

Section 3

Water Engineering and Environment (WEE)

Based on Credit Hours System

September 2019

1. INTRODUCTION

Water is the most precious natural resource in the world. Continuous industrial development and population growth place higher stress on natural resources and environmental systems. This is particularly true for water resources in the Arab countries, Middle Eastern countries as well as the Nile Basin countries. Anticipated shortage in water resources coupled with the ambitious development plans in human life maximize the stress on the water sector in the above regions.

Moreover, there has been a growing world-wide concern about environmental water management issues including, for example, concerns about coastal and estuarine water pollution, river flooding and urban drainage, wetland and mangrove management, ecological aspects of lakes and reservoirs. All these challenges and concerns facing the water sector world-wide and more specifically in Egypt and neighboring countries called for concerted effort of all stakeholders in the water sector.

Therefore, Cairo University, Faculty of Engineering established a new Bachelor of Science degree B.Sc. in Civil Engineering with a major emphasis on “Water Engineering and Environment”; termed below as: WEE. This program will prepare graduates for specialized training in hydrology, hydraulics, irrigation, water resources, coastal engineering, environmental and soil science among other subjects. Graduates of WEE will be well prepared to address critical environmental issues involving interconnections between the earth, water, and environment, as well as the interaction between these applied sciences and human activities. Hence, the program will help forming human resources equipped with technical capabilities to better manage the future limited water resources not only in Egypt but also in the Arab world and the Nile river basin countries. Both regions are naturally of great importance to Egypt’s national interests and prosperity.

2. PROGRAM MISSION

The mission of the WEE program is to serve the future development of Egypt, Arab countries and, the Nile river basin countries by disseminating and developing technical expertise capable of improving the physical infrastructure and addressing environmental issues related to water resources development and utilization. This will support sustainable water resources management to meet the present and future water challenges. The Program aims at providing a well-rounded and superior university engineering education with talented graduates and creative engineers. The program also aims at preparing its graduates for broad and dynamic career paths in civil engineering at large with a major specialty in environmental water engineering.

3. EDUCATIONAL OBJECTIVES

The WEE Program's mission infers the following set of educational objectives:

- Preparing graduates capable of applying science and engineering fundamentals and logical thinking to solve engineering problems
- Providing graduates with the ability to discover, apply, and disseminate the knowledge required to solve increasingly complex environmental engineering problems
- Preparing graduates capable of planning, designing, operating and managing water projects through their deep understanding of available water resources, appropriate technology, as well as the socioeconomic and environmental aspects of the water projects
- Provide graduates with deep appreciation of ethical issues associated with their profession
- Building the leadership skills, teamwork, life-long learning, career advancement and engineering capabilities
- Enhance graduate design expertise by offering curricular design experiences that include term projects, industrial training and graduation projects with higher involvement with the professional community
- Provide appropriate technical proficiency in the water and environmental engineering, and
- Foster a respect for the educational process that is manifested by a lifelong pursuit of learning

These objectives reflect both the WEE PROGRAM mission as well as the mission of Cairo University.

4. PROGRAM LEARNING OUTCOMES

The WEE program has adopted mostly the National Academic Reference Standards (NARS) for Engineering issued by the National Authority for Quality Assurance and Accreditation for Education (NAQAAE) as the program learning outcomes to ensure the satisfaction of the national quality assurance standards. The NARS for Engineering are broad statements that define the main characteristics and performance expected from all engineering students upon their graduation. Minor modifications to the standard NARS system were made so that the specific educational objectives of the WEE program can be achieved. These changes are listed as a separate Academic Reference Standards (ARS). The adopted academic standards are divided into four categories:

- Knowledge and Understanding (a)
- Intellectual Skills (b)
- Professional and Practical Skills (c)
- General and Transferable Skills (d)

4.1 NARS Knowledge and Understanding

- (a1) Explain the basic concepts, theories and laws of mathematics and sciences.
- (a2) Recognize the basics of information and communication technology (ICT).
- (a3) Classify the characteristics of engineering materials related to the discipline.
- (a4) Recognize the principles of design including elements design, process and/or a system related to specific disciplines.
- (a5) Identify methodologies of solving engineering problems, data collection and interpretation.
- (a6) Recognize quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues.
- (a7) Describe business and management principles relevant to engineering.
- (a8) Classify current engineering technologies as related to disciplines.
- (a9) Discuss topics related to humanitarian interests and moral issues.
- (a10) Demonstrate knowledge of technical language and report writing techniques.
- (a11) Outline and confirm the importance of professional ethics and socio-economical impacts of engineering solutions on society and environment.
- (a12) Discuss contemporary engineering topics.

Additional Knowledge and Understanding Standards

- (a13) Comprehend the basic civil engineering principles in the fields of reinforced concrete, metallic structures', geo-techniques and foundations, sanitary engineering, roadways, surveying and photogrametry.
- (a14) Recognize the components of the hydrological cycle and its interaction with various ecosystems.
- (a15) Recognize basic properties of Water and principles of design for different flow systems, reservoir operation, irrigation and drainage networks, water and wastewater networks, pumping stations, and water resources management
- (a16) Demonstrate basic knowledge of environmental management with particular emphasis on aquatic systems.
- (a17) Develop process engineering knowledge for water and wastewater treatment systems.
- (a18) Acquire basic knowledge of harbor engineering and coastal processes
- (a19) Recognize and describe projects and construction management including planning, finance, bidding and contracts.

4.2 NARS Intellectual Skills

- (b1) Select appropriate mathematical and computer-based methods for modeling and analyzing problems
- (b2) Select appropriate solutions for engineering problems based on analytical thinking.
- (b3) Think in creative and innovative way in problem solving and design.

- (b4) Combine, exchange, and assess different ideas, views, and knowledge from a range of sources.
- (b5) Assess and evaluate effectively the characteristics and performance of components, systems and processes.
- (b6) Investigate the failure of components, systems and processes.
- (b7) Solve engineering problems, often on the basis of limited and possibly contradicting information.
- (b8) Select and appraise appropriate ICT tools to a variety of engineering problems.
- (b9) Judge engineering decisions considering balanced costs, benefits, safety, quality, reliability, and environmental impact.
- (b10) Incorporate economic, societal, environmental dimensions and risk management in design.
- (b11) Analyze results of numerical models and appreciate their limitations.
- (b12) Create systematic and methodic approach when dealing with new and advancing technology.

Additional Standards for Intellectual Skills

- (b13) Select appropriate building materials from the perspective of strength, durability, suitability of use to location, temperature, weather conditions and impacts of seawater and environment.
- (b14) Evaluate and appraise adequate design for water control structures, irrigation and drainage networks, water supply and sewerage systems and pumping stations.
- (b15) Analyze and select codes of practice in designing reinforced concrete, earth works and metallic structures.
- (b16) Define, plan, conduct and report management techniques.
- (b17) Assess and evaluate different techniques and strategies for solving water resources problems and related resolution of conflicts.
- (b18) Incorporating wider vision (regional and global dimensions) in dealing with environmental problems

4.3 NARS Practical and Professional Skills

- (c1) Apply knowledge of mathematics, science, information technology, design, business context and engineering practice to solve engineering problems.
- (c2) Professionally merge the engineering knowledge, understanding and feedback to improve design, products and/or services.
- (c3) Create and/or re-design a process, component or system, and carry out specialized engineering designs.
- (c4) Practice the neatness and aesthetics in design and approach.
- (c5) Use computational facilities and techniques, measuring instruments, workshops and laboratories equipment to design experiments, collect, analyze and interpret results.
- (c6) Use a wide range of analytical tools, techniques, equipment, and software packages for the discipline and develop required computer programs.
- (c7) Apply numerical modeling methods to engineering problems.

- (c8) Apply safe systems at work and observe appropriate steps to manage risks.
- (c9) Demonstrate basic organizational and project management skills.
- (c10) Apply quality assurance procedures and follow codes and standards.
- (c11) Exchange knowledge and skills to engineering community and industry.
- (c12) Prepare and present technical reports.

Additional Standards for Practical and Professional Skills

- (c13) Practice and master the use of field measurement equipment related to stage / discharge / velocity measurements along with environmental monitoring of water quality.
- (c14) Observe, record and analyze data in laboratory related to flows. Heads, and basic fluid properties along with pump tests.
- (c15) Practice integrated management skills. Develop a multi-prospective approach for design of water management systems
- (c16) Demonstrate the ability to produce a professional environmental impact assessment report.
- (c17) Demonstrate professional working knowledge of selected commercial software for design of water and wastewater networks
- (c18) Develop the appropriate engineering sense for problem solving.

4.4 NARS and Transferable Skills

- (d1) Collaborate effectively within multidisciplinary team.
- (d2) Work in stressful environment and within constraints.
- (d3) Communicate effectively, and demonstrate presentation skills
- (d4) Demonstrate efficient IT capabilities.
- (d5) Lead and motivate individuals.
- (d6) Effectively manage tasks, time and resources.
- (d7) Search for information and engage life-long self-learning discipline.
- (d8) Acquire entrepreneurial skills.
- (d9) Refer to relevant literatures.

