to Computers** **Prerequisites:** None Introduction to Computer engineering, different accessories and peripherals, the notion of data and information, introduction to software concepts and implementation, emphasizing problem solving through abstraction and decomposition, one high level programming language, concepts and skills are mastered through programming exercises, many of which employ graphics to enhance conceptual understanding. Hands-on training with some tools: e.g. internet searching.
GEN N002	**English Language** **Prerequisites:** None Discovering personal opinion, composing essay and thesis statements, importance of figurative language, typical English writing errors and pitfalls, effective reading skills, organizing written material, skills for implementing transitions and enhancing introductions, control of sentence and paragraph length, peer evaluation, final essay revision.
GEN N001	**Humanities and Engineering** **Prerequisites:** None History of Technology: Engineering and technology in a cultural, social, and historical context. Development of technology as a key to history of civilization in a comparative perspective. Exploring the Humanities: Introduction to modes of thought found within humanities and social sciences. Humanities for Engineers: Humanities themes of increased complexity. Different work methodologies. Critical analysis of information and choice of argumentation. Work methodologies and pedagogical interest.
GEN N101	**Technical Writing** **Prerequisites: GEN N002** Discovering Ideas. Outlining Ideas and Organizing Outlines. Ways To Begin. The Three Parts of Technical Texts. Writing Abstracts, Summaries, and Conclusions of Long Reports. The Thesis Statement. Forms: Letters, Memos, Reports, Scientific Articles, Job Description, CV. Writing References and Footnotes. Selection of Key Words, Titles, and Subtitles. Editing, Revising and Proofreading Techniques. Electronic Word Processing and Technical Writing, Vocabulary Building, Basic Types and Patterns of Argument: Terminology, Building Sub-Arguments of Fact and Policy.
GEN N102	**Fundamentals of Management** **Prerequisites:** None Introduction to management, Historical view and evolution of concepts. Basic Managerial Functions: Planning, Strategies, Objectives, MBO; Organizing, Departmentation, Job Descriptions; Elements of Human Resource Management: Staffing, Directing, Controlling. Total Quality Management, Continuous Improvement. Various Engineering Applications.
GEN N210	**Risk Management** **Prerequisites:** GEN N102 Introduction. Risk Definition and Accident Theory. Principle of Risk Management: Identification of Risks. Preliminary Risk Analysis (PRA). Failure Modes, Effect and Criticality Analysis (FMECA). HAZOP. Methods of System Analysis. What is Risk Assessment. Risk Control. Apply hierarchy of Control. Monitoring and Review. The Process of Fire Risk Management. Regulations and agencies, non-governmental organizations, fires and explosions, pressure relief systems,

	process hazard analysis, inherently safe design. Study of a problem from upstream/downstream in which the student apply Basic Risk Management
GEN N201	**Communication and Presentation Skills** **Prerequisites: GEN N101** Introduction. Planning a presentation. The communication process. The Concept of Thesis Statement. Way To Develop the Thesis Statement. Structuring a presentation. Rules for Writing Text Charts. Writing Titles. Rules for Designing Effective Slides and Charts. Other Elements. Presentations. How to Deal With a Hostile Audience. Elements of An Effective Speech. Speech Preparation as a Process, How to Gesture Effectively. Using LCD Projectors. How To Use Transitions Effectively. Four Ways To Remember Material. Making a Dynamic Presentation Gathering Information & Materials.
GEN N204	**Accounting** **Prerequisites:** None **Basic accounting concepts**: Accounting Terms and Assumptions, **Accounting Methodology:** balance sheet, income statement, cash flow statement. **Income Determination**: Cash Effects, Basis of Accounting. Accounting ratio – measuring the performance – cost concepts – cost accumulation – cost allocation – cost/volume/profit analysis – budgets – forecasting. Cost Accounting.
