



The
BRITISH UNIVERSITY
IN EGYPT

FACULTY OF ENERGY AND ENVIRONMENTAL
ENGINEERING

Faculty of Energy and Environmental Engineering

The British University in Egypt

Bachelor of Science in Engineering Bylaws

for

Undergraduate Programs

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Nomenclature

- BUE: The British University in Egypt
- FEEE: Faculty of Energy and Environmental Engineering
- UK: United Kingdom
- BSc: Bachelor of Science
- ID: Identification Number
- NARS: National Academic Reference Standard
- NAQAAE: The National Authority for Quality Assurance and Accreditation of Education
- Cr: Credit Hour
- ECTS: European Credit Transfer and Accumulation System
- SWL: Student Workload
- Lec: Lecture
- Tut: Tutorial
- TT: Total
- N/A: Not Available
- UR: University Requirement
- FR: Faculty Requirement
- DR: Department Requirement
- PR: Program Requirement

Part A: Introduction

The British University in Egypt (BUE) was established in accordance with the provisions of law No. 101/1992 regulating private universities. The University has a special legal personality and is represented by the University president. The President of the Arab Republic of Egypt issued Decree No. 411 of 2004 to establish the BUE as a private non-profit Egyptian university.

The British University in Egypt (BUE) is considered an added value to the system of higher education in Egypt as it provides excellent educational opportunities aiming to qualify distinguished new generations in the fields of modern science and technology in Egypt, Africa, and the entire Arab world as per the needs of the current and future job market by striving to achieve the following goals:

- Qualifying a class of graduates specialized in the various fields of technology and the other fields required for the labour market to enable them to accommodate the modern scientific and technological developments, whether by dealing efficiently with, maintaining, or developing the state-of-the-art technology-enhanced tools with the assistance of modern management and information systems.
- Qualifying graduates of faculties and institutes, as per the needs of the labour market, in the fields and specialisations that the University provides.
- Providing postgraduate opportunities for solving problems arising in the industry and in other productive and service units which are keen on keeping pace with the scientific and technological developments.
- Providing a wide range of continuous education and training opportunities for engineers, technicians, administrators, and others who work in the different fields of science to raise the efficiency of their work performance.
- Conducting preliminary studies which aims to raise the efficiency of performance and productivity, save energy, protect the environment, and enhance the other activities necessary for the technological development of the environment and society in various fields.

Accordingly, the President of the Arab Republic of Egypt issued Decree No. 344 of 2015 to establish the Faculty of Energy and Environment Engineering (FEEE) at the BUE. The following bylaw is designed according to the regulatory reference framework for preparing study programs for the bachelor's level in engineering faculties 2022 and the according to the National Academic Reference Standard NARS 2018, as stipulated by the Egyptian Supreme Council of Universities.

Rationale for the Establishment of FEEE at the BUE:

- Expectations of an increase in the demand for graduates specializing in the fields of energy and environmental engineering in the upcoming stage, the matter which

requires a prompt action on the part of the educationalists concerned to introduce education systems that meet the current and future demands and needs of society.

- A belief in the role of private universities in enriching the Egyptian educational system with untraditional educational specialisations and systems that keep pace with the new and advanced specialisations of the developed world.
- The need for adopting untraditional teaching and assessment methods based on providing learning opportunities through research and practical projects assigned in the modules of specialisation upon the completion of the mandatory modules.
- The need for exposing undergraduates to diverse scientific backgrounds that are lacking in the specialty modules of other engineering faculties and that create of them a future workforce equipped with solid scientific basis to contribute to advanced areas of energy, design, planning, construction, installation, maintenance, and scientific as well as technological research which aim at ensuring the availability of economical, regular, and renewable energy sources that are open to global technological developments and are capable of making the best use of such developments in Egypt.
- The need for introducing unique learning skills that would qualify the graduates to understand essential economic, administrative and environmental dimensions and would enable them to plan and set up small projects, deal with problems arising from the use of traditional sources of energy, and address the environmental problems resulting from industrial, agricultural, and urban activities.
- The existence of manifold branches of energy specialties involving traditional and renewable energy (wind - solar - nuclear), the matter which makes the inclusion of all these disciplines in one department difficult.
- The adoption of this mainstream by various countries worldwide.

The Faculty Vision, Mission, and Goals

Vision of the Faculty

The Faculty of Energy and Environmental Engineering strives to be regionally recognised as a leading institution dedicated to professionalism, research and community development, while offering students and researchers internationally accredited Energy and Environmental Engineering programs.

Mission of the Faculty

The Faculty's mission is to provide a broad spectrum of education and research in line with British standards, to work closely with UK and global partners for the purpose of offering internationally recognised quality degrees that enable graduates to develop their knowledge related to Energy and Environmental Engineering and entrepreneurship skills and allow them to contribute to community development.

Faculty Goals

- Providing a high-quality educational and research environment that is capable of attracting distinguished students to assist them in receiving education, conducting scientific research, and transferring skills and knowledge in order for them to be creative society members who are capable of facing challenges.
- Graduating students with high academic levels, professional behavior and high moral commitment in addition to providing them with the intellectual, analytical and innovative abilities as well as practical skills needed in the fields of engineering sciences and practical and technical applications in order for them to be capable of rendering community services and developing the environment.
- Preparing graduates capable of self- and continuous learning so that the student is the focus of the educational process through various training and evaluation methods.
- Being a leading centre for scientific research in Egypt and the Middle East region in the various fields of energy engineering as well as environmental engineering through its openness to the world and partnership with internationally distinguished institutions in the various energy fields.
- Providing advisory services to the engineering sector and the society in the various fields of energy engineering, studying the impact of such services on the environment, and providing high-quality expertise to stimulate and support innovative solutions, knowledge transfer, and cooperation to endorse economic development.
- Ensuring the availability of the structures and mechanisms necessary for supporting the academic ambition and success.
- Studying community needs and developing educational programs on an ongoing and periodic basis to keep pace with technological developments and to face challenges for achieving the entire needs of society in the fields of energy and environmental engineering.

The Faculty's Competitive Edge

- Modern and interdisciplinary study programs that are compatible with the needs of the labour market in the fields of energy engineering (traditional and renewable) and the environment.
- Unique educational specialisations and systems that keep pace with the new and advanced disciplines in the developed world.
- Variety of scientific backgrounds and uniquely offered modules which are unavailable in other faculties of engineering.
- Latest software used in energy and environmental engineering sciences.
- Field training programs for students inside and outside Egypt.
- Practice-based scientific curricula.

- Graduation projects that enhance the students' research and continuous self-learning skills.

General Qualities of the Faculty Graduates

The Faculty graduates will be able to:

- Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations;
- Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation;
- Behave professionally and adhere to engineering ethics and standards;
- Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance;
- Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
- Value the importance of the environment, both physical and natural, and work to promote sustainability principles;
- Use techniques, skills and modern engineering tools necessary for engineering practice;
- Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies;
- Communicate effectively using different modes and in different languages and audiences, use digital tools and media to deal with academic/professional challenges in a critical and creative manner;
- Demonstrate leadership qualities, business administration and entrepreneurial skills.

The aforementioned qualities are revealed in the graduates' continuous self-learning skills, knowledge and understanding, and in their cognitive, practical, transferrable, and acquired skills that the entire module specifications of the Faculty address.