Additional Standards for General and Transferable Skills

- (d10) Apply a holistic approach when dealing with water resources
- (d11) Develop negotiation and arbitration skills

5. PROGRAM DESCRIPTION

To achieve the above mentioned goal, a 4 year curriculum is proposed following the initial “freshman” year. The curriculum is planned to offer instructions in the “Civil Engineering Discipline” in addition to numerous topics in “Water Resources” as the specialty major area. The necessary fundamental background in structures, materials, mechanics, soil, fluid mechanics, urban planning as well as some other engineering disciplines is also covered. At the end of these courses, students are expected to gain knowledge in design and analysis of advanced water supply systems, exploitation and preservation of surface and groundwater resources, design and performance of pipelines, design of irrigation/drainage systems and related hydraulic structures, design of drainage and sewer systems, water and waste water treatment systems, maritime structures, quality of the coastal and

marine environment, remediation of contaminated soils and groundwater environments.

As the curriculum is totally based on the credit hour system, a total of 175 credit hours should be successfully completed by a student to earn the degree (about 275 contact hours). A total of 35 credit hours are required for the freshman year which leaves 140 credits for the subsequent years of the study program. During these subsequent years, the student is gradually exposed to fundamental and applied courses pertinent to civil Engineering, and to courses dealing with water resources and environmental management issues.

5.1 Curriculum Overview

The curriculum of the WEE program consists of 175 credits spread over 69 courses covering topics in Humanities and Social Sciences (HSS), Basic Sciences (BS), Engineering Sciences (ES), and Applied Engineering Sciences (AS). Sample Courses in each category are presented as follows:

5.1.1 Humanities and Social Sciences

- History of Science and Engineering
- Technical Writing
- Fundamentals of Management
- Communication and Presentation Skills
- Risk Management and Environment
- Ethics and Legislation
- Human Resources Management
- Selections of Life Long Skills

5.1.2. Basic Sciences

- Mathematics
- Physics
- Mechanics
- Dynamics of Rigid Bodies
- Chemistry
- Fundamentals of Economics and Accounting
- Marketing

5.1.3. Basic Engineering Sciences

- Basic Engineering Design
- Basic Architectural Design
- Fundamentals of Manufacturing Engineering
- Statistics and Probability
- Structural Analysis
- Engineering Materials
- Mechanics of Materials
- Fluid Mechanics

5.1.4. Applied Engineering Sciences

- Surface and Subsurface Hydrology
- Water Resources Engineering
- Water and Wastewater Treatment
- Environmental and Sanitary Engineering
- Irrigation and Drainage Engineering
- Design of Large Irrigation Structures
- Coastal and harbor engineering
- Steel Structures Design
- Reinforced Concrete Design
- Open Channel Hydraulics
- Highway Engineering
- Soil Mechanics and Foundation 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, well-rounded 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 19 credits (10.86% of total 175 credits) spread over common courses to all credit hours programs. This common university core consists of 13 compulsory credits and 6 elective credits. Table 1a lists university core compulsory courses which represent 13 credits. Table 1b lists the university electives, where students should select only three (3) courses which represent 6 credits.

**Table 1a. Compulsory Courses of University Requirements
(13 Credits, 7.4% of total 175 Credits)**

	Code	Course Title	Credits
1	GENN001	History of Science and Engineering	1
2	GENN004	Computers for Engineers	2
3	GENN005	Technical Writing	2
4	GENN102	Fundamentals of Management	2
5	GENN201	Communication and Presentation Skills	2
6	GENN210	Risk Management and Environment	2
7	GENN224	Fundamentals of Economics and Accounting	2

**Table 1b. Elective Courses of University Requirements
(Student should select only 6 Credits, 3.4% of total 175 Credits)**

	Code	Course Title	Credits	Group
1	GENN301	Ethics and Legislation	2	E-1
2	GENN303	Critical thinking	2	
3	GENN305	Interdisciplinary Project	2	
4	GENN310	Advanced Risk Management	2	
5	GENN311	Technical Writing in Arabic	2	
6	GENN321	Foreign Language	2	
7	GENN326	Marketing	2	
8	GENN327	Selections of Life-long Skills	2	
9	GENN328	Scientific Research Methods	2	
10	GENN331	Business Communication	2	
11	GENN332	Service Management	2	
12	GENN333	Creativity, Art & Design	2	
13	GENN380	Thesis Writing for GP	2	

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 hours programs is implemented. This unified college core contains two categories of courses. 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, and Chemistry. The second category includes courses that all students are required to undertake in order to develop certain intended learning outcomes common to all engineering graduates. These include courses of Seminar, Industrial Training, and Graduation Project. The common college core consists of 44 compulsory credits representing 25% of the total 175 credit hours of the B.Sc. degree. These 44 credits of the college core are spread over 18 compulsory courses, as shown in Table 2.

**Table 2a: Compulsory Courses of Common College Requirements
(44 credits, 24% of total 175 credits)**

	Code	Course Title	Credits
1	CHEN001	Chemistry	3
2	GENN003	Basic Engineering Design	2
3	MDPN001	Engineering Graphics	3
4	MDPN002	Fundamentals of Manufacturing Engineering	3
5	MECN001	Mechanics-1	2
6	MECN002	Mechanics-2	2
7	MTHN001	Introduction to Linear Algebra and Analytic Geometry	3
8	MTHN002	Calculus I	3

	Code	Course Title	Credits
9	MTHN003	Calculus II	3
10	MTHN102	Multivariable Calculus and Linear Algebra	3
11	MTHN203	Probability and Statistics	3
12	PHYN001	Mechanics, Oscillations, Waves and Thermodynamics	3
13	PHYN002	Electricity and Magnetism	3
14	WEEN280	Engineering Seminar	1
15	WEEN281	Industrial Training-1	1
16	WEEN381	Industrial Training-2	2
17	WEEN480	Graduation Project-1	1
18	WEEN481	Graduation Project-2	3

**Table 2b: Compulsory Courses of Non-Common College Requirements
(10 credits, 5.7% of total 175 credits)**

	Code	Course Title	Credits
1	ARCN116	Introduction to CAD Systems for Civil Engineers	2
2	ARCN110	Basic Architectural Design and Building Construction	2
3	MECN101	Dynamics of Rigid Bodies	3
4	MTHN103	Differential Equations	3

5.4 Discipline Requirements

Students pursuing a B.Sc. degree in the WEE program has to finish 54 credits (30.8% of the total 175 credits) spread over 20 courses to satisfy the requirements of the Civil Engineering discipline by covering topics in Construction, Structural, Geotechnical, Environmental, Hydraulic, and Transportation Engineering. The discipline core consists of 46 compulsory credits (26.3% of total 175 credits) and eight (8) elective credits (4.6% of the total 175 credits). First, the 46 compulsory credits of the discipline are satisfied by completing 17 compulsory courses, as shown in Table 3a. Second, the 8 elective credits are satisfied by completing three (3) courses: two (2) courses (6 credits) should be selected from discipline technical elective courses in Table 3b, and one (1) course (2 credits) should be selected from the discipline elective courses in Table 3c that serves the interdisciplinary courses in the WEE program.

**Table 3a. Compulsory Courses of Civil Engineering Discipline Requirements
(46 Credits, 26.3% of total 175 Credits)**

	Code	Course Title	Credits
1	IHDN104	Civil Engineering Drawing	3
2	IHDN201	Fluid Mechanics	3
3	IHDN202	Open Channel Hydraulics	2
4	PBWN201	Water and Waste Water Engineering	2
5	PBWN202	Surveying for Engineers	3
6	PBWN301	Highway Engineering	2
7	PBWN302	Soil Mechanics	3
8	PBWN303	Foundations	3
9	STRN101	Structural Analysis-1	3
10	STRN102	Structural Analysis-2	3
11	STRN103	Engineering Materials	3
12	STRN104	Mechanics of Materials	3
13	STRN105	Human Resources Management	2
14	STRN201	Reinforced Concrete Design I	3
15	STRN302	Steel Structures Design I	3
16	STRN303	Reinforced Concrete Design II	3
17	INTN203	Mechanical and Electrical Systems	2

**Table 3b. Technical Electives of Civil Engineering Discipline Requirements
(Student should select only 6 Credits, 3.4% of total 175 Credits)**

	Code	Course Title	Credits	Group
1	IHDN355	Non-Conventional Wastewater Treatment Systems	3	E-4
2	IHDN450	Hydrogeology	3	
3	IHDN452	Optimization Techniques	3	
4	IHDN455	Irrigation Design Works-2	3	
5	PBWN441	Advanced Surveying and Digital Mapping	3	
6	PBWN445	GIS and Remote Sensing Applications	3	
7	PBWN446	Deep Excavation and Side Support	3	
8	STRN466	Design and Construction of Water and Wastewater Structures	3	

**Table 3c. Interdisciplinary Electives of Civil Engineering Discipline
(Student should select only 2 Credits, 1.1% of total 175 Credits)**

	Code	Course Title	Credits	Group
1	ARCN211	Urban Planning	2	E-2
2	GENN341	Operation Research	2	
3	GENN342	Decision Support System	2	

5.5 Major Requirements

The program offers a specialty in Water Engineering and Environment. A student who wishes to complete a specialty in Water Engineering and Environment must complete the minimum major requirement, which represent 48 credits (27.42 % from the total credits). This major core consists of 39 compulsory credits (22.2% of total 175 credits) and nine (9) elective credits (5.1% of the total 175 credits). First, the compulsory credits of the major are satisfied by completing 14 compulsory courses, as shown in Table 4a. Second, the elective credits are satisfied by completing three (3) courses (9 credits from the elective courses in Table 4b).