GEN N221	**Economics** **Prerequisites:** None **Economics as a Discipline**: Economics as a Social Science, Microeconomics and Macroeconomics, Theories in Economics, Barriers to Clear Thinking in Economics. **The Economic Problem**: Scarcity, Resources and Production, Production Possibility Boundaries, Choices and Opportunity Costs, Resource Use (Fundamental Choices). **Demand and Supply**: The Mechanics of a Market. Demand and Supply, Consumers Behavior (Demand, Individual Demand and Market Demand), Properties of Demand Curves, Demand versus Quantity Demanded, Producers Behavior: Supply, Individual Supply and Market Supply, Properties of Supply Curves, Supply versus Quantity Supplied, Equilibrium of Demand and Supply, Adjustment in Market Equilibrium **Supply and Demand Analysis**: Economic Analysis, Demand Shifts: Substitutes and Complements, Demand Shifts: Superior and Inferior Goods, Price Ceilings, Price Floor, Excise Taxes. **Price Elasticity of Demand**: Price Sensitivity, Price Elasticity of Demand, Measuring Price Elasticity of Demand with the Arc Formula, Price Elasticity of Demand and Slope, Price Elasticity of Demand and Total Revenue, Determinants of Price elasticity of Demand, Other Elasticities. **Perfect Competition and Monopoly Production and Input Use:** Production, Production Functions, Short-Run Functions, Long-Run Production, Choices of Inputs. **Economic Costs**: Economic Costs, Short-Run Costs, Short-Run Cost Curves, Long-Run Costs and Long-Run Cost Curves. **Profits, Interests, and Rent. Interest Rates, and Time Value of Money. Feasibility Studies. Project Economic Analysis. Depreciation. Factor Markets: Perfect and Imperfect Competition.**

GEN N301	**Ethics and Legislation** **Prerequisites:** None Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical Responsibilities of Technologists. Codes of professional ethics. Case studies. Value Crisis in contemporary society. Nature of values: Psychological values, Societal values, Aesthetic values, Moral and ethical values. Work ethics and professional ethics. The legal rule: Mandatory and complementary. Sources of Law. Formal sources: Statutory Law, Custom, the Principles of natural Law and rules of justice. Informal sources: Jurisprudence, Doctrine. Application of Law. Holders of right; Natural persons, Juristic persons. Theory of Obligation; definition, forms. Sources of Obligations. Labor Law. Safety and Vocational Laws. The contract; Parties, Formation, Validity, Effect, Interpretation, Responsibilities, Dissolution, and compensation of Damage. Contracts. The legal rule: Mandatory and complementary. Sources of Law. Formal sources: Statutory Law, Custom, the Principles of natural Law and rules of justice. Informal sources: Jurisprudence, Doctrine. Application of Law. Holders of right; Natural persons, Juristic persons. Labor Law. Safety and Vocational Laws. Code of Engineers Syndicate. Code of bedding and its Bylaws. Codes of Environment Protection.
GEN N326	**Marketing** **Prerequisites: GEN N102** Introduction. The Field of Sales; Strategic Sales Force Management. The Personal Selling Process and Sales Force Organization. Profiling and Recruiting Salespeople; Selecting and Hiring Applicants, Developing the Sales Program, Sales Force Motivation, Sales Force Compensation, Expenses and Transportation; Leadership of a Sales Force, Forecasting Sales and Developing Budgets; Sales Territories, Analysis of Sales Volume, Marketing Cost and Profitability Analysis, Performance Evaluation; Ethical and Legal Responsibilities tender writing.
GEN N327	**Environment** **Prerequisites:** None Environmental Systems: Local, Regional and Global. Influence of Air Pollutants on the, Environment, Water Pollutants, Industrial Waste, Hazardous Wastes, Management of Pollutant Releases, Pollution Prevention, Recycling of Waste Materials, Waste Treatment Technologies, Ultimate Disposal of Wastes, Water Treatment Technologies & Control of Air Pollution, Contaminated Land and Its Reclamation, Principals and Uses of the Environmental Risk Assessment, Environmental Risk Assessment Methodology, Environmental Impact Assessment Environmental Health Risk Assessment. National and International regulations.

COLLEGE CORE COURSES	
PHY N001	**Mechanics, Waves and thermodynamics** **Prerequisites:** None Physics and measurements. Elastic properties of solids. Universal gravitation and motion of planets. Fluid mechanics (statics and dynamics). Wave motion. Sound waves. Thermodynamics; temperature, heat and the first law of thermodynamics, the kinetic theory of gases, heat engines, entropy and the second law of thermodynamics. Laboratory experiments on the course topics.