Article (1) The Faculty Departments

The Faculty of Energy and Environmental Engineering at the British University in Egypt consists of the following **scientific departments**:

1. Energy Engineering
2. Bioenergy Engineering
3. Petroleum Engineering
4. Sustainable Architecture Engineering
5. Basic Sciences

Article (2) The Faculty Programs

The Faculty of Energy and Environmental Engineering at the British University in Egypt offers the following **programs**:

1. Mechanical Engineering - Renewable Energy
2. Electrical Engineering - Renewable Energy
3. Biochemical Engineering
4. Petroleum Engineering and Gas Technology
5. Architecture Engineering - Sustainable Building Design

Article (3) Offered Degrees

The faculty of Energy and Environmental Engineering, upon the recommendation of the Faculty Council and the approval of the University Board, offers the following degrees:

1. B.Sc in Mechanical Engineering - Renewable Energy
2. B.Sc in Electrical Engineering - Renewable Energy
3. B.Sc in Biochemical Engineering
4. B.Sc in Petroleum Engineering and Gas Technology
5. B.Sc in Architecture Engineering - Sustainable Building Design

The faculty of Energy and Environmental Engineering, upon the recommendation of the Faculty Council and the approval of the University Board, also offers the following **minor** degrees:

1. Minor in Mechanical Engineering - Renewable Energy
2. Minor in Electrical Engineering - Renewable Energy
3. Minor in Biochemical Engineering
4. Minor in Petroleum Engineering and Gas Technology
5. Minor in Architecture Engineering - Sustainable Building Design

- The Faculty has future plans for developing postgraduate programs in energy and environmental engineering, establishing a number of research centres that develop scientific research and serve the community and that are consistent with the general strategy of Egypt, the Middle East, and the North Africa region in the field of energy, in general, and renewable energy, in particular, in addition to the field of environmental engineering.
- The basic organizational structure of the Department of Renewable Energy Engineering will include professors specialising in the field of new and renewable energy engineering (mechanical power, wind energy, solar thermal energy, electric energy, photovoltaic energy, electric energy transmission, and thermal fluid mechanics).



- The basic organisational structure of the Department of Biochemical Engineering will include professors specialising in the field of biochemical engineering (biomass energy, biofuel energy, and bio-product energy, etc.)

Article (4) International Agreements

All five faculty programmes are conducted through a partnership with the British University of London South Bank, thus granting the student who meets all the requirements (Agreed upon between the two universities and announced to the students) in the British system a British certificate in addition to the Egyptian certificate granted by the university and approved by the Supreme Council of Universities.

Part B: Admission Regulations and Academic System (Two Semesters)

Definitions and Terminology

The academic year: two semesters, the first and second semesters.

The academic semester: a period of time not less than fifteen weeks during which the academic modules are studied.

Academic level: It denotes the stage of study according to the approved study plans.

The study plan: It is a set of compulsory and optional modules, the sum of which forms the graduation requirements that the student must pass successfully to obtain the academic degree in the specified specialty.

The major program: It is the field of study that the student passes and specializes in to obtain a bachelor's degree, considering the requirements of each academic program with regard to the student's achievement level or to his success in passing some modules or in passing the agreed upon aptitude admission test.

The minor program: It is the minor field of study that the student chooses to study in addition to his major program, and this is an optional program.

The academic module: a subject within the approved study plan of each major. Each academic module is given a number, code (code), name, and detailed specification where the module's overview, objectives, content, and competencies are explained. Moreover, a special file for each module is prepared at the end of each semester for the purpose of follow-up, evaluation, and development.

Article (5): Language of Study

The English language is the language of study in the Faculty's entire scientific specialisations.

Article (6): Study System

The academic year consists of two semesters, in addition to a third summer semester for the minor program.

Article (7): Registration Conditions

- Registration is permitted for Egyptian and foreign students, of the mathematics division or its equivalent, who passed Thanaweya Amma with a minimum score that is specified by the Council of Private Universities and the University Council annually. Registration is also permitted for students who transferred from other

faculties with not less than the Thanaweya Amma or its equivalent minimum score which is accepted by the Engineering Studies Sector and in accordance with the conditions set by the Supreme Council of Universities.

- The Faculty establishes general rules for admission where the student's interest and the principle of equal opportunities are a top priority. The regulations of the University and its faculties specify the other conditions that must be met for the admission of students as well as the conditions required to award any of the academic degrees referred to according to the relevant stage.
- Registration is permitted for holders of technical certificates upon the approval of the Engineering Studies Sector Committee and the Supreme Council of Universities, in accordance with the regulating rules.
- Students who have obtained Thanaweya Amma in the science division are allowed to enroll in the Biochemical Engineering program under the condition that they study an additional mathematics course as a basic requirement for enrollment in the program.

Article (8): Study Grades

- The general evaluation of the students' success in each degree year is calculated according to the grades they obtain as per the system specified by the University's general academic regulations, taking into account that their grade does not exceed "pass" in the module which he has previously failed or was absent in without an acceptable excuse. But if a student was absent with an acceptable excuse, he/she passes the module.
- The grades of each student per an academic year equal the total grades obtained in the two semesters of this year.
- The student's success in the undergraduate modules is expressed by one of the following letter grades: D, C, B, A. The following table shows the equivalent percentages for each letter grade.

Degree Class	Percentage	Letter Grade
Excellent	≥ 89	A
Very Good	$\geq 76 < 89$	B
Good	$\geq 67 < 76$	C
Pass	$\geq 60 < 67$	D

- Class honours is awarded to the student whose general grade is very good throughout the entire study years except for the prep year. The student is awarded class honours only if he/she does not fail any module throughout his/her study years at the Faculty.

Article (9): Calculation of GPA

The Grade Point Average for students is calculated according to the following table:

Grade	Letter Grade	Mark	GPA
Distinction	A+	97 and above	4
	A	$\geq 93 < 97$	3.9
	A-	$\geq 89 < 93$	3.7
Very Good	B+	$\geq 84 < 89$	3.5
	B	$\geq 80 < 84$	3.1
	B-	$\geq 76 < 80$	2.7
Good	C+	$\geq 73 < 76$	2.5
	C	$\geq 70 < 73$	2.3
	C-	$\geq 67 < 70$	2
Satisfactory	D+	$\geq 64 < 67$	1.8
	D	$\geq 60 < 64$	1.6
	F	Less than 60	0

Article (10): Examination System

- The marks of each module are distributed in percentages between coursework- including exercises, reports, projects, in-class tests, laboratory reports, or oral assessment- In-Class Assessment, and final written exam. All of this is done according to the assessment strategy of each module separately.
- In internship modules where students receive corporate training, the student's work is assessed and the training grades are pass or fail.
- Students must attend 75% of the module sessions in order for them to be allowed to take any module exam. Upon the request of the Department Councils of different specialties, the Faculty Council bars the student from taking the final module exam if he does not attend 75% of the module's sessions in the semester.
- The student passes a module if his/her total module score is at least 60%.
- The Faculty Council may, upon taking the opinion of the relevant Department Council and according to the nature of the academic modules, decide to hold the examination in one or more modules, and it is also permissible to hold the examination in the whole module or part of it in a way that allows it to be corrected electronically, provided that a request is submitted to the University's Council of teaching and learning which will then approve and submit it to the University board for final approval.
- If a student fails a core or elective module, he is eligible to repeat the module, under the condition that the maximum grade he can get is D.
- If a student fails an elective module and takes another module instead of repeating the same module, he is exempt from the maximum D grade condition and takes his actual grade.

