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Tables

III. TEACHING AND LEARNING

III.1. Learning Outcomes (See section 2 of the PS1-PS4, Annex-1)

Intended Learning Outcomes (ILO's) meet the aims of the programme specified in section II. Based on the tables mentioned in the programme specifications, all ILO's represented by **knowledge** (general science, specialized engineering), **skills** (on specific, intellectual and general subjects) and competences are considered. Knowledge is provided through the curriculum described in the Annex 1. This curriculum covers a wide scope on pure science and engineering topics. Skills are provided through supervised exercises, projects and laboratories. Competence is acquired through multidisciplinary activities that are required during the last two years. Indeed, summer training is most of the time performed in engineering institutions where the student is learned how to solve problems of multidisciplinary aspect. Also, the final year project is an activity where the student uses his knowledge and skills in order to successfully achieve a multidisciplinary project under a time constraint [9]. These three ILOs items are easily acquired due to the high academic profile of our students. This profile is due to the hard selective process that is represented by a high level entrance exam. Also during his study the student is subjected to an important academic load (24 credits per semester) representing a big challenge that should be faced by means of a strict optimized student work planning

Therefore, the Faculty programmes focus on the following major achievements:

- Acquire the technique of following up recent technical development through course projects, mini-projects, case studies (Bureau d'Études) and final year projects;
- Acquire self-learning profile through multiple references that should be explored by students;
- Acquire deep theoretical skills due to the large quantity of theoretical courses in all the faculty programmes (Annex 2 & 3). These skills will allow the student to pursue postgraduate studies;
- Experience and master ICT tools to be used in their professional carrier.

III.2. Curriculum

The curriculum of the different programmes in the Faculty of Engineering are set in the Decree 3814 (8 April 1987) as an analytic path. These programmes are distributed into 10 semesters and 16 weeks per semester. The first 4 semesters are considered to form the Common Engineering Core Programme (CECP), i.e. semesters common to all engineering programmes and options. The six last semesters are specific for each engineering domain.

The programmes offer a good coverage of a broad set of engineering domains. The system being semester based an evaluation of the students is conducted at the end of each semester.

Although the system is semester-based, all students follow the same track that is they take a predetermined set of courses every semester. If a student fails either in fall semester or in spring semester she or he has to wait till the next year in order to repeat this semester.

A credit system is adopted however without elective courses: all courses are obligatory (24 credits per semester distributed over 10 to 12 courses). Course prerequisites are defined in course syllabus.

The CECP programme consists of the following categories of courses: Mathematics, Physics, Chemistry, ICT and General. The *table II.1* shows the distribution of these courses in each course category and each semester.

	Common Engineering Core Programme (Common Trunk)			
Semester	I	II	III	IV
Mathematics	16	15	11	3
Physics	5	7	7	18
Chemistry	3	4	4	2
ICT	3	3	4	5
General	3	4	8	6
Total (hours/week)	30	33	34	34

Table II.1: Number of hours per week for each category of courses (detailed in Annex 1-2)

Mathematical courses are provided to give students a deep knowledge required in major engineering programmes for setting numeric models, for analyzing numeric results and for solving complex problems. Topics given in this category are so deeply treated and they would be useful even in graduate studies [1]. Courses related to Physics and Chemistry are provided to give students basic curriculum knowledge of physical phenomenon. These are also deepened in order to give students a strong theoretical grasp, which is the standard of "Grandes Ecoles" in France.

ICT courses are provided to give required computer tools like programming languages, scientific and office work softwares. General courses are given to improve different skills relative to the practice of foreign languages, engineering drawings and practical workshops.

Civil, Electrical & Electronic and Mechanical Engineering Programmes are given over 3 years (6 semesters). During these years, students follow a condensed programme containing courses in the common core part of each programme, specialty courses in each sub-major and laboratory courses. All these courses are given following a schedule of

around 32 hours/week (for more details see tables presented in Annex 2 LC1-LC4). Courses are defined in the faculty Presidential Decree and their content is found in the University handbook [1].