Table 4a. Compulsory Courses of Water Engineering and Environment Requirements Credits (39, 22.2% of total 175 Credits)

	Code	Course Title	Credits
1	IHDN101	Principals of Irrigation and Drainage	3
2	IHDN203	Water Chemistry and Microbiology	2
3	IHDN204	Computational Water and Wastewater Networks	3
4	IHDN301	Introduction to Water Resources Engineering	3
5	IHDN302	Irrigation Design Works-1	3
6	IHDN303	River Engineering	2
7	IHDN304	International Law of Water and Environment	2
8	IHDN305	Applied Hydrology	3
9	IHDN401	Coastal and Harbor Engineering	3
10	IHDN402	Environmental and Municipal Hydraulics	3
11	IHDN403	Field Measurements and Water Quality Aspects	3
12	IHDN404	EIA for Water, Wastewater and Irrigation Projects	3
13	IHDN405	Integrated Water Resources Management	3
14	STRN 345	Management of Infrastructure Projects	3

Table 4b. Technical Elective Courses in Water Engineering and Environment (Student should select only 9 Credits, 5.1% of total 175 Credits)

	Code	Course Title	Credits	Group
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1	IHDN350	Participatory Irrigation Water Management	3	E-3
2	IHDN351	Water in the Arab Region and Africa	3	
3	IHDN352	Non-Conventional Water Resources	3	
4	IHDN353	Drainage Engineering	3	
5	IHDN354	Water Resources Assessment	3	
6	IHDN356	Advanced Fluid Mechanics	3	
7	IHDN357	Applied Hydrology Statistics	3	
8	IHDN358	Design of Pipelines and Pumping Stations	3	
9	IHDN451	Computational Hydraulics	3	
10	IHDN453	Advanced River Engineering	3	
11	IHDN454	Wadi Hydrology	3	
12	IHDN456	Design of Large Irrigation Structures	3	
13	IHDN458	Design of Coastal Protection Works	3	
14	IHDN406	On Farm Irrigation Methods	3	
15	IHDN459	Design of Water and Wastewater Treatment Plants	3	

5.6 Conformity to SCU Requirements

Classification and categorization of courses in the Water Engineering and Environment program follow the guidelines provided by the Supreme Council of Universities (SCU), as shown in Table 5. The classification is based upon the “Sample Study Plan and Program Details”, which is described in the Section 6. The categorization is given for the following five student levels according to the regulations of the credit hours system at the Faculty of Engineering, Cairo University:

- **Freshman:** a student who completed less than 35 credits
- **Sophomore:** a student who completed more than 35 credits but less than 70 credits
- **Junior:** a student who completed more than 71 credits but less than 105 credits
- **Senior-1:** a student who completed more than 106 credits but less than 143 credits
- **Senior-2:** a student who completed more than 144 credits but less than 175 credits

The total 175 credit hours of the Water Engineering and Environment program are distributed between lectures (Lec) and tutorial sessions, where the tutorial can be classified as a problem solving (PS) session and/or projects, laboratory, and practical work (PP) session, as shown in Table 6. In the WEE program, the one (1) credit hour of a tutorial session (PS or PP) corresponds to 2-3 contact hours to provide sufficient practical training for the students. As a result, the total contact hours of the WEE program are 275 real hours.

Table 5. Conformity to Supreme Council Criterion

Category	Freshman	Sophomore	Junior	Senior-1	Senior-2	Total Credits	%
Humanities and Social Sciences	3	5	2.8	3	0.75	14.55	8%
Basic Sciences	23.8	11.5	4.5	1	0	40.8	23%
Basic Engineering Sciences	1.2	16.5	13.5	6.05	4.35	41.05	24%
Computer Application	7	2	3.6	0	4.35	16.95	10%
Applied Engineering Sciences	0	0	7.8	22.55	12.6	42.4	25%
Projects and Practice	0	0	2.8	3.4	8.95	15.15	9%
Discretionary	0	0	0	6.5	4.5	11	6%
Total	35	35	35	42.45	35.3	181.9	105%
University Requirements	5	2	6	6	0	19	10.86
College Requirements	30	13	4	1	6	54	30.86
Discipline Requirements	0	17	17	14	6	54	30.86
Major Requirements	0	3	8	16	21	48	27.43
Total	35	35	35	37	33	175	100%

Table 6. Course Status of WEE Program and Equivalent Contact Hours

	Courses	Credits	Equivalent Contact Hours			
			LEC	PS	PP	Total
Compulsory =	60	152	90	107	48	245
Electives =	9	23	11	19	0	30
Total =	69	175	101	126	48	275
			36.7%	45.8%	17.5%	100%

6. SAMPLE STUDY PLAN and PROGRAM DETAILS

A sample study plan for the WEE program is provided to present the recommended sequence of delivery of the program 69 courses over 10 main semesters, Fall and Spring semesters per academic year. Since the WEE program is based on the credit hours system, the student does not have to take the courses during the semester indicated in the study plan as long as the prerequisites of a particular course are satisfied. Students in the Water Engineering and Environment are also encouraged to participate in research through independent study projects. Moreover, the curriculum gives the students the opportunity to interact with the industrial sector and government agencies through two practical training summer courses. In addition, students will be exposed to large water related project in their practical training and graduation projects.

Freshman Year Course Schedule

	Semester-1: Fall		Semester-2: Spring	
	Course Code	CR	Course Code	CR
1.	MECN001	2	MECN002	2 ⁽¹⁾
2.	MTHN002	3	MTHN003	3 ⁽²⁾
3.	PHYN001	3	PHYN002	3
4.	MTHN001	3	CHEN001	3
5.	MDPN001	3	MDPN002	3
	<u>OR</u> MDPN002	<u>OR</u> 3	<u>OR</u> MDPN001	<u>OR</u> 3
6.	GENN005	2	GENN001	1
7.	GENN004	2	GENN003	2
	<u>OR</u> GENN003	<u>OR</u> 2	<u>OR</u> GENN004	<u>OR</u> 2
Semester Credit Hrs		18		17

Remarks:

- (1) Course MECN002 has a prerequisite course MECN001**
- (2) Course MTHN003 has a prerequisite course MTHN002**

WEE Program Study Plan

	Semester-3: Fall		Semester-4: Spring		Semester-5: Fall		Semester-6: Spring	
	Course Code	CR	Course Code	CR	Course Code	CR	Course Code	CR
1.	ARCN116	2	ARCN110	2	GENN224	2	STRN201	3
2.	MECN101	3	IHDN101	3	IHDN201	3	GENN210	2
3.	GENN102	2	MTHN103	3	IHDN203	2	IHDN202	2
4.	IHDN104	3	STRN102	3	MTHN203	3	IHDN204	3
5.	MTHN102	3	STRN104	3	PBWN201	2	IHDN301	3
6.	STRN101	3	STRN105	2	PBWN202	3	INTN203	2
7.	STRN103	3	-----	-----	GENN201	2	WEEN280	1
8.	-----	-----	-----	-----	-----	-----	XXXNXXX ⁽²⁾	2
Semester Hrs	Credit	19		16		17		18

	Semester-7: Fall		Semester-8: Spring		Semester-9: Fall		Semester-10: Spring	
	Course Code	CR	Course Code	CR	Course Code	CR	Course Code	CR
1.	STRN345	3	GENN3XX ⁽¹⁾	2	IHDN401	3	IHDN404	3
2.	GENN3XX ⁽¹⁾	2	IHDN303	2	IHDN402	3	IHDN405	3
3.	GENN3XX ⁽¹⁾	2	IHDN304	2	IHDN403	3	IHDNXXX ⁽³⁾	3
4.	IHDN302	3	IHDN3XX ⁽³⁾	3	IHDNXXX ⁽³⁾	3	WEEN481	3
5.	IHDN305	3	PBWN301	2	WEEN381 ⁽⁰⁾	2	XXXNXXX ⁽⁴⁾	3
6.	PBWN302	3	PBWN303	3	WEEN480	1	-----	-----
7.	STRN302	3	STRN303	3	XXXNXXX ⁽⁴⁾	3	-----	-----
8.	WEEN281 ⁽⁰⁾	1	-----	-----	-----	-----	-----	-----
Semester Hrs	Credit	20		17		18		15

Remarks:

- 0 Industrial training courses are mostly conducted in the summer semester and with exam conducted in the following Fall semester**
- 1 General elective course (group E-1, 2 credits per course): GENN301, GENN303, GENN305, GENN310, GENN311, GENN321, GENN326, GENN327, GENN328, GENN331, GENN332, GENN333, GENN380**
- 2 Discipline elective course (group E-2, 2credits per course): ARCN211, GENN341, GENN342**
- 3 Major elective course (group E-3, 3 credits per course): IHDN350, IHDN351, IHDN352, IHDN353, IHDN354, IHDN356, IHDN357, IHDN358, IHDN451, IHDN453, IHDN454, IHDN456, IHDN458, IHDN459**
- 4 Discipline elective course (group E-4, 3 credits per course): IHDN355, IHDN450, IHDN452, IHDN455, PBWN441, PBWN445, PBWN446, STRN466, IHDN465**