Article (11): Conditions for obtaining a bachelor's degree

In order to obtain a bachelor's degree from the Faculty of Energy and Environmental Engineering, the student must:

- Pass all academic modules in the Major program.
- Pass the two graduation projects (the design project and the research project).
- Pass the mandatory summer training modules.

Article (12): Academic Modules

- The Teaching and Learning Committee reviews the mandatory and optional modules in all specialties and may assign other members in the various specialties to give feedback before presenting the modules to the Faculty Council.
- The Faculty Council determines the minimum number of students registered for each optional module.
- Each department issues a brief including the specifications of its program and modules per each semester of the Faculty's entire academic years.
- The specification of each scientific program includes an introduction to the program and its management, the goal of the program, the characteristics of the graduate and the Competencies that the graduate must acquire, the structure of modules, the academic standards adopted, assessment methods, and student support methods.
- The specification of each module includes an introduction to the module, the objective of the module, the Competencies that the student should acquire at the end of teaching this module, the module content, teaching and learning methods, assessment methods, and a reference list.
- Each educational program creates a matrix that demonstrates the acquisition of the various skills required for the graduate (the program matrix with the modules), taking into account the general skills needed for engineers and specified in the accreditation requirements for the National Authority for Quality Assurance and Accreditation model.

Article (13): Study Plan

- Studying in the Faculty is a two-semester system for all Major programs, and in the case of choosing to study a Minor program, a third summer semester is added to the student. The internal bylaws of the departments indicate the various study materials, the distribution of the compulsory and the elective modules among the academic levels for the different departments, and the number of the assigned credit hours. In light of the suggestions offered by the relevant departments' councils, the college determines the scientific content for each module. Consequently, the University Council issues its approval in the light of the

continuous development of the educational process keeping pace with the scientific and technological developments.

- The study plan for a bachelor's degree is offered as a four-year full-time program over 8 semesters.
- The student proceeds from the academic level in which he/she is enrolled to the next one when he/she passes all the modules. The same applies in case the student fails or is absent in no more than two academic modules from the academic level that he/she is enrolled to or a lower academic level.
- If a student fails in one of the humanities modules in addition to two courses in his/her own specialization, as referred to in the previous item, he/she is allowed to proceed to the next academic level.
- After consulting with the relevant Department Council and according to the nature of the academic modules, the Faculty Council may decide to have one module or more to be delivered using the Blended Learning method, where 60% of the module is covered through online interaction and 40% covered in traditional face-to-face place-based method, provided that this is presented to the University's Student Affairs Council and, consequently, submitted to the University Council for approval.

Article (14): Program Dates

- The academic year at the university is based on a two-semester system, each semester consists of 15 weeks.
- The academic year begins in September of each year and ends in June of the following year. The University Council decides on the exact start and end dates of the academic year as well as the mid-year vacation dates.
- The Board of Trustees may decide to start or end the academic year before or after the pre-specified dates, based on what is proposed by the University Council.

Article (15): Program Duration

- The minimum allowed study duration is eight main semesters (four years).
- The maximum allowed study duration is eight academic years, which does not include frozen semesters (suspension of registration - medical excuse - etc..) for reasons accepted by the Faculty of Engineering Council, after which the student is dismissed from the programs.
- In case that a student registers for a Minor, one academic year is added to the maximum allowed study duration specified in the previous point.

Article (16): Program Admission

Student admission in any of the programs/specialisations is based on his/her desire as well as the conditions set by the Faculty in case the numbers exceed the planned enrolment numbers set for each program separately.

Article (17): Suspension and Re-registration

- A student may apply to suspend his/her registration for a period of an academic level for an excuse acceptable to the Faculty, provided that the registration suspension does not exceed two consecutive or non-consecutive years as a maximum.
- A dismissed student can apply for re-registration, keeping his same ID number and academic records before dismissal, according to the following regulations:
 - To apply for re-registration within two academic years from the date of dismissal.
 - The Faculty Council and the relevant parties agree to re-enrol the student.
 - It is not permissible to re-enrol a student who was dismissed from the University for educational or moral misconduct. The same applies to that whoever was dismissed from another university for moral misconduct. Moreover, if it becomes clear after his/her re-registration that he/she was previously dismissed for such reasons, his/her registration shall be deemed cancelled from the date of re-registration.

Article (18): Student Transfer and Registration Transfer

Student transfer from the institutes and faculties of national and international universities to the Faculty of Energy and Environmental Engineering at the British University in Egypt is carried out according to the following regulations:

- Year One or preparatory year students are transferred to the Faculty of Energy and Environmental Engineering at the British University in Egypt if they have obtained the Egyptian General Secondary Education Certificate or its equivalent with the minimum required marks; that is specified by the Egyptian Supreme Council of Universities and the Council of Private Universities. The same students should also meet the Faculty's admission requirements and any other Faculty Council decisions regarding student transfer.
- Students enrolled in higher academic levels may be transferred to the Faculty of Energy and Environmental Engineering in the same or a different academic level upon equating the credits of the modules they already studied in another university with the credits of the specialized scientific programs offered by the Faculty. The student may also take or be exempted from the examinations in any modules according to the decision of the Scientific Committee of Equating

Credits as per the study plan decided by the Faculty Council, the general academic regulations of the university, and in accordance with any other regulations approved by the Faculty Council.

- A transferred student from any other university is enrolled as a new student in the academic level to which he/she is assigned to. The student's failed years are calculated starting from his/her enrolment date in the British University in Egypt regardless his/her enrolment status in his/her previous university.
- A decision approving the student transfer or the registration transfer shall be issued by the President of the University or his deputy.

Article (19): Foreign Students Admission and Transfer

- The minimum admission score for international students at the university is the nominal total of marks in equivalent certificates, provided that these marks are not less than the prescribed minimum, in addition to any other prerequisites determined by both the Faculty and the university.
- Admission applications are submitted directly to the admission office for inspecting the prerequisites according to the governing procedures.
- It is permissible to accept transfer students coming from foreign and Egyptian universities and institutes according to the transfer regulations applied to Egyptian students.
- International students are accepted and transferred according to the terms and conditions set by the Egyptian Supreme Council of Universities for private universities.

Article (20): Graduation Projects

- Year Four students prepare two graduation projects; the first one is a research project (individual) and the second one is a design project (collective). The relevant departments' councils decide on the suggested research topics taking into account associating these graduation projects with industry and community services.
- Students submit their graduation projects a month after completing their final exams.
- The two graduation projects are evaluated/assessed by committees consisting of external members.
- Graduation projects are assessed as follows: 50% based on the student's coursework and 50% based on a project presentation and discussion at the end of the year.
- Students should pass at least 340 credit points (102 credit hours) to be eligible for registering in their graduation projects.

Article (21): Field Training and Internships

- Year Two and Year Three students receive at least two field trainings/internships in all specialisations.
- By the end of the field training/internship, the student submits a report on the acquired skills and knowledge.
- The student presents a report to a committee formed from each scientific department and includes a representative from the industry to assess, discuss, and verify the skills acquired during the internship.

Article (22): Academic Misconduct and Program Dismissal

Reference is to be made to the Student Handbook that is issued annually by the university regarding the rules and regulations for student discipline. For further regulations, reference is to be made to the provisions of the Universities Organization Law.