Common courses are provided during the three first semesters of department common core, and during the three last semesters, courses relative to sub-majors are given. Courses content of these programmes are described in details in the University Handbook [1] and on the University website [3]. Each instructor distributes a syllabus at the beginning of the semester [4].

The graduation of multidisciplinary engineers is provided through the distribution of courses over multiple domains such as major courses with ICT courses, Projects Management and Economics courses.

Relevant ILOs concern in one side multidiscipline profile and in the other side deep theoretical knowledge. Courses given in the three common semesters of a major insure deep theoretical profile and those given in the next three specialty semesters provide a deeper knowledge in the specialty. Some of the courses in the specialty phase are given in order to produce a self-learning and a multidisciplinary profile through projects and seminars (2.9.11, 2.9.12, 2.10.1, 3.9.9, 3.9.12, 1.5.11, 1.9.12…).

Given that we aim to develop a general profile for the graduates from each specialty, the curriculum is designed to provide for all the programmes a mixture of specific majors in each engineering domain.

For efficiency and economic reasons, most local and regional engineering institutions need to recruit engineers able to be easily and quickly adapt to any variation in their strategy. The solid basic knowledge acquired in all fields of engineering during semesters 5, 6, and 7 provide to students an important tool for studying on their own any new topic .

The curriculum is structured by domains. Each domain is provided horizontally across all the semesters and the evolution in this domain is performed through courses that become more subject specific during coming semesters. Also, at the same time general skills and intellectual skills are more and more reinforced from one semester to the next one; this is due to the increasing quantity of courses and projects along the programme ensuring these skills. Project based courses develop these skills. Also it concerns courses like mini-projects and seminars.

The curriculum is continuously improved by the academic staff involved in research, industrial or engineering activities.

The different curriculums are provided on the website of the Faculty. The available description covers (See Annex-3):

- The programme
- The course code
- The course title
- The number of hours (contact hours)
- The semester
- The instructor name
- The language of delivery

- The objectives of the course
- The learning outcomes
- The prerequisites
- The content
- The bibliography
- The assessment methods

III.3. Teaching and Learning Method

Courses related to the Engineering Programme are distributed over three years and categorized as theoretical (with the methods used being lectures and TD*), practical (lab), general (seminars and non-specialized courses) and projects (See tables II.2-II.5). These categories are designed in order to reinforce knowledge, understanding, subject-specific, intellectual and general skills of the student.

	Common Engineering Core Programme (Common Trunk)			
Semesters	I	II	III	IV
Lecture	18	19	20	18
TD*	10	11	9	11
Lab	2	3	5	5
Total(hours/week)	30	33	34	34

Table II.2: Number of hours per week and per semester for each category of study in Common Engineering Core Programme. (TD: Travaux Dirigés) (Detailed in Annex-1 PS1: section 3 and Annex-2: LC1)*

	Common Electrical Engineering Core			Power Specialty			Telecommunication Specialty		
Semester	V	VI	VII	VIII	IX	X	VIII	IX	X
Lecture	17	16	18	15	19		16	18	
TD*	12	10	8	10	5		9	7	
Lab	3	6	6	6	6		6	6	
Seminar					1			1	
Projects/B.T.				2		32	2		32
Total Hours/Week	32	32	32	33	31	32	33	32	32

Table II.3: Number of hours per week and per semester for each category of study in Electrical/Electronic Engineering Programme (Detailed in Annex 1 PS2 and Annex-2 LC2)

	Common Mechanical Engineering Core				Energetics Specialty		Construction Specialty	
Semester	V	VI	VII	VIII	IX	X	IX	X
Lecture	17	16	19	20	22		22	
TD*	13	11	10	9	6		6	
Lab	4	6	4	4	-			
BE*					2		2	
Projects/ B.T.						32		32
Total Hours/Week	34	33	33	33	30	32	30	32

Table II.4: Number of hours per week and per semester for each category of study in Mechanical Engineering Program (BE: Bureau d'Etude) (Detailed in Annex-1 PS3 and Annex-2 LC3)*