7. COURSE CONTENTS

7.1 University-Core Courses

<p>GENN001</p>	<p><u>History of Science and Engineering</u> Compulsory, Credits: 1 (1+0+0) Prerequisite(s): 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 Humanities: Modes of thought found within humanities and social sciences. Humanities for Engineers: Humanities themes of increased complexity - Different work methodologies - Critical analysis of information & choice of argumentation - Work methodologies and pedagogical interest.</p>
<p>GENN003</p>	<p><u>Basic Engineering Design</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): 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 & the Positive Attitudes for Creativity - Systematic generation and evaluation of ideas.</p>
<p>GENN004</p>	<p><u>Computers for Engineers</u> Compulsory, Credits: 2 (1+0+3) Prerequisite(s): none Developing basic concepts of algorithmic thinking to solve problems of relevance in engineering practice and implementing these algorithms using high-level computer language. Using data types, input/output commands, loops, control structures, functions, arrays, and other programming language constructs in a computer program. Evaluating and interpreting the results of programming work.</p>
<p>GENN005</p>	<p><u>Technical Writing</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): Passing required exam held in the University Discovering and outlining ideas. Organizing outlines. Ways To begin the three parts of technical writing. Writing abstracts, summaries, and conclusions of long reports. The thesis statement. Forms: letters, memos, reports, scientific articles, job description, CV, references and footnotes. Selection of key words, titles, and subtitles. Editing, revising and proof-reading techniques. Electronic word processing and technical writing, vocabulary building, and basic types and</p>

	patterns of argument.
GENN102	<p><u>Fundamentals of Management</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): 28 credits Introduction to management, Historical view and evolution of concepts. Basic Managerial Functions: Planning, Strategies, Objectives, MBO; Organizing, Departmentation, Job Description; Elements of Human Resource Management: Staffing, Directing, Controlling. Total Quality Management, Continuous Improvement. Engineering Applications.</p>
GENN201	<p><u>Communication and Presentation Skills</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): GENN005 Analyzing the audience. Selecting presentation topics and objectives. Recognizing different types of speeches and presentations. Overcoming nervousness and developing confidence while addressing an audience. Researching and generating information for informative presentations. Chunking presentation content. Designing effective visual aids. Using explicit and effective transitions throughout a presentation. Creating benefit statements for persuasive presentations. Using persuasive devices such as pathos and logos in speeches. Planning and delivering informative, persuasive, entertaining and inspiring presentations. Handling question and answer sessions effectively.</p>
GENN210	<p><u>Risk Management and Environment</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): GENN102 <u>Risk Management:</u> Introduction. Risk Definition. Basic Axioms Behind Risk Management. Systemic Approach to Handling Risk . Principle of Risk Management: Identification of Risks. Preliminary Risk Analysis (PRA). Risk Assessment. Risk Evaluation. Risk Control. Hierarchies of Control. Monitoring and Reviewing. Documentation. Study of a practical problem in which the student applies Basic Risk Management <u>Environment:</u> 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.</p>
GENN224	<p><u>Fundamentals of Economics and Accounting</u> Compulsory, Credits: 2(2+0+0)</p>

	<p>Prerequisites (s): 42</p> <p>The main objective of this course is to provide engineers with the basic concepts of Economics and Accounting where the engineer has to be able of conceiving a business' vision from financial & strategic dimensions alongside to his/her technical skills.</p> <p>The course includes introduction to financial accounting, overview of managerial accounting, and economic concepts. The financial accounting includes the accounting cycle and financial statements. It also includes financial ratios for measuring the organization's performance. The Managerial accounting and behavior of cost includes the cost volume relationships and its further use in Budgeting & Forecasting.</p> <p>Economic concepts are addressed in microeconomics & macroeconomics where microeconomics includes the basic principles of economics, theory, assumptions, and models of economics as a social science, it also includes market forces of supply and demand, and elasticity & its applications. Another important topic addressed in this part is the competitive markets where decisions regarding maximizing profit, shutting down or exiting the market are discussed through computational methods & formulas. Macroeconomics includes measuring the nation's income where it explains the gross domestic product (GDP), its components & types.</p>
<p>GENN301</p>	<p><u>Ethics and Legislation</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): 80 credits</p> <p>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.</p> <p>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. The contract; Parties, Formation, Validity, Effect, and compensation of Damage. Introduction to Engineering Contracts. Contracting Contract.</p>

GENN303	<u>Critical Thinking</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN003 The aim of the course is to apply critical thinking in the context of problem solving in the engineering field. Critical thinking and abstract thought are invaluable tools, which complement an engineer's technical expertise. Critical Thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. The following terms and applications are also discussed: Analysis, breaking down the problem into parts and finding the relationships between them; Synthesis, thinking about other ways to solve the problem either by incorporating new information or combining the parts in a different way; and finally, Evaluation is making a judgment about the results using the evidence at hand.
GENN305	<u>Interdisciplinary Project</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): 108 credits The course aims to give students more space for creativity, out of box thinking, collaboration and involvement in team work. It's a free specialization course where the subject is to be determined by the student team. The team consists of up to 6 students and minimum of 4 students. A maximum of two students of the same credit hour program can be members of the same student team. The team shall register the topic of the project with the course coordinator and follow up with him/her at least 3 times during the semester. No mid-term Exam for the course and the final Exam jury will be nominated by the course coordinator depending on the project subject, but not necessarily on the student(s) cr. Hr. program. The course is graded as a normal graded course. Final grade consists of: 20% for Semester work + 80% for Final Exam.

<p>GENN310</p>	<p><u>Advanced Risk Management</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN210 + MTHN203 Review of the Basic Risk Axioms and Concepts. Evolution of Risk Concepts and Terminology. Financial and Industrial Risk: Comparison and Contrast. Probabilistic Nature of Risk. System Decomposition. Legal and Regulatory Risks. Tools for Risk Assessment: Probability and Consequences: Event Tree, Fault Tree, FMECA, FMEA, MOSAR (The French Approach), Simulation, Optimization and Operations Research. HACCP: principles and applications. HAZOP. Qualitative and Quantitative Risk Assessments (QRA). Quantitative Risk Assessment: Qualitative Aspects of System Analysis (Quantification of Basic Events. Confidence Interval. Quantitative Aspects of System Analysis. System Quantification for Dependent Events. Human Reliability. Uncertainty Quantification). Operational Risk. Reporting Risk Operations. Sectoral Risk Management. Specific Risk Topics: Risk Specific to Confined Spaces. The Special Case of BLEVE and Explosive Mixtures. Social and Psychological Risk. Social Risk Management and Social Protection. Disaster Risk Management and Vulnerability Reduction. Can Risk be a Management Style?</p>
<p>GENN311</p>	<p><u>Technical Writing in Arabic</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN005 + 80 credits Review of the Basics of Arabic Grammar and Mechanics. Writing Effective Sentences and Paragraphs Using Arabic Language. Discovering and Outlining Ideas. Writing Abstracts, Summaries, and Conclusions of Long Reports. The thesis Statement. Writing Technical Forms Using Arabic Language: 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. Integrating Graphs, Tables and Charts in Technical Documents. Vocabulary Building. Basic Types and Patterns of Argument: Terminology, Building Sub-Arguments of Fact and Policy. مراجعة أسس القواعد النحوية و ميكانيكيات اللغة العربية - الأخطاء الشائعة في استخدامات اللغة العربية - كتابة جمل وفقرات صحيحة وفعالة باستخدام اللغة العربية - خلق الأفكار (التفكير) - كتابة مقدمات، ملخصات و خاتمات التقارير - كتابة الأبحاث - أشكال الكتابة باللغة العربية: الرسائل، المذكرات، التقارير، المقالات العلمية، الوصف الوظيفي، كتابة السيرة الذاتية وتوثيق المراجع - اختيار الكلمات المفتاحية و كذلك العناوين الرئيسية والفرعية - التعرف على تقنيات التحرير و المراجعة و القراءة الاحترافية - إمكانية معالجة النصوص والكتابة الإلكترونية - الرسوم و الجداول و المخططات البيانية في الوثائق الفنية - بناء حصيلة لغوية من الكلمات والمفردات - تعلم الانماط و الأساليب الأساسية والمبدئية للنقاش من حيث المنهجية والبناء.</p>
<p>GENN321</p>	<p><u>Foreign Language</u></p>

	<p>Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN201 Emphasizing the development of student's communicative skills to speak, listen, read and write in languages other than Arabic and English, such as French, German, Spanish, Italian, Japanese, Chinese, etc, and to study cultural characteristics of such foreign languages from historical, geographical, literature, economic, and social viewpoints. Topics include, but not limited to, the basics of language grammar and mechanics, writing effective sentences and paragraphs, vocabulary building, writing technical engineering documents and writing technical forms: letters, memos, reports, scientific articles, job description, resumes and curriculum vitas.</p>
GENN326	<p><u>Marketing</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN102 + 80 credits 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 & Profitability Analysis, Performance Evaluation; Ethical and Legal Responsibilities tender writing.</p>
GENN327	<p><u>Selections of Life-Long Skills</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN201 Communicating Clearly - Managing Time and Resources - Making Decisions - Delegating Successfully - Motivating People - Managing Teams - Negotiating Successfully - Minimizing Stress - Getting Organized - Managing Changes - Interviewing People - Managing Your Career - Balancing Work and Life - Thinking Creativity and Innovation - Influencing People – Systems Thinking – Interpersonal Management Skills – Entrepreneurial Skills.</p>
GENN328	<p><u>Scientific Research Methods</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): 108 credits Course covers the process of scientific knowledge and practical implementation, underlying research methodology issues. To develop a critical and questioning mindset, critical understanding of issues related to research questions, literature review, methodological design, data collection, analysis and conclusion. Moving you toward fulfillment of the publication and dissertation requirements, perhaps will turn you into a 'Researcher'. All of which to use content to solve technical, practical, and life problems.</p>
GENN331	<p><u>Business Communication</u></p>