Article (23): Academic Program Components

- The academic programs include modules which are divided according to the qualitative distribution of the Terms of Reference -Credit Hour System Study Regulations – Faculties of Engineering (2022) which align with the undergraduate's required skills and knowledge, which include social sciences, business administration, mathematics and basic sciences, engineering culture, basic engineering sciences, engineering applications and design, and project and field training.
- According to the percentages specified in the frame of reference, the modules included in each academic program should meet the requirements of the university, Faculty, general specialization, and the precise 17pecialization.
- The programs and modules include all the points mentioned in the Terms of Reference -Credit Hour System Study Regulations – Faculties of Engineering (2022).

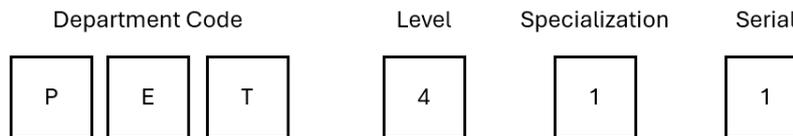
Article (24): Quality Unit and Its Responsibilities

- The Faculty Dean has the authority to decide on establishing the Faculty quality unit with a board of directors with the dean of the Faculty as the head of the unit and members from all the scientific departments including representatives from the Faculty staff, administrators, and students.
- This unit is to be concerned with following up on the educational process and writing the annual self-report and the development plan to ensure a continuous improvement according to the model prepared by the National Authority for

Quality Assurance and Accreditation of Education. Moreover, the unit will work spreading the culture of quality to all Faculty members.

Article (25): The Academic Curricula Code System

- Each course is assigned a code that reflects its Level.
- Course codes are designed based on the department offering the course, its level, the specialization within the department, and a sequential number.
- Courses are classified into five main levels, namely, S, 4, 5, 6, which correspond to the Framework for Higher Education Qualifications of UK Degree-Awarding Bodies and M, which corresponds to a minor module.
- Each level defines the depth of knowledge acquired within the program study year.
- Each department is assigned a three-letter code.
- The following shows a sample code, while the tables outlines the letter codes for each department and the number for each specialization in each department.



The Department Codes:

No.	Department Name	Letter Code
1	Energy Engineering	ENG
2	Bioenergy Engineering	BIO
3	Petroleum Engineering	PET
4	Sustainable Architecture Engineering	SAE
5	Basic Science	BSC
6	Language	LNG
7	Industrial Training	IND

The Specialization Codes:

No.	Specializations in the Energy Engineering department	Specialization No.
1	Renewable Energy	1
2	Thermofluids and their Applications	2
3	Mechanical Design and Production	3
4	Automatic Control and Measurements	4
5	Energy and Environment	5
6	Electrical Power Systems	6
7	Electrical Machines and Power Electronics	7
8	Pneumatics and Hydraulics	8
9	Graduation Projects	9

No.	Specializations in the Bioenergy department	Specialization No.
1	Bioenergy sources	1
2	Transport phenomena and separation processes	2
3	Processes Engineering	3
4	Modeling and design processes	4
5	Environmental Engineering	5
9	Graduation Projects	9

No.	Specializations in the Petroleum Engineering department	Specialization No.
1	Exploration and Formation Evaluation	1
2	Drilling Engineering	2
3	Reservoir Engineering and Reservoir Management	3
4	Production Engineering	4
5	Refinery Engineering	5
9	Graduation Projects	9

No.	Specializations in the Sustainable Architecture Engineering department	Specialization No.
1	Architecture engineering design	1
2	Sustainable Design	2
3	Architecture Tectonics	3
4	Building physics	4
5	Building information modeling	5
9	Graduation Projects	9

No.	Specializations in the Basic Science department	Specialization No.
1	Mathematics modules	1
2	Physics modules	2
3	Contemporary Issues	3

Article (26): The National Academic Reference Standards (NARS)

The Faculty adopts the National Academic Reference Standards (2018) in addition to the academic standards applied in the United Kingdom so that all the Faculty programs are compatible with the national and international systems.

Article (27): Student Transfer and Registration Transfer among Faculty Programs

The student can transfer from one program to another within the Faculty according to the Faculty internal rules which are approved by the Faculty Council every year taken into consideration the necessary equating procedures.

Article (28): Personal Advisors

- All students are allocated a Personal Advisor.
- The role of the Personal Advisor is to help monitor and evaluate students' progress.
- For new students entering the University the Personal Advisor plays a key role in guiding students in the successful transition from a school ethos to a university ethos and in helping to develop independent and autonomous learning skills.

Article (29): Failure and Number of Attempts

Students registered for the UK / Egyptian dual award have a maximum of two years to pass any study year, students who fail to pass any study year after two years will be dismissed from the UK degree track.

Article (30): Impaired Performance

- A student has the right to report in writing circumstances that may have impaired his or her performance in any assessment by the required deadline. Relevant circumstances are defined as 'serious and acute problems and events beyond a student's control and ability to foresee'.
- Only medical conditions approved by the BUE Clinic are accepted; Clinic approval is required within one week of return to study.
- Upheld Impaired Performance claims apply only to the component of assessment for which a claim has been made.

Article (31): Academic Appeals

- A student may appeal against the following:
 - the mark awarded for any module; and/or
 - the overall outcome of a program of study; and/or
 - the decision of a Program Examination Board in respect of the student's progression; and/or
 - the decision of a Dean or University Committee to exclude a student from the University

- the result of an Academic Misconduct or Impaired Performance Committee.
- Appeals against the academic judgement of examiners is not permitted.

Article (32): Minor Program

- Is an optional program as is not a requirement for obtaining the Major Bachelor's degree.
- Any student is eligible to select a minor program in any of the other faculty's programs.
- The Minor program is mentioned in the graduation certificate to the students that complete the requirements for the Minor program.
- The student must pass all the requirements of the minor program that he chose. These requirements are 18 credit hours.
- The student applies for the modules in the minor program in the summer semester, with a maximum of 9 credit hours.

Article (33): Additional Regulations

Any matter not stipulated herein or in the bylaw of the British University in Egypt shall be settled by virtue of the provisions of the Universities Regulation Law.

Part C: Study plan for Academic Programs (Two-Semester System)