MTH N001	**Algebra and Analytic Geometry** **Prerequisites:** None Mathematical induction, Binomial expansion (real powers), Theory of equations, Horner's division, Matrices, System of Linear Equations, Types of solutions, Equivalence of matrices and change of basis.
MTH N002	**Calculus I** **Prerequisites:** None The set R, Functions, Composite and inverse functions, Theory of limits, Continuity of functions, Differentiation, Chain rule, Implicit and parametric differentiation, Taylor's expansion, Applications
MEC N001	**Mechanics-1** **Prerequisites:** None Vector algebra and its application, forces and resultant of a system of forces in space, moments of forces and couples, the equivalent force, couple system, equilibrium of a particle, equilibrium of a rigid body subjected to coplanar forces, Planar kinematics of a rigid body, center of mass, introduction of moments of inertia.
MDP N001	**Engineering Graphics** **Prerequisites:** None Techniques and skills of engineering drawing, normal and auxiliary projections. Solid geometry. Intersections between planes and solids. Development, sectioning. Drawing and joining of steel frames. Assembly drawing of some mechanical parts.
CHE N001	**Chemistry** **Prerequisites:** None Gases, Applications to gaseous law - Mass balance and heat balance in combustion processes of fuels - solutions and separation techniques – Applications to electrochemistry - Corrosion - Water treatment - Building materials - Environmental Engineering - Selected chemical industries : fertilizers, dyes, polymers, sugar, petrochemicals, semi - conductors, oil and fats, industrial systems – Chemical Vapor deposition.
GEN N003	**Basic Engineering Design** **Prerequisites:** None Introduction to Design: Problem description and Introduction to Internet communication - Project Management: Project Management Application , Problem Solving Techniques: Problem Definition, Design Constraints- Creative Thinking and Problem Solving: Introduction to critical and creative thinking, nature of design problems - Brainstorming seminar, list of possible and impossible solutions and generating Ideas - Creative Thinking and Decision making: Product life cycles , Selection of idea (s), Final decision matrix, Justify decision - The Design Matrix: Context, purpose and requirements of engineering design - Analyze selected solution / preliminary design - Automated Design and the Positive Attitudes for Creativity - Systematic generation and evaluation of ideas.

MDP N002	**Fundamentals of Manufacturing Engineering** **Prerequisites: MDP N001** Engineering Materials- Elements of Manufacturing Processes, material flow, energy flow and information flow- Forming in the liquid state, Casting and molding processes- forming in the solid state, metal forming, forming of plastics and powder metallurgy- Material Joining processes, welding, soldering and brazing, riveting, joining by mechanical elements, assembly processes- Material removal processes, metal cutting and finishing processes-computer applications in manufacturing-Term mini-Project.
MTH N003	**Calculus II** **Prerequisites: MTH N001 – MTH N002** **Integration:** The indefinite integral, Different techniques of integration, the definite integral, Approximate integration (trapezoidal and Simpson's rule), Applications to integration. **Analytic Geometry**: Quadratic Equations in Two Variables, Systems of Coordinates, Circles, radical axis, Conic sections (parabola-ellipse-hyperbola), Solid Geometry, Plane, Straight line, Spheres, Surfaces of revolution.
PHY N002	**Electricity and Magnetism** **Prerequisites:** None Electricity and Magnetism: Electric field. Gauss' law. Electrostatic potential. Capacitance and dielectrics. Current and resistance. Direct current circuits. Magnetic fields. Sources of magnetic fields. Faraday's law. Maxwell's equations. Inductances. Magnetic properties of matter. Laboratory experiments on the course topics.
MEC N002	**Mechanics-2** **Prerequisites: MEC N001** Kinematics of particle: Displacement, velocity and acceleration of particle in Cartesian and intrinsic coordinates. Kinetics of a particle: Newton's laws of motion, applications on circular motion of a particle, projectiles, gravitational forces and satellites, principle of work and kinetic energy, conservation of mechanical energy theory, Kinematics of particle: Displacement, velocity and acceleration of particle in Cartesian and intrinsic coordinates.
MTH N102	**Multivariable Calculus and Linear Algebra** **Prerequisites: MTH N003** Vector spaces:- Matrices- Eigen value Problem- Fourier series: Laplace's transform: Properties and applications, shifting theorem, initial and final value theorems.