	<p>Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN201 Skills for effective communication in the workplace; constructing and delivering persuasive business presentations; theoretical and experiential knowledge of argumentation and debate for informal and formal presentations; style, layout, and convention of business writing; writing business proposals, progress reports, and feasibility reports; common areas of miscommunication.</p>
GENN332	<p><u>Service Management</u> Elective (group E-1), Credits: 2 (2+0+0) Prerequisite(s): GENN102 + 80 credits Role of services in the economy, The nature of services, Service quality, Service Strategy, Developing new services, The role of technology in supporting service delivery, Design of services, Capacity planning and managing queues, Quantitative methods for service management.</p>
GENN333	<p><u>Creativity, Art & Design</u> Elective (group E-1), Credits: 2 (1+3+0) Prerequisite(s): AA APPROVAL This course will provide entry level visualization, communication and design skills for a wide variety of fields including: mechanical engineering, architecture, interior and furniture design, graphic design, package design, marketing, visual arts, ...etc. It will help produce innovative creative and artistic projects. To develop basic thinking, visualizing and problem-solving skills , in order to apply these skills to a realistic simple creative project ex. exhibit design, landscape design, furniture design, ... etc</p>
GENN380	<p><u>Thesis Writing for GP</u> Elective (group E-1), Credits: 2 (1+3+0) Prerequisite(s): GENN005, AA Approval [registering in GP1] The thesis writing course is a capstone project, presenting a well-argued piece of research on a precise architectural/engineering theme or topic independently selected by the student. The student acquires the main scientific writing skills of typical dissertations through the course to finally submit a scientific paper of 10,000 words. The student goes through the formulation of the different phases of writing starting from having an argument, writing an abstract, developing methodologies and then going through literature review, together with critical analysis of information and relevant case studies to end with developing empirical/ applied studies.</p>

7.2 College-Core Courses

CHEN001	<p><u>Chemistry</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): none Gases; Applications to gaseous law; Mass balance and heat balance in combustion processes of fuels; Solutions & separation techniques; Applications to electrochemistry; Corrosion; Water treatment; Building materials; Environmental Engineering; Selected chemical industries: fertilizers, dyes, polymers, sugar, petro-chemicals, semi-conductors, oil and fats, industrial systems; Chemical Vapor deposition.</p>
GENN003	<p><u>Basic Engineering Design</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): 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 & the Positive Attitudes for Creativity - Systematic generation and evaluation of ideas.</p>
MDPN001	<p><u>Engineering Graphics</u> Compulsory, Credits: 3 (1+0+4) Prerequisite(s): 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. Drawing of Architectural projections and reading of blueprints.</p>
MDPN002	<p><u>Fundamentals of Manufacturing Engineering</u> Compulsory, Credits: 3 (2+1+2) Prerequisite(s): none 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.</p>
MECN001	<p><u>Mechanics-1 (Statics)</u> Compulsory, Credits: 2 (1+3+0)</p>

	<p>Prerequisite(s): none Statics of particles, forces in three-dimensions, vector algebra; equivalent systems of forces, resultant of a group of forces, moments of forces, moment of a couple, reduction of a system of forces, wrench; equilibrium of rigid bodies in two dimensions, reactions at supports and connections for a 2D structure, 2D trusses, equilibrium of rigid bodies in three dimensions, reactions at supports and connections for a three dimensional structure; centroids and centers of gravity, center of gravity of 2D bodies, centroids of areas and lines, first moments of areas and lines, composite plates and wires; moments of inertia, moments of inertia of areas, second moment, or moment of inertia of an area, polar moment of inertia, radius of gyration of an area, parallel-axis theorem, moments of inertia of composite areas, product of inertia, principal axes and principal moments of inertia, moments of inertia of masses, moment of inertia of a mass, parallel axis theorem, moments of inertia of thin plates, moments of inertia of composite bodies, mass product of inertia, principal axes and principal moments of inertia.</p>
MECN002	<p><u>Mechanics-2 (Dynamics)</u> Compulsory, Credits: 2 (1+2+1) Prerequisite(s): MECN001 <u>Kinematics of particles:</u> rectilinear motion of particles, position, velocity and acceleration, uniform rectilinear motion, uniformly accelerated rectilinear motion, curvilinear motion, derivatives of vector functions, rectangular components of velocity and acceleration, relative motion, tangential and normal components of acceleration, motion of a particle in a circular path, velocity and acceleration of a particle in polar coordinates. <u>Kinetics of particles:</u> Newton's second law, linear momentum of a particle, equations of motion with applications in Cartesian coordinates, tangential and normal directions, polar coordinates, free vibrations of particles, simple harmonic motion; energy & momentum methods, work of a force, kinetic energy of a particle, principle of work and energy, applications, power and efficiency, potential energy, conservation of energy, principle of impulse and momentum, impulsive motion, impact, direct central impact and coefficient of restitution, oblique central impact.</p>
MTHN001	<p><u>Introduction to Linear Algebra and Analytic Geometry</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): none Matrix algebra, determinants, inverse of a matrix, row equivalence, elementary matrices, solutions of linear systems of equations; parabola, ellipse and hyperbola, eccentricity and conic sections; quadratic equations; solid geometry, line, plane, quadratic surfaces.</p>
MTHN002	<p><u>Calculus I</u> Compulsory, Credits: 3 (2+3+0)</p>

	<p>Prerequisite(s): none Functions, graphing of functions, combining functions, trigonometric functions; limits and continuity; differentiation; inverse functions; exponential and logarithmic functions; inverse trigonometric functions; hyperbolic and inverse hyperbolic functions; indeterminate forms and L'Hopital's rule; Taylor and Maclaurin expansions.</p>
MTHN003	<p><u>Calculus II</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): MTHN002 Anti-derivatives; indefinite integrals; techniques of integration; definite integrals, applications of definite integrals; functions of several variables; partial derivatives, applications for partial derivatives.</p>
MTHN102	<p><u>Multivariable Calculus and Linear Algebra</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): MTHN001 + MTHN003 Double integrals, double integrals in polar coordinates; triple integrals, triple integrals in spherical and cylindrical coordinates; applications of double and triple integrals; line and surface integrals; vector analysis, gradient of a scalar function, divergence of a vector, curl of a vector, divergence and Stokes' theorems, vector identities; LU-factorization; vector spaces; inner product spaces; eigenvalues and eigenvectors; diagonalization of matrices; functions of matrices.</p>
MTHN203	<p><u>Probability and Statistics</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): MTHN102 Probability axioms; probability laws; conditional probability; random variables; discrete and continuous distributions; joint distribution; computer simulation; sampling; measures of location and variability; parameter estimation, testing of hypothesis.</p>
PHYN001	<p><u>Mechanics, Oscillations, Waves and Thermodynamics</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): none Physics and measurements; elastic properties of solids; universal gravitation and motion of planets; fluid mechanics (statics and dynamics); oscillatory motion; 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 course topics.</p>
PHYN002	<p><u>Electricity and Magnetism</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): none Electric field; Gauss' law; electrostatic potential; capacitance and dielectrics; current and resistance; direct current circuits; magnetic fields, sources of magnetic field; Faraday's law; Maxwell's equations; inductances; magnetic properties of matter. Laboratory experiments on</p>

	the course topics.
WEEN280	<p><u>Engineering Seminar</u> Compulsory, Credits: 1 (1+0+0) Prerequisite(s): 72 credits + AA Approval Talks and presentations are invited from industrial establishments relevant to the program. The guest speaker should discuss the organization, management, and recent technologies implemented in his/her industrial establishment. Students exercise writing brief technical reports on the guest presentation and deliver their own presentation about the topic. The course is graded as Pass/Fail grade-system.</p>
WEEN281	<p><u>Industrial Training-1</u> Compulsory, Credits: 1 (0+0+0) Prerequisite(s): 85 credits + AA Approval + STRN201 Training on industrial establishments relevant to the program. Training lasts for total of 90 hours, during a period about three weeks in site activities. A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by the examining panel which consists of three members with one member appointed from industry or other colleges of engineering. The course is graded as Pass/Fail grade-system.</p>
WEEN381	<p><u>Industrial Training-2</u> Compulsory, Credits: 2 (0+0+0) Prerequisite(s): CEMN281 + AA Approval Training in industrial establishments relevant to the program. Training lasts for total of 180 hours, during a minimum period of six weeks, two weeks in site and four weeks in the technical office, A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and a presentation to be evaluated by the examining panel which consists of three members with one member appointed from industry or other colleges of engineering. The course is graded as Pass/Fail grade-system. If student presents a proof of participating in a workshop, organized and held by a reputable organizer approved by the Program, on "Primavera" & "Rivets" soft wear programs, with a minimum of 28hours per each work shop, it can substitute a week of field training for each work shop, and the student is required to conduct only the rest of the eight weeks in industrial establishment as out lined above. "Successfully passing the work shop" is an essential certificate to be presented to the "Examining Panel of the Course".</p>
WEEN480	<p><u>Graduation Project-1</u> Compulsory, Credits: 1 (0+0+3) Prerequisite(s): 130 credits + AA Approval</p>

	<p>Students undertake a major project as part of the program. The aim of the project is to provide the students, who work in groups, with an opportunity to implement appropriate concepts and techniques to a particular design. Students are required to select and research the expected project to be designed and implemented in the following course Graduation Project-2. The student should give an oral presentation to be approved. The course is graded as Pass/Fail grade-system.</p>
WEEN481	<p><u>Graduation Project-2</u> Compulsory, Credits: 3 (1+0+6) Prerequisite(s): CEMN480 + AA Approval All students undertake a major project as part of the program. The aim of the project is to provide the students, who work 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.</p>