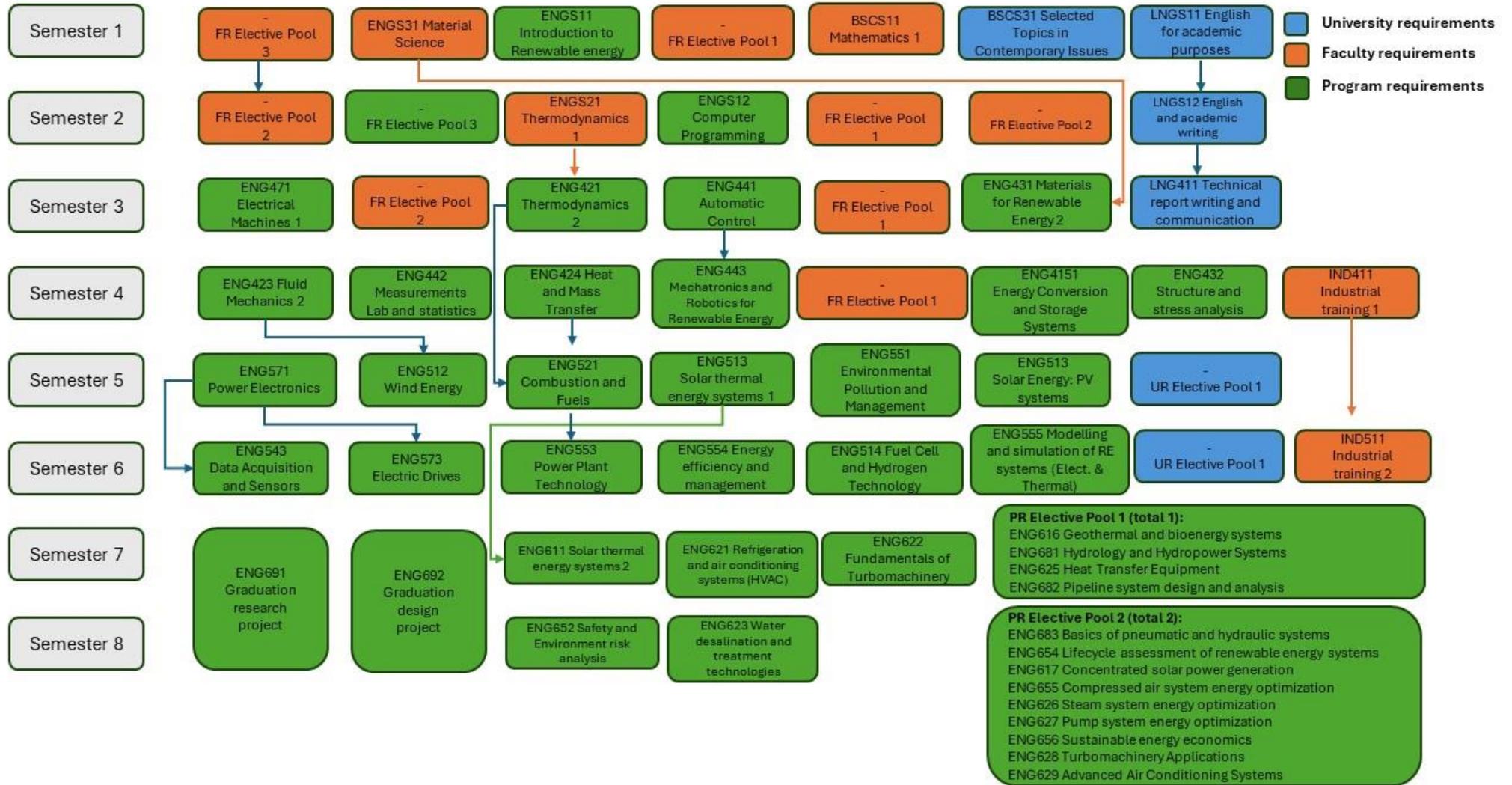
1. Mechanical Engineering - Renewable Energy
 2. Electrical Engineering - Renewable Energy
 3. Biochemical Engineering
 4. Petroleum Engineering and Gas Technology
 5. Architecture Engineering - Sustainable Building Design
- Every student has the right to join any of these programs directly from the time of joining the college after obtaining the minimum level in the coordination of engineering colleges, based on the decisions of the Supreme Council of Universities in this regard, which are determined every year.
 - The following are tables showing all the courses that the student will study in each program separately to obtain a bachelor's degree.

Part D: Details of Offered Programs

(Mechanical Engineering - Renewable Energy Program)

	Code	Semester 1	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR	Code	Semester 2	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR
Level 3	ENGS31	Material science	2	2	1	3	5	125	10	ENGSXX	FR Elective Pool 2	2	2	1	3	5	125	10
	ENGS11	Introduction to Renewable Energy	2	2		3	5	125	10	ENGSXX	FR Elective Pool 2	1		3	3	5	125	10
	ENGSXX	FR Elective Pool 3	2	1	1	2	3	75	5	ENGS21	Thermodynamics 1	2	2	1	3	5	125	10
	BSCSXX	FR Elective Pool 1	2	2	2	3	5	125	10	BSCSXX	FR Elective Pool 1	2	2		3	5	125	10
	BSCS11	Mathematics 1	2	2		3	5	125	10	ENGS12	Computers and Programming for renewable energy	1		3	2	3	75	5
	BSCS31	Selected Topics in Contemporary Issues	2	1		2	3	75	5	ENGSXX	FR Elective Pool 3	1		3	2	3	75	5
	LNGS11	English for Academic Purposes	3			3	4	100	10	LNGS12	English and Academic Writing	3			3	4	100	10
				15	10	4	19	30	750	60			12	6	11	19	30	750
Level 4	ENG471	Electrical Machines 1	2	2	1	3	4	100	10	ENG442	Measurements Lab and statistics	2	1	2	3	4	100	10
	ENG421	Thermodynamics 2	2	2	1	3	5	125	10	BSC4XX	FR Elective Pool 1	2	2	1	3	5	125	10
	BSC4XX	FR Elective Pool 1	2	2		3	5	125	10	ENG451	Energy Conversion and Storage	2	2	1	3	5	125	10
	ENG441	Automatic Control 1	2	2	1	3	4	100	10	ENG423	Fluid Mechanics 2	2	2	1	3	5	125	10
	ENG4XX	FR Elective Pool 2	2	2	1	3	5	125	10	ENG443	Mechatronics and Robotics for Renewable Energy	2	1		2	3	75	5
	ENG431	Materials for Renewable Energy 2	2	1	1	2	4	100	5	ENG432	Structure and stress analysis	2	1		2	3	75	5
	LNG411	Technical Report Writing and Communication	2			2	3	75	5	ENG424	Heat and mass transfer	2	2	1	3	5	125	10
										IND411	Industrial training 1							
			14	11	5	19	30	750	60			14	11	6	19	30	750	60
Level 5	ENG521	Combustion and Fuels	2	2		3	4	100	10	ENG553	Power Plant Technology	2	2	1	3	5	125	10
	ENG511	Solar Energy: PV systems	2	2	1	3	5	125	10	ENG554	Energy efficiency and management	2	2		3	5	125	10
	ENG512	Wind Energy systems	2	2	1	3	5	125	10	ENG514	Fuel Cell and Hydrogen Technology	2	2		3	5	125	10
	ENG571	Power Electronics	2	2	1	3	5	125	10	ENG543	Data acquisition and sensors	2	2		3	4	100	10
	ENG551	Environmental Pollution and Management	2	1		2	3	75	5	ENG555	Modeling and simulations of RE systems (Elect. & Thermal)	1		3	2	3	75	5
	ENG513	Solar thermal energy systems 1	2	2	1	3	5	125	10	ENG573	Electrical Drives	2	2	1	3	5	125	10
	ENG5XX	UR Elective Pool 1	2	1		2	3	75	5	ENG5XX	UR Elective Pool 1	2	1		2	3	75	5
										IND511	Industrial training 2							
			14	12	4	19	30	750	60			13	11	5	19	30	750	60
Level 6	ENG691	Graduation Research Project				3	5	125	10	ENG691	Graduation Research Project				3	5	125	10
	ENG692	Graduation Design Project				3	5	125	10	ENG692	Graduation Design Project				3	5	125	10
	ENG611	Solar thermal energy systems 2	2	2	2	3	5	125	10	ENG652	Safety and Environment risk analysis	2	2		3	5	125	10
	ENG621	Refrigeration and air conditioning systems (HVAC)	2	1	2	3	5	125	10	ENG623	Water desalination and treatment technologies	2	2		3	5	125	10
	ENG622	Fundamentals of Turbomachinery	2	2		3	5	125	10	ENG6XX	PR Elective Pool 2	2	2		3	5	125	10
	ENG6XX	PR Elective Pool 1	2	2		3	5	125	10	ENG6XX	PR Elective Pool 2	2	2		3	5	125	10
				8	7	4	18	30	750	60			8	8	0	18	30	750