MTH N203	**Probability and Statistics** **Prerequisites: MTH N102** Theory of probability – conditional probability – probability distribution functions – random variables – discrete a continuous probability distribution functions – statistical measures - statistical analysis – test of hypothesis – Marckovian chains.
ABT N280	**Seminar-1** **Prerequisites:** Completion of 72 Credit hours + AA Approval Invited talks about latest technology and to teach students how to do a seminar. The course is graded as Pass/Fail system
ABT N380	**Seminar-2** **Prerequisites: ABT N280** All students will be required to present seminars about the latest technology.
ABT N281	**Industrial Training-1** **Prerequisites:** Completion of 72 Credit hours + AA Approval Training on site with one of the multinational companies or industrial partners and a committee will approve the plan and progress of accrediting the student pass of credits. The course is graded as Pass/Fail system**.**

ABT N381	**Industrial Training-2** **Prerequisites: ABT N281** Training on site with one of the multinational companies or industrial partners and a committee will approve the plan and progress of accrediting the student pass of credits. The course is graded as Pass/Fail system
ABT N480	**Graduation Project-1** **Prerequisites:** Completion of 130 Credit hours + AA Approval All students undertake a major project as part of the program. The aim of the project is to provide the students - in groups - with an opportunity to implement the appropriate concepts and techniques to a particular design. Students are required to choose and research the expected project to be designed and implemented in course project-2. The student is expected to give an oral presentation to be approved.
ABT N481	**Graduation Project-2** **Prerequisites: ABT N 480** All students undertake a major project as part of the program. The aim of the project is to provide the students - in groups - with an opportunity to implement the appropriate concepts and techniques to a particular design. A dissertation on the project is submitted on which the student is examined orally.

DISCIPINE AND SPECIALITY COURSES	
LEVEL 100 COURSES	
ARC N101	**Introduction to the History and Theory of Architecture** **Prerequisites:** None Provides an outline of the history and theory of architecture and urbanism from Ancient Egypt to the 19th century. Analyzes buildings as the products of culture and in relation to the special problems of architectural design.
ARC N102	**History of Structures in Architecture** **Prerequisites: ARC N101** Technical and historical study of structures in architecture and engineering. Focuses on the design and assessment of historic structures in masonry, timber, concrete, and metal. An emphasis on the impact of the 20th century modern technology is introduced.
ARC N103	**Architecture and Humanities** **Prerequisites: GEN N001** Course introduces architectural thought and practice from the Egyptians to the present. Content includes philosophical and practical problems of providing habitable spaces for human beings. Art and architecture reflect culture and technology, and represent significant career possibilities. Through readings, guest lectures, and field trips, students will explore outstanding examples in architecture, make critical reports, and develop skills for success in Architectural Technology.
ARC N104	**Architectural Design Skills I** **Prerequisites: MDP N001- GEN N003** Focuses on representation tools used by architects during the design process and attempts to discuss the relationship they develop with the object of design. Teaches how to translate an intension to its concrete version, through the use of representation devices. Subject spans two semesters and establishes a reciprocal relationship with the design studio. In the fall semester, students focus on manual representation tools, such as graphic layouts, physical model making, drafting of architectural plans, sections and perspectives. In the spring semester, students focus on digital media, which has redefined the design process.
ARC N105	**Introduction to Building Construction and Technology** **Prerequisites:** None The course builds on the fundamentals of surveying and building construction; and also the environmental control systems dealing specifically with building heating, cooling, lighting, water, waste, and acoustics. This course places an emphasis on the integration of spatial, visual, and environmental performance aspects of buildings. Innovative environmental solutions will be illustrated throughout the course.
ARC N106	**Introduction to CAD Systems** **Prerequisites: GEN N004 – MDP N001** The aim of this course is to explore current CAD technologies and develop skills in the use of specialist CAD software to produce 2D and 3D design specifications, to transform CAD drawings into photo realistic virtual products and to gain an awareness of CAD data and how such information can be transformed to engineering drawings. At the end of the course, the students will understand a variety of terms and terminology as applied to CAD technology; demonstrate the use of an industry stand operating system to create stand CAD packages for 2D and 3D design drawings.