	Common Civil Engineering Core				Building Specialty		Public Works Specialty		Structure Specialty		Hydraulics Specialty	
Semester	V	VI	VII	VIII	IX	X	IX	X	IX	X	IX	X
Lecture	17	17	15	17	18		20		19		21	
TD*	10	10	15	15	8		8		8		5	
Lab	3	4	3	1	-				2			
BE*	3	1			6		3		2		5	
Projects/B.T.						32		32		32		32
Total Hours/Week	33	32	33	33	32	32	31	32	31	32	31	32

Table II.5: Number of hours per week and per semester for each category of study in Civil Engineering Programme (Detailed in Annex-1 PS4 and Annex-2 LC4)

In lectures, basic and theoretical knowledge is equitably transmitted to students along the programme path through lectures and "Travaux Dirigés" (TD). In the latter, exercises and problems related to courses are given in class and supervised by the instructor. In labs, practical skills are reinforced by increasing, along the programme path the number of lab hours. The main objective is to establish a link between theoretical and practical aspects of different topics. A weekly scheduled slot is reserved for seminars during which external specialists give presentations about the state of the art in specific subjects [8].

Different types of projects are specified in the programme:

1- Projects given within the course. they will provide students with the opportunity to use appropriate software tools relative to the course, to extend their knowledge to some extra topics of the given subject and to learn how to search efficiently on useful references for achieving the project [5].

2- Projects given during a specific course named "Mini-Projects" [5]. The learning outcomes for this course are the skills students will need for their final years

projects. They work in small teams on a predefined multidisciplinary subject; they perform required research, design and analysis, write a final technical report and present orally their results and findings.

3- The final year project. It has similar learning outcomes to the mini-project but requires a much greater quantity of work on a wider subject. It is carried out during the last semester on a full time basis [6].

III.3.1. Final Year Project

Each student at the faculty has to conduct a final year project. One student or a group of 2 to 3 students will conduct one final year project. This project has often two parts: theoretical and engineering design and practical part, i.e. often the final year project ends up with a prototype. The Lebanese University Faculty of Engineering final year projects are often appreciated and rank very well in different national evaluation conferences like the one conducted by the Lebanese Industrialist Research Association (LIRA). This is obviously a sign of quality.

There are two additional signs of quality regarding the projects. Firstly, some of the projects are conducted with an industrialist showing good cooperation between the faculty and local industry. Secondly, another set of the projects are conducted abroad within a cooperation programme between the faculty and international faculties of engineering. Actually, there exist several examples of such cooperation agreements leading to a joint degree (e.g. with University of Nantes in France). The projects' reports are written in different languages (often French and English); this shows some multilingual competences among the students and good communication skills. The projects' reports are saved in the library.

The final year project provides the most important self-learning opportunity. The project team (mostly two students) is charged with undertaking necessary documentation, analysis, implementation, tests and measurements in order to achieve the project requirements [6].

III.3.2. Summer Training

At least one month at of summer training [9] is required between semester 8 and semester 9. During this training students are asked to work as trainee engineers in an enterprise, where they learn how to achieve efficiently scheduled tasks, how to collaborate in teamwork and how to respect the institution rules.

III.3.3. Summary

Different learning methods are applied in order to reach the specific objectives of the programmes:

- Theoretical aspects are explained on a white board or during projection sessions in amphitheaters or lecture rooms.
- Applied exercises are solved in a classroom through discussions with students.

- Practical aspects are given during lab hours where students are distributed on all the department laboratories. Teams of two to three students are distributed on different experiments and each laboratory is supervised by an assistant. A distribution schedule is set by the lab assistant at the beginning of each semester [18].

Regarding student participation, they participate effectively in the learning process by means of project achievement, due to multiple meetings with the instructor who discusses topics and advises each project team separately. At the beginning of the semester the instructor transmits to students the material to be used for learning support (text book, written notes, photocopies of slides, solved exercises, references…).