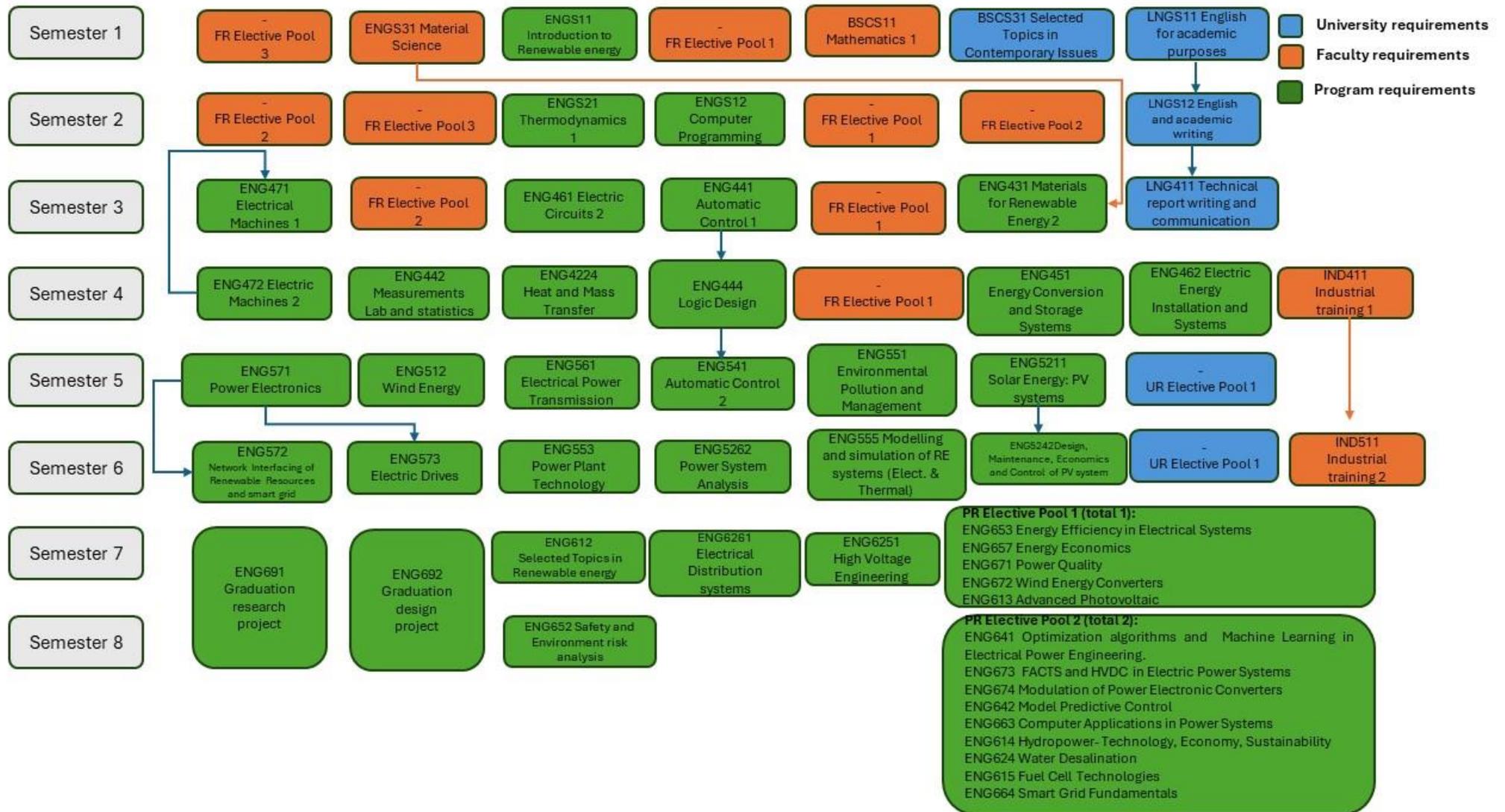
(Mechanical Engineering - Renewable Energy Program)



(Electrical Engineering - Renewable Energy Program)

	Code	Semester 1	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR	Code	Semester 2	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR
Level 3	ENGS31	Material science	2	2	1	3	5	125	10	ENGSXX	FR Elective Pool 2	2	2	1	3	5	125	10
	ENGS11	Introduction to Renewable Energy	2	2		3	5	125	10	ENGSXX	FR Elective Pool 2	1		3	3	5	125	10
	ENGSXX	FR Elective Pool 3	2	1	1	2	3	75	5	ENGS21	Thermodynamics 1	2	2	1	3	5	125	10
	BSCSXX	FR Elective Pool 1	2	2	2	3	5	125	10	BSCSXX	FR Elective Pool 1	2	2		3	5	125	10
	BSCS11	Mathematics 1	2	2		3	5	125	10	ENGS12	Computers and Programming for renewable energy	1		3	2	3	75	5
	BSCS31	Selected Topics in Contemporary Issues	2	1		2	3	75	5	ENGSXX	FR Elective Pool 3	1		3	2	3	75	5
	LNGS11	English for Academic Purposes	3			3	4	100	10	LNGS12	English and Academic Writing	3			3	4	100	10
				15	10	4	19	30	750	60			12	6	11	19	30	750
Level 4	ENG471	Electrical Machines 1	2	2	1	3	4	100	10	ENG442	Measurements Lab and statistics	2	1	2	3	4	100	10
	ENG461	Electric Circuits 2	2	2	1	3	5	125	10	BSC4XX	FR Elective Pool 1	2	2	1	3	5	125	10
	BSC4XX	FR Elective Pool 1	2	2		3	5	125	10	ENG451	Energy Conversion and Storage Systems	2	2	1	3	5	125	10
	ENG441	Automatic Control 1	2	2	1	3	4	100	10	ENG462	Electric Energy Installation and Systems	2		2	2	3	75	5
	ENG4XX	FR Elective Pool 2	2	2	1	3	5	125	10	ENG444	Logic Design	2	2	1	3	5	125	10
	ENG431	Materials for Renewable Energy 2	2	1	1	2	4	100	5	ENG472	Electrical Machines 2	2	1	1	2	3	75	5
	LNG411	Technical Report Writing and Communication	2			2	3	75	5	ENG424	Heat and mass transfer	2	2	1	3	5	125	10
										IND411	Industrial training 1							
			14	11	5	19	30	750	60			14	10	9	19	30	750	60
Level 5	ENG561	Electrical Power Transmission	2	2		3	4	100	10	ENG553	Power Plant Technology	2	2	1	3	5	125	10
	ENG511	Solar Energy: PV systems	2	2	1	3	5	125	10	ENG542	Design, Maintenance, Economics and Control of PV system	2	2		3	5	125	10
	ENG512	Wind Energy systems	2	2	1	3	5	125	10	ENG562	Power system analysis	2	2		3	5	125	10
	ENG571	Power Electronics	2	2	1	3	5	125	10	ENG572	Network Interfacing of Renewable Resources and smart grid	2	2		3	4	100	10
	ENG551	Environmental Pollution and Management	2	1		2	3	75	5	ENG555	Modeling and simulations of RE systems (Elect. & Thermal)	1		3	2	3	75	5
	ENG541	Automatic Control 2	2	2	1	3	5	125	10	ENG573	Electrical Drives	2	2	1	3	5	125	10
	ENGSXX	UR Elective Pool 1	2	1		2	3	75	5	ENGSXX	UR Elective Pool 1	2	1		2	3	75	5
										IND511	Industrial training 2							
			14	12	4	19	30	750	60			13	11	5	19	30	750	60
Level 6	ENG691	Graduation Research Project				3	5	125	10	ENG691	Graduation Research Project				3	5	125	10
	ENG692	Graduation Design Project				3	5	125	10	ENG692	Graduation Design Project				3	5	125	10
	ENG612	Selected Topics in Renewable energy	2	2		3	5	125	10	ENG652	Safety and Environment risk analysis	2	2		3	5	125	10
	ENG661	Electrical Distribution systems	2	1	2	3	5	125	10	ENG662	Power system Protection	2	2		3	5	125	10
	ENG651	High Voltage Engineering	2	2		3	5	125	10	ENG6XX	PR Elective Pool 2	2	2		3	5	125	10
	ENG6XX	PR Elective Pool 1	2	2		3	5	125	10	ENG6XX	PR Elective Pool 2	2	2		3	5	125	10
				8	7	2	18	30	750	60			8	8	0	18	30	750