7.3 DISCIPLINE COURSES

ARCN116	<p><u>Introduction to CAD Systems</u> Compulsory, Credits: 2 (1+0+3) Prerequisite(s): GENN004 + MDPN001 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 standard operating system to create standard CAD packages for 2D and 3D design drawings.</p>
ARCN110	<p><u>Basic Architectural Design</u> Compulsory, Credits: 2 (1+1+2) Prerequisite(s): GENN003 + MDPN001 Introduction to design, Design as A goal Directed Activity, The Management Of Architectural Information, Architectural Design and Decision Making, Basic Elements of Architectural Design, The Architectural Design Matrix, Form and Form Generation, Space & Compositions, The Building Matrix.</p>
ARCN201	<p><u>Building Construction and City Planning</u> Compulsory, Credits: 2 (1+2+1) Prerequisite(s): ARCN110 Introduction; Aim and definitions; Building construction stages; Wall</p>

	bearing structures: stone construction, masonry-raw bricks and brick masonry; Vertical circulation element; Stairs detailing, Complementary and finishing materials; Construction building types; Urban and city planning approaches & basic guidelines of the field.
IHDN104	<p><u>Civil Engineering Drawing</u> Compulsory, Credits: 2 (1+1+2) Prerequisite(s): MDPN001</p> <p>Introduction to civil engineering projects, General Concepts, Legend and symbols, Scales and drawing size, General layout and plans, Longitudinal and cross sections, Detailing, Earthworks and retaining walls, Applications on irrigation and land reclamation projects, Half-earth-removed views, Pitching and protection. Drawing of steel sections and connections, reinforced concrete sections. Projection of beams and columns.</p>
IHDN201	<p><u>Fluid Mechanics</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): PHYN001</p> <p>Fluid Properties: Units, Dimensions, The Continuum, Viscosity, Specific Volume, Weight, Gravity, Heat, Pressure, Compressibility, Vapor pressure, Surface tension. Fluid Statistics, Pressure at a Point, Pressure Measuring Devices, Forces on Plane and curved Surfaces. Buoyant Force, Stability of floating and submerged bodies, Horizontal, vertical and radial acceleration, and Forced vortex. Ideal-Fluid Flow, Flow classification, The Continuity, Requirements for Ideal Flow, Euler's equation of Motion, Irrotational flow, Velocity potential, Integration of Euler's Equation, Bernoulli's Equation, The Stream function, Sink, Source, Doublet.</p>
IHDN202	<p><u>Open Channel Hydraulics</u> Compulsory, Credits: 2 (1+2+1) Prerequisite(s): IHDN201</p> <p>Introduction, Types of cross sections, Stage and depth measurements, Types of flow, Velocity distribution, Velocity measurements, Kinetic energy and momentum, correction factors, Curvilinear pressure distribution, Steady uniform flow, Resistance to flow, Design of cross sections, Design of circular cross sections, Specific energy and critical flow, Applications on specific energy, Specific force, Steady rapidly varied flow, Hydraulic Jump, Weirs, Discharge measurements, Steady gradually varied flow, Water surface profiles, Computation of water surface profiles length, Flow control, Laboratory experiments,</p>
INTN203	<p><u>Mechanical and Electrical Systems</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s):</p> <p>Introduction to electrical circuits; Electrical installation in residential</p>

	and industrial buildings (illumination networks in rural areas, data lines, telephone lines and antenna, control of air conditioning, lift); Requirements of audio systems; Alarm devices (fire - security - gas); HVAC components and systems; Plumbing elements and features; Essential mechanical systems used in typical residential and institutional projects.
MECN101	<p><u>Dynamics of Rigid Bodies</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): MECN002</p> <p>Planar kinematics of rigid bodies- center of mass- moment of inertia - planar kinetics of rigid body: linear and angular equations – application of the equations of motion of rigid body, translation, rotation about a fixed axis, and general plane motion - Principle of Work and Kinetic Energy- Conservation of Mechanical Energy- Principle of Impulse and Momentum – Introduction to Vibrations.</p>
MTHN103	<p><u>Differential Equations</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): MTHN003</p> <p>First-order differential equations, separable, exact, linear, homogeneous and Bernoulli equations; modeling with first order differential equations; higher-order differential equations; method of undetermined coefficients; variation of parameters; modeling with higher order differential equations; series solutions; Laplace transform; properties and applications, shifting theorems, convolution theorem; solutions of differential equations using Laplace transform; Fourier series; Fourier transform.</p>
PBWN201	<p><u>Water and Waste Water Engineering</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s):</p> <p>Introduction; Definitions; Fields of environmental engineering; Environmental system; Waste cycles; Main environmental problems; Global problems; Water pollution; Water supply engineering; Water purification works; Water distribution system and storage tanks; Sanitary drainage; Sewerage system; Wastewater treatment Works.</p>
PBWN202	<p><u>Surveying for Engineers</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): MTHN003</p> <p>Engineering principles and applications of surveying sciences (with emphasis on plane surveying) are presented in relation to engineering. Popular techniques and engineering uses of distance, angles and height difference measurements are studied and practiced. Applications in detail mapping, earthwork computations, and setting out engineering structures are covered in this course. Integrated digital surveying and mapping using total station are introduced.</p>

<p>PBWN301</p>	<p><u>Highway Engineering</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s): None Introduction to transport planning and traffic engineering; Route study and reconnaissance; Functional classification of road network; Criteria of geometric design; Design of road horizontal and vertical alignments; Cross section elements; Type of road pavement; Vehicle, load and stresses; Construction equipments; Method statement and quality control; Pavement management and rehabilitation; Traffic control during road construction and maintenance; Use of computer simulation for selection of equipment.</p>
<p>PBWN302</p>	<p><u>Soil Mechanics</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): STRN102 + STRN104 Basic properties of soil; Soil classification; Compaction; Soil stresses; Consolidation; Shear strength.</p>
<p>PBWN303</p>	<p><u>Foundations</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s): PBWN302 Bearing capacity; Shallow foundations; Deep foundations.</p>
<p>STRN101</p>	<p><u>Structural Analysis-1</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): None Types of structures, loads, supports, reactions, internal forces, analysis of beams, frames, trusses. Influence lines of statically determined structures, Moving loads</p>
<p>STRN102</p>	<p><u>Structural Analysis-2</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): STRN101 Deformations: differential equations, virtual work. Indeterminate structures: consistent deformation, moment distribution. Buckling of columns.</p>
<p>STRN103</p>	<p><u>Engineering Materials</u> Compulsory, Credits: 3 (2+1+2) Prerequisite(s): PHYN001 + MECN001 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.</p>
<p>STRN104</p>	<p><u>Mechanics of Materials</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): STRN103 Analysis of stress, strain, and deformation of sections subjected to</p>

	<p>tension, compression, bending, shear, and torsion – Buckling - Theories of failure - Laboratory: Lab Testing of materials for strength evaluation; the definition of the mechanical properties (elasticity-plasticity- stiffness- strength- ductility- brittleness- resilience-toughness-..) and their determination in different cases of loading. The load and corresponding deformation diagram is to be plotted. The different properties are to be determined.</p>
STRN105	<p><u>Human Resources Management</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): GENN102 This course will teach students the basics fundamentals of human resource principle, management and strategy. The course will be built around the concept of viewing human resources as a dynamic, strategic asset and the study of individual human relations issues within the context of a knowledge-based organization. It adopts the perspective of a general manager and addresses human resource topics (including reward systems, performance management, high-performance human resource systems, training and development, recruitment, retention, equal employment opportunity laws, workforce diversity, and union-management relationships) from a strategic perspective.</p>
STRN201	<p><u>Reinforced Concrete Design I</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s): STRN102 + STRN104 Methods of design; Codes; Structural systems and load distribution; Design using limit states method; Section subjected to bending moments; Section subjected to shear and torsion; Reinforcement details for beams; Limit state of deflection, Working stress design method.</p>
STRN302	<p><u>Steel Structures Design I</u> Compulsory, Credits: 2 (1+3+0) Prerequisite(s): STRN102 + STRN104 Introduction to structural steel design; Design criteria (materials, loads, and systems); General layout; Design of tension members; Design of compression members; Design of beams; Design of beam-columns.</p>
STRN303	<p><u>Reinforced Concrete Design II</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): STRN201 Design and reinforcement details: solid slabs, ribbed slabs, paneled beams slab, flat slabs (beamless slabs), stairs; Design of sections under axial forces; Design of sections under eccentric forces; Design and reinforcement details of concrete columns.</p>
GENN341	<p><u>Operation Research</u> Elective, Credits: 2 (1+3+0)</p>