ARC N107	**Architectural Design Skills II** **Prerequisites: ARC N104** Focuses on representation tools used by architects during the design process and attempts to discuss the relationship they develop with the object of design. Teaches how to translate an intension to its concrete version, through the use of representation devices. Subject spans two semesters and establishes a reciprocal relationship with the design studio. In the fall semester, students focus on manual representation tools, such as graphic layouts, physical model making, drafting of architectural plans, sections and perspectives. In the spring semester, students focus on digital media, which has redefined the design process.
ARC N108	**Visual Perception and Art** **Prerequisites:** None Visual perception from neurological, cultural, and artistic vantage points. Students examine aspects of visual culture ranging from body adornment to public spaces, and from logotypes to moving images. Lectures, oral presentations, field trips, and written essays develop tools of visual analysis and interpretation.
ARC N109	**Introduction to Design Computing** **Prerequisites: ARCH N106** Introduces students to architectural design and computation through the use of computer modeling, rendering, and digital fabrication. Focus on the exploration of space- and place- making through the use of computer rendering and design construction through CAD/CAM fabrication. Students design a small building using computer models leading to a full package of physical and virtual materials, from computer generated drawings.
STR N101	**Structural Analysis-1** **Prerequisites: None** Types of structures, loads, supports, reactions, internal forces, analysis of beams, frames, trusses. Analysis of beams subjected to moving loads. Influence lines of statically determined structures.
STR N102	**Structural Analysis-2** **Prerequisites: STR N101** Deformations: deferential equations, virtual work. Indeterminate structures: consistent deformation, moment distribution. Buckling of columns, circular plates, rectangular plates, shell structures.
STR N103	**Engineering Materials** **Prerequisites: PHY N001** Classification of types of materials- Concrete and asphalt concrete; constituent materials and their properties, mix design, manufacture, properties, and standard and quality control testing- Steel, Building stones- Bricks- Timber- Heat insulating and acoustic materials. Laboratory: Testing for QC.
INT N127	**Electro Mechanical Systems** **Prerequisites:** None Core framework for engineers concerned with the principles of design of Electro-Mechanical systems. Engineering aspects of such systems may include modeling, simulation, instrumentation, compensation and control.

DISCIPINE AND SPECIALITY COURSES	
LEVEL 200 COURSES	
ARC N202	**Building Construction I: Construction Documents** **Prerequisites: ARC N105** The course provides a comprehensive overview on how an architect writes, interprets, enforces, or manages construction documents. Project architects, contractors, contract administrators, material suppliers, and manufacturers' representatives are all realizing the advantages of being Construction Documents Technologists.
ARC N203	**Urban Design and Landscape** **Prerequisites: ARCN104- ARCN208** A design studio. Introduces skills needed to build within contemporary cities, extending from the historical center to expanding edges. Students analyze an existing environment and design a built structure that fosters relationships between its intended activities and the larger urban territory and redefines the urban environment. The course also Introduces skills needed to build within a landscape establishing continuities between the built and natural world. Students learn to build appropriately through analysis of landscape and climate for a chosen site and conceptualize design decisions through drawings and models.
ARC N204	**Engineering Thermal and Aerodynamics** **Prerequisites: MEC N002- ARCN105** Application of heat transfer and air dynamics to airflows within buildings. Analytic models of coupled flow and heat transfer for wind- and buoyancy-controlled natural ventilation. Stability of multiple equilibrium solutions. Analysis of displacement ventilation, jet flows and diffusers. Multi-node and multi-zone models, and computational air dynamics. Use of similitude in laboratory scale models. Measurement techniques within real buildings.
ARC N205	**Building Technologies II** **Prerequisites: ARC N105** Introduction to the elements of architectural structures. Topics in mechanical static are addressed as they relate to major contemporary structural systems. The study of forces and the achievement of equilibrium is the framework in which structural morphologies are studied and structural design is used as a primary determinant of building form. A variety of methods for discovering structural form and calculating limit capacities are introduced and used to complete several structural design projects.
ARC N206	**Architectural Design: Level I** **Prerequisites: ARC N107** Establishes basic attitudes tow architectural organization and its reflection in form. Includes projects where imposed conditions of site, program, and building system emphasize the interrelationship of fundamental elements in the pattern of decision making that constitutes architectural design. Develops presentations through drawings and models.