III.4 SWOT analysis for teaching and learning program

The SWOT analysis is a method of analyzing an organization's competitive situation that involves assessing organizational strengths (S), weaknesses (W), environmental opportunities (O), and threats (T).

Both strengths and weaknesses are internal factors that are subject to change from within the organization itself. Opportunities and threats are the conditions within the external environment that affects the organization, such as: technological, economic, legal-political, sociocultural, and the international element.

III.4.1 Strengths:

- An integrated modern library, containing books, periodicals, and other documents.
- Teaching methods are specified and matched by the department
- Existing increasing efforts to improve teaching methodology by staff ,
- Students exchange program with international universities.
- Many opportunities for developing student contribution and discussing matters relevant to the students: exam schedule...
- Lecture halls are adequate despite the large number of students and are equipped with basic facilities.
- Students and staff have average computer skills
- Communications hours between staff and students
- Very selective students at the entrance exams this gives a high level of studies

III.4.2 Weakness

- Lack of a system /policy and changing programs

- Inadequate capacity to overcome the large number of students especially in first and second year
- No available program that monitors students' progress or their need for support.
- Inadequate space and teaching facilities in some departments.
- Students' library is deficient in up-to-date publications electronic facilities.
- Student are not presented in the administration committee
- Number of Professor /HDR is not sufficient
- No global alumni
- Lack of research activities has an influence on the teaching methods

III.4.3 Opportunities

- Available faculty development opportunities : sufficient funding , possibility of utilizing local mentors for teaching and research
- Collaborations with many universities. Students continue their final year studies or final year project abroad.
- Very strong market demand for our student
- Level of Lebanese baccalaureate improve the quality of students

III.4.4 Threat

- Influence of the environmental and political situations on the Lebanese university
- Competition (local, regional and global), Emerging local and regional private colleges, accessibility of international schools via distance education
- Law at the Lebanese university is not sufficiently applied
- Professors are bound to finish up the material even in semesters during which some days were missed because of political trouble
- No rules at the higher education level to allow a fair competition
- Result of immigration of our best students did not allow to improve the quality of teaching of the faculty

III.5 Developing Strategies

- Split classes into several sections in the first and the second year.

- Propose new law to improve the internal policies of the faculty of engineering: changing programs,...
- Library must be electronically accessed
- Work on a global alumni

III.6. Assessment

Students' work is assessed by a variety of different means. Mid-term and final written exams [13] are adopted in most of the courses in order to evaluate the knowledge and analysis capability of students in applying appropriately learned theory to specific technical domains. Slots of 90 minutes sessions are given to solve problems and topics related to a course. Required topics that students should revise for the exam are defined by the instructor, providing him with the means to evaluate students' achievement.

The grading system is based on the distribution of points according to each exercise to be solved. These points are indicated on the question sheet. There is no a specific rule concerning the repartition of points but in general they are distributed such that 80% of students should succeed if they have well prepared the materials.

In order to prevent any dissemination of the exam before its scheduled time, questions are prepared and typed by the instructor and they are transmitted to the administration one day before the exam. All question sheets are enclosed in special envelopes that are opened just at the beginning of the exam for distribution. Students write their answers on exam booklets; the names of students are written and hidden on this booklet in order to perform anonymous correction. Exams are double-marked by the course instructor and by another faculty member of a similar specialty. If there is a disagreement between grades the final grade is set according to an agreement between evaluators.

Another form of assessment is the course project [5]. Small projects are given during some courses like Digital Control, Microprocessors, Electrical Machines, Architecture, Urbanism, Sanitary; Calculation Machines Quantity Surveying,…. Instructors may give these mini-projects in order to complete knowledge and some intellectual skills like analysis, and some specific skills like finding technical solutions for a specific problematic. Different project subjects or a subject with different parameters are given and have to be carried out by teams of two or three students. The instructor supervises the evolution of the project work during the semester by means of advice given during meetings with students. The project is assessed by a report and/or a practical product submitted by the end of the semester. The instructor evaluates the work by giving the same grade to all members of the team or by giving different grades to each one. Predefined weight is given to the project for the final grade calculation. At the end of each semester all averages are calculated following a general formula set by the faculty Decree (See Annex-1 Section 4).