	<p>Prerequisite(s): None Introduction - Linear programming - Network analysis - Decision analysis - Random processes - Queuing models - Inventory analysis - Simulation - Dynamic programming - Nonlinear programming - Game Theory - Waiting line theory.</p>
GENN342	<p><u>Decision Support Systems</u> Elective, Credits: 2 (1+3+0) Prerequisite(s): None Management Support Systems. Decision Making Process: Systems, Models, Sensitivity Analysis, "What-If?" Analysis, Goal Seeking, DSS Characteristics, DSS Components, DSS Hardware and Software, Static and Dynamic Models, Handling Certainty and Uncertainty, Mathematical, Programming, Simulation, Heuristic Programming, Forecasting, Financial and Planning Modeling. Artificial versus Natural Intelligence, Knowledge in AI. Fundamentals of Expert Systems.</p>
ARCN211	<p><u>Urban Planning</u> Elective, Credits: 2 (1+3+0) Prerequisite(s): ARCN201 This course examines the evolving structure of cities and the way that cities, suburbs, and metropolitan areas can be designed and developed. International cities studied to see how physical, social, political and economic forces interact to shape and reshape cities over time.</p>
PBWN445	<p><u>GIS and Remote Sensing Applications</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): PBWN202 This course provides a conceptual overview and hands-on experience using the GIS software, giving the background knowledge to quickly take advantage of GIS powerful display and query capabilities in such enhanced format supporting decision makers. It Introduce the concepts of GIS, Present GIS different uses, Learn basic ArcView functionality, Become familiar with the ArcView user interface, and Use ArcView to create charts and layouts. GIS graphic user interface (GUI): Interacting with the application window and its components; using online help, Projects and documents: How projects organize, manage and store documents (view, tables, charts and layouts), Creating and editing themes: Using GIS modules to create and edit shape themes, Tables: Creating tables from a variety of tabular data sources; selecting from a table; joining multiple tables; modifying table structure, Charts: Creating a chart for presenting and analyzing tabular data, Layouts: Combining views, tables, charts and images, as well as, logos and scale bars, to create layouts</p>
PBWN441	<p><u>Advanced Surveying and Digital Mapping</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): PBWN202</p>

	<p>Advanced surveying concepts and digital mapping systems are presented in relation to engineering. Geodetic techniques, computations and practices in establishing control points, dealing with coordinate system transformations, deformation monitoring and map projections are studied. Concepts of terrestrial and aerial photogrammetry for mapping are presented. Satellite surveying and mapping systems are overviewed, with emphasis on the Global Positioning System and Remote Sensing uses and applications in engineering.</p>
<p>PBWN446</p>	<p><u>Deep Excavation and Side Support</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): PBWN302 Introduction to deep excavation – Slope stability – Construction of: sheet pile walls, -Selection of proper Retaining system – Insulation</p>
<p>IHDN355</p>	<p><u>Non-Conventional Wastewater Treatment Systems</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): PBWN201 + IHDN203 Introduction to Non-conventional wastewater treatment, Physico-chemical Treatment Processes. Introduction to Biological Treatment Processes, natural-biological treatment, Natural law, Design of biological treatment systems for the treatment of municipal sewage,</p>
<p>IHDN450</p>	<p><u>Hydrogeology</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN301 Introduction: Hydrology and Hydrogeology, Hydrogeologists, Applied Hydrogeology, Soil Moisture and Groundwater: Porosity of Earth Materials, Specific Yield, Hydraulic Conductivity of Earth Materials, Effective Porosity, Forces Acting on Groundwater, Water Table, Infiltration, Soil Moisture, Theory of Unsaturated Flow, Water-Table Recharge, Aquifers, Aquifer Characteristics, Homogeneity and Isotropy., Principles of Groundwater Flow: Mechanical Energy, Hydraulic Head, Force Potential and Hydraulic Head, Darcy’s Law, Permeameters, Equations of Groundwater Flow, Solution of Flow Equations, Gradient of Hydraulic Head, Flow Nets, Refraction of Streamlines, Steady Flow in a Confined Aquifer, Steady Flow in an Unconfined Aquifer, Fresh-Water-Saline-Water Relations, Tidal Effects., Groundwater Flow to Wells: Unsteady Radial Flow, Well Hydraulics in a Completely Confined Areally Extensive Aquifer, Flow in a Semi-Confined Aquifer, Effect of Partial Penetration of Wells, Water-Table Aquifer, Measurement of Aquifer Parameters Using Piezometers, Steady-State Radial Flow, Theis Equations, Intersecting Pumping Cones and Well Interference, Effect of Hydrogeologic Boundaries, Pumping-Test Design</p>
<p>IHDN452</p>	<p><u>Optimization Techniques</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): MTHN102 This course is intended to introduce students to an array of</p>

	<p>optimization techniques. The course will cover fundamental optimization methods; linear programming, integer programming, network models, and dynamic programming methods. Some discrete optimization techniques will also be introduced. The theory underlying the various optimization methods is covered. Applications from water resources engineering will be discussed.</p>
IHDN455	<p><u>Irrigation Design Works-2</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN302 Basis and procedures for designing control structures. Seepage under structures. Scour downstream of structures. Weirs: types and functions, stepped and flow measuring weirs, accuracy and submergence ratios, Structural design. Barrages: structural design, design and operation of gates.</p>
STRN466	<p><u>Design and Construction of Water & Wastewater Structures</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): STRN303 Cracking limits, Design of water tight sections, Water pipe sections, Design of water structures; underground circular and rectangular tanks and swimming pools, elevated circular and rectangular deep and shallow tanks, Detailed design and construction of RC water and wastewater treatment facilities.</p>

7.4 MAJOR COURSES

<p>IHDN101</p>	<p><u>Principles of Irrigation and Drainage Engineering</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): None Definitions, Water resources, Components of irrigation systems, Irrigation water quality, Soil - water plant relationships, Estimation of water requirements, Introduction to various types of irrigation systems (Surface - Sprinkler - Drip), Subsurface drainage, Horizontal and vertical drainage. , Concepts of irrigation efficiency and uniformity.</p>
<p>IHDN203</p>	<p><u>Water Chemistry and Microbiology</u> Compulsory, Credits: 2 (1+2+1) Prerequisite(s): CHEN001 Basic water quality concepts, Basic chemistry concepts, Good laboratory practice, Standard solutions, Water color, odour and temperature, Understanding and measuring pH, Understanding and measuring EC, Understanding and measuring DO, Understanding and measuring COD, Understanding and measuring BOD, Basic aquatic chemistry concepts, Oxygen balance in surface waters, Major ions in water, Trace compounds in the aquatic environment, Potentiometric analysis of water quality, Use of ion selective probes, Absorption spectroscopy, Emission spectroscopy, Measurement of selected ions in water, Introduction to microbiology, Microbiological laboratory techniques, Coliforms as indicators of fecal pollution, How to measure coliforms</p>
<p>IHDN204</p>	<p><u>Computational Water and Wastewater Networks</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): IHDN201, PBWN201 Water distribution systems, demands, demand variables, pipe flow, networks, pumps, appurtenances, materials, Design techniques, Modeling of distribution systems, Design problem considerations-distribution, Wastewater collection systems, pipe flow, inflows, inflow variables, appurtenances, installation, materials, and Modeling of collection systems</p>
<p>IHDN301</p>	<p><u>Introduction to Water Resources Engineering</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): Hydrologic cycle, precipitation, infiltration, evaporation and evapo-transpiration, rainfall; Runoff relationships (rational method, unit hydrograph, statistical and probability approaches), stream flow hydrographs, types of aquifers, ground-water flow equations, well hydraulics, monitoring of groundwater levels, hydraulic characteristics of aquifers, groundwater management and safe yields.</p>

IHDN302	<p><u>Irrigation Design Works-1</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): IHDN101 Planning and design of irrigation and drainage networks, seepage losses, technical and economic feasibility of canal lining, irrigation structures and their functions, general requirements and design considerations (hydraulics, loads, stability, structural aspects), transitions and wing walls, design of typical conveyance and crossing structures (culverts, syphons, aqueducts, short span bridges), tail escapes, construction methods.</p>
IHDN303	<p><u>River Engineering</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): IHDN202 Introduction, River morphology, Hydraulics of flow in river channels, Local scour around piers, Local scour around embankments, Flow in curved river channels, Analytical river morphology, River meanders, Physical modeling, Mathematical modeling for erodible channels, River training works, Field visits, Case studies.</p>
IHDN304	<p><u>International Law of Water and Environment</u> Compulsory, Credits: 2 (2+0+0) Prerequisite(s): Historical background, basis of the international law for water, legal aspects of the international agreements concerning shared water resources, international water laws and agreements, the legal system of the Nile basin (case study).</p>
IHDN305	<p><u>Applied Hydrology</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): IHDN301 The course covers two parts: surface and subsurface hydrology. The first part covers the Sources of Streamflow, Streamflow Hydrograph, SCS Method for Abstraction, Stream Network, Unit Hydrograph, Synthetic Unit Hydrograph, Unit Hydrograph for Different Rainfall Duration, Lumped Flow Routing, Hydrologic River Routing, Linear Reservoir Model, Distributed Flow Routing: Saint-Venant Equations, Wave Motion. The second part covers classification of hydro geological strata and its properties, general equation of groundwater flow, saturated/unsaturated flow, pollution mechanics and equations, introduction, equations of solute transport, governing equation, solute concentration,</p>
IHDN350	<p><u>Participatory Irrigation Water Management</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN101 The course covers the concept, types and features of PIM. PIM applications in Egypt will be covered at the different levels of the national irrigation system; the mesqa level, branch canal level</p>