ARC N207	**Architectural Design: Level II** **Prerequisites: ARC N206** Projects develop the design skills and the experience of both theoretical and pragmatic issues facing the architect. Fall term studios focus on learning about the material and tectonic aspects of architectural production, especially as they influence the generative ideas of form. Spring studios center upon learning how architecture creates environments for living, working, and learning in varied settings and with complex programmatic needs. Both terms integrate environmental and climatic concerns, structure and constructional parameters. Emphasis on energy efficiency, environmental systems integration and building envelope design.

ARC N208	**Site Planning and Development** **Prerequisites:** None This course aim for planning Studies to apply technical knowledge to social problems: the problems of cities of the developing world; problems of the environment and the design of spaces. The purpose of the course is to develop the knowledge and skills to make one capable of analyzing and planning a site, or a group of urban sites, for design intervention and development. The course will discuss the theoretical and practical matters involved in planning sites within the context of natural systems.
ARC N209	**Building Technologies III** **Prerequisites: ARC N205** Introduction to the elements of architectural structures. Topics in mechanical statistics are addressed as they relate to major contemporary structural systems. The study of forces and the achievement of equilibrium is the framework in which structural morphologies are studied and structural design is used as a primary determinant of building form. A variety of methods for discovering structural form and calculating limit capacities are introduced and used to complete.
STR N104	**Mechanics of Materials** **Prerequisites: STR N103** Analysis of stress, strain, and deformation of sections subjected to tension, compression, bending, shear, and torsion- Buckling- Theories of failure- Laboratory: Testing of materials for strength evaluation.

DISCIPINE AND SPECIALITY COURSES	
LEVEL 300 COURSES	
ARC N301	**Architectural Design: Level III** **Prerequisites: ARC N206** Emphasizes setting of architectural work as part of an organized community in projects having to do with built-up areas, as well as those on new sites. Studies plan for long-range development, giving students increasing experience in the analysis of real-life situations requiring program research.
ARC N302	**Building Construction II: Finishing Materials and Detailing** **Prerequisites: ARC N209** The major areas of study will be: 1) exterior and interior finishing materials and specifications, 2) common exterior and interior finishing materials and specifications, 3) basic carpentry mathematics related to exterior and interior finishing, 4) insulation installation and specifications, 5) drywall installation and finishing, 6) interior doors and running trim installation. Credits will be awarded upon competency completion.
ARCN303	**Smart Building Information Systems** **Prerequisites: None** This course introduces some main issues of buildings performance. It focuses on two main topics. The first one is the smart building information systems. It aims to Exploring the Humanities: Introduction to modes of thought found within humanities and social sciences. The second topic is about building control and diagnostics. It concentrates on the empirical evaluation of the built environment (building components and systems, interactions between building, occupants and environmental conditions) in view of multiple performance criteria (thermal, visual and acoustic performance). All this will be achieved through the use of computation tools in all processes of building design, construction and operating.
ARC N304	**Fundamentals of Energy in Buildings** **Prerequisites: ARC N204** Introduction to energy fundamentals important to buildings. Conservation of energy. Air-water vapor mixtures. Thermal comfort. Solar energy and refrigeration cycles, limiting thermodynamic performance. Heat transfer within buildings and major components. Several creative design projects are assigned.
ARC N305	**Building Construction III** **Prerequisites: ARC N302** The course goal is to introduce the students to The construction process , Construction contract types, Modifications and substitution procedures, Contractual relationships Rights, duties, and responsibilities, Contract provisions, Relationship and organization of construction documents, Use of construction documents, Organizational formats , Interpreting construction documents. Addresses advanced structures, exterior envelopes, and contemporary production technologies. Continues the exploration of structural elements and systems, expanding to include more complex determinate, indeterminate, long-span, and high-rise systems.
STR N201	**Fundamentals of Reinforced Concrete Design** **Prerequisites: STR N102 – STR N104** Load distribution, design methods, limit state design method: flexure design, shear design, beams, solid slabs, hollow block slabs, deflection, axially loaded members, and reinforcement detailing.