The final year project [6] has to be completed on a full-time basis during the whole last semester before graduation. Therefore, the last semester grading average is the grade given to the final year project. This work is evaluated by a board of examiners which is

designated by the head of the department. The board of examiners is formed by faculty members and external examiners in cases where the project was carried out and supervised externally in a local or a foreign institution. Evaluation is based on the quality of the submitted report, on the oral presentation, on the discussion with the members of the board of examiners, on the obtained results and on the successful project achievement.

The faculty has a feedback mechanism following each assessment. After the exam, the instructor distributes its solution or he solves it during a course session. All projects reports are given back to students with the instructor remarks. If a student has an unexpected grade he can ask officially for a reevaluation, which is a process that takes time and done without the student presence. Labs work are evaluated by the lab instructor and reviewed by the corresponding course instructor. The evaluation is performed for the team according to a lab report submitted at the end of each lab experiment.

III.7. Students Progression

Accepted students that pass the entrance exam to the faculty have to achieve successfully the two first years of the Common Engineering Core Programme. The third year of study represents the first year of the major engineering programme.

At the end of each semester, the department faculty members hold the deliberation meeting. During this meeting, averages and course grades are discussed for students who are slightly below the pass threshold which is set by the Decree number 3814(8 April 1987) [2]. Depending on these students' level and on their academic history, the department board may or may not give them a chance to be accepted into the next semester. This given chance is registered in the student records providing a closer follow up on the student's academic progression [19].

The Presidential Decree number 3814 defines in the clause 42 the Conditions to pass from one semester to the next one as follows (See Annex-1, section 4):

1- Overall average higher than 58%

2- No more than 2 courses between 50% and 60%

The number of failed students varies according to the study level. The highest percentage is noticed during the First year of CECP (failing average from 2004 until 2012 is around 31 %) compared to the second year (failing average from 2004 until 2012 is around 14 %).

The tables II.6a and II6b show the number of students who successfully completed the CECP (2 years) versus their number in the first and the second year (that includes the number of repeating students). It roughly indicates the yearly percentage of success. It is seen that, although a tough selection is performed at the entrance exam, still a percentage of failure exists during two years of Common trunk study (failing average from 2004 until 2012 is around 38 % during two years). Also it is noticed that the highest percentage of failure is in the first year.

Number of students at the beginning of the first year of CECP	**2004-2005**	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
	258 (100%)	**207 (100%)**	**276 (100%)**	**317 (100%)**	**278 (100%)**	**302 (100%)**	**233 (100%)**
Number of students at the end of the first year of CECP	**209 (81%)**	**185 (76%)**	**163 (59%)**	**211 (67%)**	**217** (78%)	**194** (64%)	**154** (66%)
Number of students at the end of the second year of CECP	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**
	165 (79%)	**171 (92%)**	**148 (90%)**	**167** (79%)	**188** (87%)	**173** (89%)	**139** (90%)
end of second year over beginning of first year students rate	**64%**	**82%**	**54%**	**53%**	**68%**	**57%**	**60%**

*Table II.6a: Students' progression from 1st to 2nd year for each class of **CECP** in **Branch III** for 7 classes ending by the 2011-2012 class*

Number of students at the beginning of the first year of CECP	**2004-2005**	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
	144 (100%)	**146 (100%)**	**136 (100%)**	**141 (100%)**	**103 (100%)**	**149 (100%)**	**137 (100%)**
Number of students at the end of the first year of CECP	**113 (78%)**	**118 (87%)**	**118 (%)**	**117 (%)**	**90 (%)**	**116 (%)**	**119 (87%)**
Number of students at the end of the second year of CECP	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**
	112 (%)	**93 (%)**	**91 (%)**	**123 (%)**	**98 (%)**	**105 (%)**	**103 (%)**
End of second year over beginning of first year students rate	**78%**	**64%**	**67%**	**87%**	**95%**	**70%**	**75%**

*Table II.6b: Students' progression from 1st to 2nd year for each class of **CECP** in **Branch I** for 7 classes ending by the 2011-2012 class*

The table II.7 shows the students' progression for each year of Engineering Core Programme (Electrical, Mechanical and Civil) for seven graduation classes ending by 2011 -2012 class.