	<p>and irrigation district level. The different types of farmers associations and their role in irrigation water management practices will be addressed. The problem of PIM applications and the gender issue will be discussed and analyzed. A one day field trip to one of the PIM applications in Egypt will be organized.</p>
IHDN351	<p><u>Water in the Arab Region and Africa</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): None Global Water Resources, Water Storage on the Earth and the Hydrological Cycle .River Basins, Continental Slopes, and the Inflow to the World Ocean, River Runoff and Ground Water, The Dynamics of Water Use in the World., Water Availability and Water Resources Deficit., The African Water Resources, Rainfall ,Runoff, Recharge, major Basins, Withdrawals, Accessibility, Irrigation Potential and Water Managed Areas, Irrigated Crops, State of the African Environment, Atmosphere, Biodiversity, Coastal and Marine Habitats, Forests, Freshwater, Land, Urbanization, Arab Water Resources: Precipitation - Potential Evaporation - Internal Renewable Water Resources - Total Renewable Resources - Non conventional Water Resources (Agricultural drainage reuse, wastewater reuse, desalination) - Groundwater resources- Land use - Sectoral Withdrawals - Food security / water security - IWRM status - Shared Water Resources - Water Quality.</p>
IHDN352	<p><u>Non Conventional Water Resources</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): None This course will focus on potential non-conventional water-resource applications such as; re-use and recycling of (urban waste water and agricultural drainage water) brackish groundwater and seawater desalination, cloud seeding, and rain water harvesting.</p>
IHDN353	<p><u>Drainage Engineering</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN101 Sources of drainage water, importance of land drainage, clarification of drainage systems (open and pipe drain). Design of horizontal and vertical drainage systems, drainage investigation and field measurements of relevant soil properties, drainage system performance, reuse of drainage water.</p>
IHDN354	<p><u>Water Resources Assessment</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN301 The earth radiation balance, the hydrologic cycle, global water distribution, spatial variation, temporal variation, precipitation measurements, and forecast, Evapotranspiration, river runoff and</p>

	forecast, soil holding capacity, recharge estimation, blue water, green water, gray water, global, regional, and national assessment methodologies
IHDN356	<p><u>Advanced Fluid Mechanics</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN201</p> <p>Fluid Dynamics, The Concepts of systems and Control Volume, Euler's Equation of Motion along a Stream Line, The Bernoulli's Equation, Applications of the Energy Equation to Steady Fluid Flow Situations, Discharge Measurements, Quasi-Steady Flow applications, The Momentum Equation, The Linear Momentum), Equation, Applications Of the Linear Momentum Equation, Dynamic Thrust of a Jet, Forces on Pipe Fittings, The Hydraulic Jump, Losses in Sudden Pipe Contractions and Expansions, The Moment of Momentum Equation, Viscous Effects, Fluid Resistance, Laminar Flow between Parallel Plates, Laminar Flow in Pipes, The Reynolds Number, Turbulent Flow, Prandtl Mixing Length, Turbulent Flow in Pipes, Friction Losses in Pipes, Navier Stokes Equations, Velocities and Acceleration, The Stress Tensor, The Full Equation of Motion, The Boundary layer, Description of the Boundary Layer, Momentum Integral equations of the Boundary Layer, Laminar' Boundary Layer over a flat Plat, Turbulent Boundary Layer over a flat Plat, Forces on Immersed Bodies, Skin Resistance, form Resistance, Drag and Lift, Real Flow around a Cylinder.</p>
IHDN357	<p><u>Applied Hydrology Statistics</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): MTHN203, IHDN301</p> <p>This course involves the study of surface and subsurface variability and the interpretation of observations using existing theories. The course will cover: review of probability and statistics, time-series modeling, estimation of static and dynamic hydrologic systems, analysis of spatial hydrologic processes. It incorporates updated techniques and applied statistics and geostatistics, risk analysis, the use of computers in statistical analysis, and the use of statistics in hydrologic and water quality modeling</p>
IHDN358	<p><u>Design of Pipelines and Pumping Stations</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN201</p> <p>Flow in pipes, friction losses, local losses, pump-pipeline systems, pump characteristic curves, system curves, operation point and pump performance, pumps in parallel and series, pump-pipe networks, water hammer.</p>

IHDN401	<p><u>Coastal and Harbour Engineering</u> Compulsory, Credits: 3 (2+3+0) Prerequisite(s): IHDN201 Introduction - Wave theory and characteristics - Wave forecasting - Wave transformation - Tides and water levels - Coastal sediment - Harbour planning - Harbour and port facilities - Design of breakwaters - Design of berths - Inland navigation - Case studies.</p>
IHDN402	<p><u>Environmental and Municipal Hydraulics</u> Compulsory, Credits: 3 (2+2+1) Prerequisite(s): IHDN203, IHDN202 Sources of pollution of surface and ground waters, Types and properties of pollutants, Evaluation of hazardous effects of pollutants, Spread and movement of pollutants in surface and ground waters, Motion and mass balance equations, Pollution measurement techniques. Environmental impact of hydraulic structures, Hydraulic methods of industrial and domestic sewage discharge into water bodies, Groundwater pollution and treatment, Water quality control for surface and ground waters.</p>
IHDN403	<p><u>Field Measurements and Water Quality Aspects</u> Compulsory, Credits: 3 (2+1+2) Prerequisite(s): IHDN203, IHDN202 The objective of the course is to build a fundamental level of competence with instruments, field techniques and basic statistical sampling and data summarization techniques commonly applied in hydrology. It covers; measuring surface and groundwater parameters, stream flow, identifying channel cross section, measuring climatic parameters.</p>
IHDN404	<p><u>EIA for Water, Wastewater and Irrigation Projects</u> Compulsory, Credits: 3 (2+2+0) Prerequisite(s): Introduction to EIA, definitions, history, EIA procedures, base line environment, screening, scoping, impact assessment, mitigation measure, environmental management plan, EIA screen in Egypt, environmental impacts on; surface water, ground water, air, noise impact, health impact, culture impact. Impact assessment methods, check list, simple matrix, stepped matrix, loops and networks. Environmental management plan.</p>
IHDN405	<p><u>Integrated Water Resources Management</u> Compulsory, Credits: 3 (2+2+0) Prerequisite(s): IHDN301</p>
STRN345	<p><u>Infrastructure Asset Management</u> Compulsory, Credits: 3 (2+2+0) Prerequisite(s): 70 cr. This is a course in asset management of civil infrastructure assets with a particular focus on urban infrastructure systems and wet utilities. The course presents a generic framework for asset</p>

	<p>management that includes asset inventory, condition assessment, deterioration modeling, valuation, risk management, performance measures, levels of service, and budget allocation. Elements in this framework will be presented within the context of 4 civil infrastructures systems; Roads, Buildings, Water networks, and Sewer networks. The course will emphasize the use of emerging technologies, information systems, and decision making tools that support the various elements of the asset management framework.</p>
<p>IHDN451</p>	<p><u>Computational Hydraulics</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDH202</p> <p>Introduction to numerical analysis via Matlab, Ordinary differential equations, Partial differential equations: Classifications of partial differential equations (elliptic, parabolic, hyperbolic), Types of boundary conditions- ; Examples of famous pde (Laplace equation, heat equation, wave equation). Introduction to the basics of finite difference techniques; applications: diffusion equation, advection equation, convection-diffusion equation, The de Saint Venant Equations - Numerical approaches: (truncation error and stability analysis); Method of finite elements. 2D-hydrodynamic and transport applications.</p>
<p>IHDN453</p>	<p><u>Advanced River Engineering</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN303</p> <p>Introduction, River morphology, Hydraulics of flow in river channels, Local scour around piers, Local scour around embankments, Flow in curved river channels, Analytical river morphology, River meanders, Physical modeling, Mathematical modeling for erodible channels, River training works, Field visits, Case studies.</p>
<p>IHDN454</p>	<p><u>Wadi Hydrology</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN305</p> <p>Introduction, wadi definition, types of wadi, characteristics of wadi. Rainfall analysis; statistical and frequency analysis, design storm analysis, probable maximum precipitation. Runoff-rainfall relation, infiltration analysis, catchment losses, transmission losses, runoff computation methods for ungauged wadis, unit hydrograph, SCS method, curve number methods, empirical equation and formula. Runoff computation for gauged wadi, frequency analysis of flow, frequency analysis of runoff volume. Hydraulic design of wadi section, conventional computation methods, computer model. Wadi recharge, conventional computation methods, computer model. Wadi environmental aspects</p>

<p>IHDN456</p>	<p><u>Design of large Irrigation Structures</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN302 Locks: Horizontal alignment, types, hydraulics of filling and emptying systems, design of walls and floor, Dams: types, purposes, annual and long term storage, design and operation of reservoirs, gravity concrete dams, analysis of seismic forces using pseudo-static methods, earth-fill and rock-fill dams, precautions against seepage, stability of earth - fill and rock-fill dams, spillways.</p>
<p>IHDN458</p>	<p><u>Design of Coastal Protection Works</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): IHDN401 Function and structural design of seawalls, breakwaters, groins and jetties for coastal and beach protection. Design of offshore structures - Floating structures - marine pipelines - Construction materials and methods - Environmental impact assessment - Case studies.</p>
<p>IHDN459</p>	<p><u>Design of Water and Wastewater Treatment Plants</u> Elective, Credits: 3 (2+3+0) Prerequisite(s): PBWN201 This course familiarizes students with appropriate design criteria and the design process for water and wastewater treatment plants. This includes Introduction to wastewater treatment plant design - design flowrates, design mass loadings, process selection, and elements of conceptual process design, Physical unit operations - flow measurement, flow equalization, mixing, Design of physical treatment units - bar racks and screens, communitors, and grit chambers, Design of physical treatment units - primary sedimentation tanks and dissolved air flotation, Design of biological treatment units - activated sludge processes, Design of aeration systems, Design of sludge disposal/treatment facilities - Solids and sludge sources, characteristics, and quantities, regulations, thickening, and dewatering.</p>