STR N302	**Steel structure Design I** **Prerequisites: STR N102 – STR N104** Introduction to structural steel design, Design Criteria (materials, loads, and systems), Design of members, Design of connections, Design drawings.
PBW N302	**Soil Mechanics and Foundation** **Prerequisites: STR N102 – STR N104** Phase diagram & basic properties – Soil Classification – Compaction – Soil Stress – Compressibility & consolidation shear strength – Bearing Capacity – Shallow Foundations.

DISCIPINE AND SPECIALITY COURSES	
LEVEL 400 COURSES	
ARC N401	**Architectural Design IV** **Prerequisites: ARC N301** Emphasizes setting of architectural work as part of a mega structure and public oriented buildings. Studies plan for image buildings and innovative structure design.
ARC N402	**Computational Design I: Theory and Applications** **Prerequisites: ARC N109** Introduces design as a computational enterprise in which rules are developed to compose and describe architectural and other designs. Topics include shapes, shape arithmetic, symmetry, spatial relations, shape computations, and shape grammars. Focuses on the application of shape grammars in creative design. Teaches shape grammar fundamentals through exercises with abstract shape grammars. Discusses issues related to practical applications of shape grammars. This course also introduces advanced computing tools such as rapid prototyping, advanced modeling and CAD/CAM fabrication. Through this part, the process of design and construction is introduced using CAD files introduced by the office of Gehry Partners during the construction of the Guggenheim Museum in Bilbao, Spain. Taught in phases starting with rapid prototyping and ending with CAD CAM of building components fabricated from CAD files.
ARC N404	**Knowledge Based Systems** **Prerequisites: ARC N109** This course has two subjects to focus on. The first one is the application of knowledge-based expert system methodology in CAE. Topics include: knowledge-based programming methodologies, knowledge-based engineering techniques, expert system development environments and representative expert system applications in CAE. Each student develops a prototype expert system for an application of his or her choice. The second subject discusses issues related to practical applications of shape grammars: shapes, shape arithmetic, symmetry, spatial relations & shape computations. The study focuses on issues related to practical applications of shape grammars as a computational enterprise.
ARC N405	**Buildings Economics** **Prerequisites:** None Two-term subject delivers the information, skills, and techniques necessary to create the physical products of real estate and manage the process of real estate development and urban developments economics. Exposes students to the general skills, techniques and process associated with each of the functional areas involved in real estate development so that they may organize and lead the development process that is economically valid. Students work in teams to create a development proposal for a particular development opportunity within a certain economical criteria.
ARC N406	**The new Practitioner: Dialogue, Tools and Techniques** **Prerequisites: ARC N401 – ARC N402** Explores a new paradigm of practice that considers dialogue essential for efficacious and creative design process. Focus on non-traditional client groups: communities, the poor, and the generally excluded middle-income. Stress on exercises and extensive field visits. Supplemented with background readings and presentations by invited professionals.

ELECTIVE COURSES –I –Level 200	
MEP N206	**Analysis and Design of Heating, Ventilating, and Air Conditioning Systems** **Prerequisites: ARC N204** Explores the fundamentals of heating, ventilating, and air-conditioning (HVAC) systems. Topics include discussion of psychrometrics, air conditioning processes, thermal comfort, indoor air quality and outdoor design conditions. Emphasis on the calculation of heating and cooling load in order to size suitable HVAC equipment, estimate energy consumption of the HVAC equipment, and control HVAC equipment. Both manual and computer methods are used. One or more site visits.
ARC N230	**Special Problems in Building Construction** **Prerequisites: ARC N205** Supplementary work on individual or group basis on special problems in building construction and the life cycle of the building to gain a sustainable Architecture.
ELECTIVE COURSES –II –Level 300	
ARC N330	**Ecologies of Construction** **Prerequisites: STR N101 – ARC N105** Examines the material and energy networks currently utilized to transfer resources from the natural world to the built environment. Theories and tools of industrial ecology are used to reveal opportunities for creating ecologies of construction; that is, mutually beneficial relationships between distinct components of the industry of construction that may be made to act symbiotically. Both the production and consumption of the architectural artifact is reviewed using tools of analysis that physically account for the flow of materials into and out of various spatial and temporal scales and boundaries.