During these three years of Engineering Core Programme the failing average is the lowest compared to the First two years of CECP (failing average is around 7.5%).

No fails are noticed in the fifth year due to the highly selective process done for previous years.

Graduation class	Electrical Engineering Programme			Mechanical Engineering Programme			Civil Engineering Programme		
	3rd year	4th year	5th year	3rd year	4th year	5th year	3rd year	4th year	5th year
2006-2007	56	55	48	33	30	30	24	23	23
2007-2008	58	56	58	61	55	55	46	44	44
2008-2009	73	66	61	52	44	44	46	43	42
2009-2010	44	44	43	42	40	39	62	58	57
20102011	45	43	37	49	48	47	73	69	70
2011-2012	39	41	38	59	54	52	90	91	81

Table II.7: Students' progression from the 3rd to the 5th year for each class and each department in Branch III for 6 classes ending by the 2011-2012 class

Grades of mid-term exams are announced during the semester in order to make students aware of the effort they need to spend in order to successfully complete the semester. Students that encounter academic problems in a specific course may ask for a meeting with the instructor and/or with the head of department in order to find appropriate solutions. Meetings are also provided between the head of department and students' representatives to solve general problems like inappropriate course performance, exams' schedule, extra course sessions etc.

Students are supposed to be at least fairly good in English and French. They are supposed to solve exams subjects written in one of these languages (foreign language support is given during the Engineering Core Programme). Some exams are written in both languages in order to avoid any misunderstanding; otherwise instructors give some translating help during the exam [13].

Proctoring process during the exam is provided by means of at least one faculty member and one administrative member.

III.8. Students Achievement

All undergraduate programmes provided by the Faculty of Engineering at the Lebanese University should meet an academic level similar to the one provided by "Grandes Écoles" in France. All learning resources and methodologies are exploited in order to graduate engineers meeting such a level as a minimum expectation. This level is mainly measured by the percentage of hired graduates in institutions of high reputation.

Agreements are established between the faculty and some French academic institutions in order to accept highly ranked fourth year students (one year before graduation) as foreign enrolled students [11] (some of them receive scholarships from the French Government or from the Association of Francophone Universities).

Best students of the fourth year are selected to complete in France the fifth year (around 13 % for the years from 2008 until 2013, Beirut Branch) [16]. This procedure gives the opportunity to the graduates of having two diplomas one from the host institution and one from the Lebanese University. They also get the Master Degree, due to the European Credit Transfer System. Most of those students stay in France for Doctorate studies, and many of them are still there and recruited in French Universities and academic research laboratories [17].

Some of our graduates are enrolled in a master programme in EDST (around 9% for the years from 2006 until 2008) [16]. Part of graduates hired in the institution where they achieved their final year project.

Multidisciplinary graduated engineers are hired according to the market demand. Some of graduated students are immediately hired after graduation and remaining graduates don't wait more than few months before recruitment.

Many institutions in Arab countries seek for our graduate students because of their multidisciplinary and trilingual profile [14].

The faculty also recruits a number of its own graduates to work as lab assistants (approximately one or two per year).

The general skills acquired by our graduates enable them to work as sales engineers, to get administrative positions and even to set up their own engineering company [14].

Based on feedbacks coming from famous successful local, regional and international institutions (Siemens, Nokia, EDL, Moeller, Dar Al Handasah, Khatib & Alami, CCC, Lacico, …), it is confirmed that our graduates have achieved the required level.

However the Faculty has no Office to help graduates to find a job or to pursue their career in Lebanon and abroad.