ARC N331	**Architectural Acoustics** & **Day-lighting** **Prerequisites: ARC N204 – INT N127** Describes interactions between people and sound, indoors and outdoors, and uses this information to develop acoustical design criteria for architecture and planning. Principles of sound generation, propagation, and reception. Properties of materials for sound absorption, reflection, and transmission. Provides the tools necessary for an efficient integration of day-lighting issues in the overall design of a building. Fundamentals of day-lighting and artificial lighting are introduced: physics of light propagation and solar radiation, photometry and colorimetry (visual perception, photometric quantities, chromatic systems), sun course, physics of windows (light and heat transfer, glazing types), electric lighting (lamps and luminaries characteristics). More advanced and design-oriented topics are presented and practiced through the design project: benefits and availability of daylight, visual and thermal comfort, primary and advanced lighting design strategies, design and assessment tools for lighting management.
ELECTIVE COURSES –III – Level 300	
ARC N332	**History of Islamic Architecture** **Prerequisites: ARC N101** Critical review of literature on Islamic architecture and analyzes its historical and theoretical frameworks. Challenges the tacit assumptions and biases of standard studies of Islamic architecture and addresses historiographic and critical questions concerning how knowledge of a field is defined, produced and reproduced.
ARC N333	**Structuring Low-Income Housing Projects in Developing Countries** **Prerequisites: ARC N208** Examines dynamic relationship among key actors: beneficiaries, government, and funder. Emphasis on cost recovery, affordability, replicability, user selection, and project administration. Extensive case examples provide basis for comparisons.

ELECTIVE COURSES –IV –Level 400	
ARC N430	**Interior Design & Modern Art** **Prerequisites: ARC N108** Introduction to modern art and theories of modernism and postmodernism. Focuses on the way artists use the tension between fine art and mass culture to mobilize a critique of both. Examines objects of visual art, including painting, sculpture, architecture, photography, and video. The course will focus also on the concept of designing public space environments that are compatible with the architecture envelope, context and structure of the building as well as accommodating human needs. Graduate-level requirements include producing individual projects for assignments and responsibility for broader solutions to assigned projects.
ARC N431	**Building Technologies IV: Energy in Building Design** **Prerequisites: ARC N204** Explores aspects of climate relevant to building design, and applies concepts and methods to energy-efficient and environmentally responsible building design. Topics include climate and comfort parameters, energy systems, and environmental implications of building. Emphasizes practical applications for environmental and structural design.
ELECTIVE COURSES –V – Level 400	
ARC N432	**Independent Studies: Smart Building Information Systems** **Prerequisites: ARC N303** This course focuses on different work methodologies. Critical analysis of information and choice of argumentation in smart buildings. Work methodologies and pedagogical interest.
ARC N433	**Introduction to Shape Grammars** **Prerequisites: ARC N109** An advanced examination of the shape grammar formalism and its relationship to some key issues in a variety of other fields, including art and design, philosophy, history and philosophy of science, linguistics and psychology, literature and literary studies, logic and mathematics, and artificial intelligence.
ELECTIVE COURSES- VI- Level 400	
ARC N434	**Geometric Modeling** **Prerequisites: ARC N109** Introduces the fundamentals of three-dimensional geometric modeling and associated computer-aided design as well as visualization applications in architecture, urban design, and computer graphics production. Provides a theoretical foundation to a selection of current h ware and software tools. Extensive opportunities to develop practical skills through lab sessions and regular practical exercises. Background in computational skills is an advantage, but not required. Students acquire the skills necessary to undertake independent CAD projects in design studios or other professional settings.
ARC N435	**Independent Studies- Advanced Building Systems Integration** **Prerequisites:** This course introduces the state-of-the-art and major innovations in building technologies and structural, enclosure, mechanical, telecommunications, lighting, and interior systems. The course continues the mandate for Total Building Performance, clarifying the full range of building performance mandates required in today's architecture, including building integrity, thermal quality, acoustic quality, visual quality, air quality, and spatial quality. The course proceeds to explore the relationships, opportunities and conflicts of these mandates and the comprehension and integration of building systems necessary to achieve performance in all areas. Given a thorough introduction in advanced building technologies, graduates of the department should bring leadership to multi-disciplinary design processes, tow s sustainable environmental performance, and the long term integrity of integrated systems.