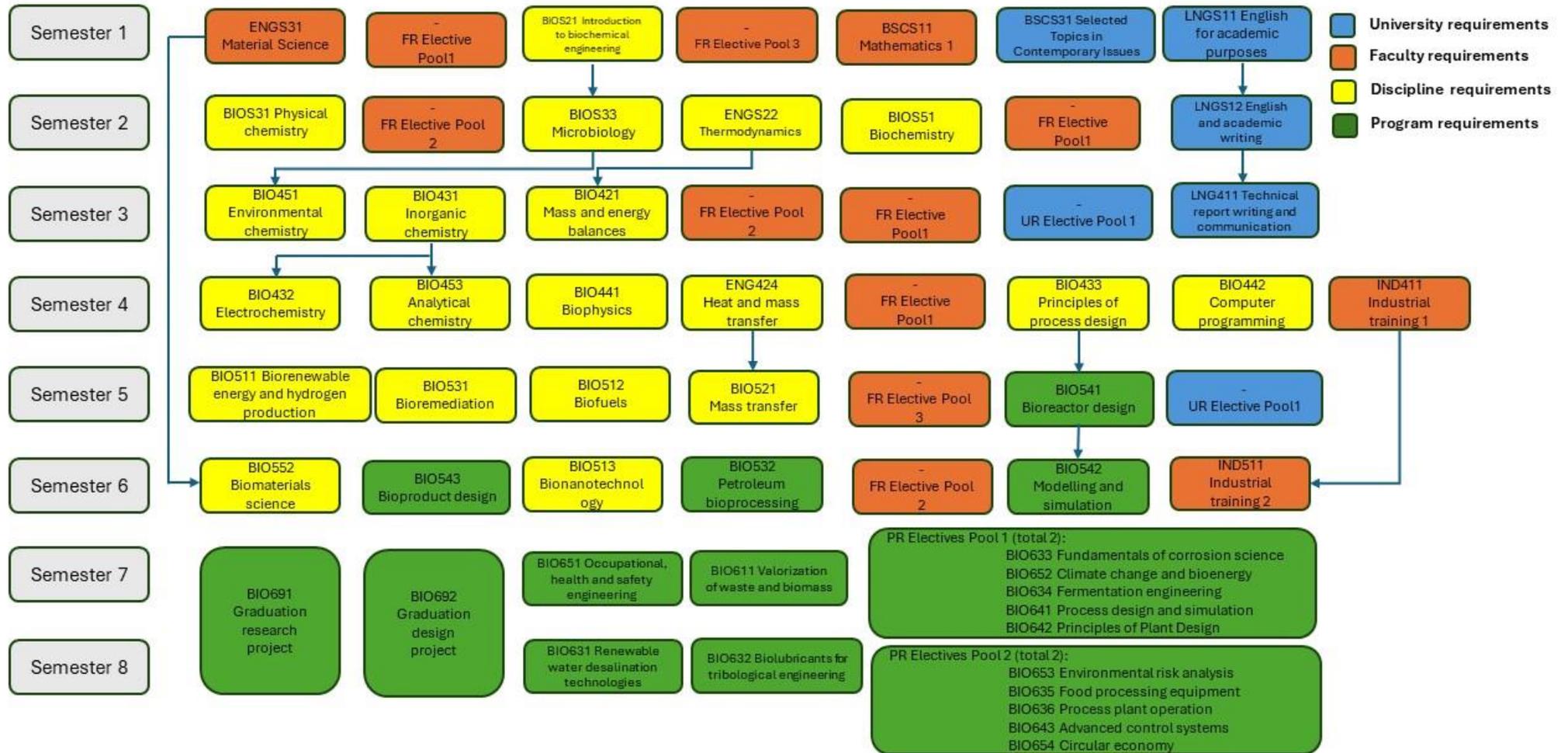
Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Electrical Engineering - Renewable Energy Program)



**Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Biochemical Engineering Program)**

	Code	Semester 1	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR	Code	Semester 2	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR
Level 3	ENGS31	Material Science	2	2	1	3	5	125	10	BIOS31	Physical Chemistry	2	1		2	4	100	5
	ENGSXX	FR Elective Pool 3	1		3	2	3	75	5	BIOSXX	FR Elective Pool 2	2	2	2	3	5	125	10
	BIOS21	Introduction to Biochemical Engineering	2	2		3	5	125	10	BIOS33	Microbiology	2	1	1	2	3	75	5
	BSCSXX	FR Elective Pool1	2	2	2	3	5	125	10	BSCSXX	FR Elective Pool1	2	2		3	5	125	10
	BSCS11	Mathematics 1	2	2		3	5	125	10	BIO51	Biochemistry	2	1	1	3	4	100	10
	BSCS31	Selected Topics in Contemporary Issues	2	1		2	3	75	5	ENGS22	Thermodynamics	2	2	1	3	5	125	10
	LNGS11	English for Academic Purposes	3			3	4	100	10	LNGS12	English and Academic Writing	3			3	4	100	10
			14	9	6	19	30	750	60			15	9	5	19	30	750	60
Level 4	BIO451	Environmental Chemistry	2	2	1	3	5	125	10	BSC4XX	FR Elective Pool1	2	2		3	5	125	10
	BIO421	Mass and Energy Balances	2	2		3	5	125	10	BIO441	Biophysics	2	1	1	3	4	100	10
	BSC4XX	FR Elective Pool1	2	2		3	5	125	10	BIO453	Analytical Chemistry	2	2	2	3	5	125	10
	BIO431	Inorganic Chemistry	2	2	2	3	4	100	10	BIO442	Computer Programming	1		3	2	3	75	5
	ENG4XX	FR Elective Pool 2	2	2	1	3	5	125	10	BIO432	Electrochemistry	2	2	2	3	5	125	10
	BIO4XX	UR Elective Pool 1	2	1		2	3	75	5	BIO433	Principles of Process Design	2	1		2	3	75	5
	LNG411	Technical Report Writing and Communication	2			2	3	75	5	ENG424	Heat and Mass Transfer	2	2	1	3	5	125	10
									IND411	Industrial Training 1								
			14	11	4	19	30	750	60			13	10	9	19	30	750	60
Level 5	BIO511	Biorenewable Energy and Hydrogen Production	2	2	1	3	5	125	10	BIO52	Biomaterials Science	2	2	1	3	5	125	10
	BIO521	Mass Transfer	2	1	2	3	5	125	10	BIO542	Modelling and Simulation	2	1	2	3	5	125	10
	BSC5XX	FR Elective Pool 3	2	1	1	2	3	75	5	BIO513	Bionanotechnology	2	2	2	3	5	125	10
	BIO5XX	UR Elective Pool1	2	1		2	3	75	5	BIO532	Petroleum Bioprocessing	2	2		3	5	125	10
	BIO512	Biofuels	2	1	2	3	5	125	10	BIO543	Bioproduct Design	2	2		3	5	125	10
	BIO531	Bioremediation	2	1	2	3	5	125	10	BSC5XX	FR Elective Pool 2	2	2		3	5	125	10
	BIO541	Bioreactor Design	2	2		3	4	100	10	IND511	Industrial Training 2						0	
			14	9	8	19	30	750	60			12	11	5	18	30	750	60
Level 6	BIO691	Graduation Research Project				3	5	125	10	BIO691	Graduation Research Project				3	5	125	10
	BIO692	Graduation Design Project				3	5	125	10	BIO692	Graduation Design Project				3	5	125	10
	BIO651	Occupational, Health and Safety Engineering	2	2		3	5	125	10	BIO631	Renewable Water Desalination Technologies	2	2		3	5	125	10
	BIO611	Valorization of Waste and Biomass	2	2		3	5	125	10	BIO632	Biolubricants for Tribological Engineering	2	2		3	5	125	10
	BIO6XX	PR Elective Pool 1	2	2		3	5	125	10	BIO6XX	PR Elective Pool 2	2	2		3	5	125	10
	BIO6XX	PR Elective Pool 1	2	2		3	5	125	10	BIO6XX	PR Elective Pool 2	2	2		3	5	125	10
			8	8	0	18	30	750	60			8	8	0	18	30	750	60

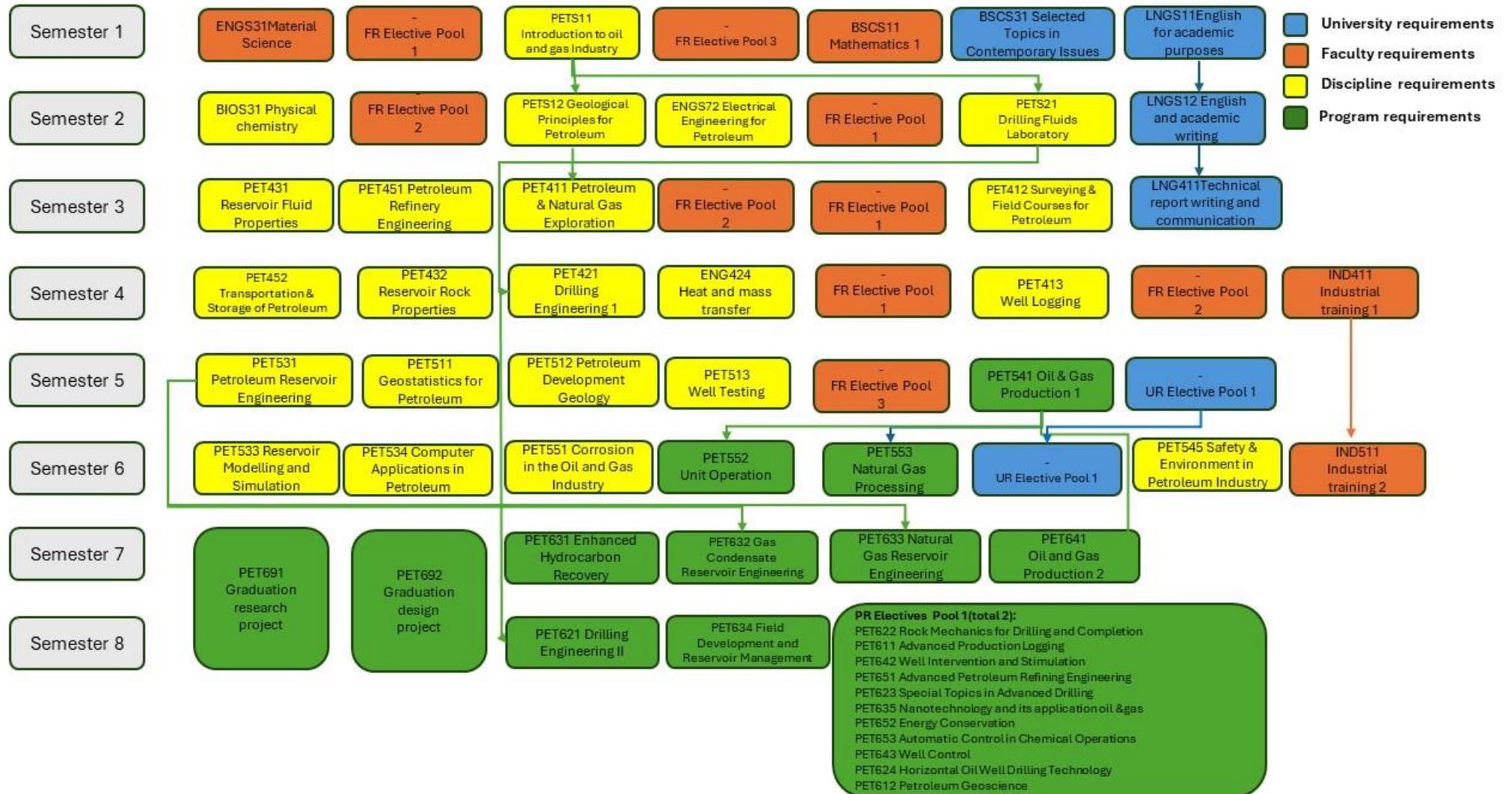
Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Biochemical Engineering Program)



Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Petroleum Engineering & Gas Technology Program)

	Code	Semester 1	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR	Code	Semester 2	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR
Level 3	ENGS31	Material science	2	2	1	3	5	125	10	BIOS31	Physical Chemistry for Petroleum Engineers	2	1		2	4	100	5
	ENGSXX	FR Elective Pool 3	1		3	2	3	75	5	BIOSXX	FR Elective Pool 2	2	2	1	3	5	125	10
	BSCSXX	FR Elective Pool 1	2	2	2	3	5	125	10	ENGS72	Electrical Engineering for Petroleum Engineers	2	1	2	3	5	125	10
	PETS11	Introduction to oil and gas Industry	2	2		3	5	125	10	BSCSXX	FR Elective Pool 1	2	2		3	5	125	10
	BSCS11	Mathematics 1	2	2		3	5	125	10	PETS12	Geological Principles for Petroleum Engineering	2	1	2	3	4	100	10
	BSCS31	Selected Topics in Contemporary Issues	2	1		2	3	75	5	PETS21	Drilling Fluids Laboratory	1		2	2	3	75	5
	LNGS11	English for Academic Purposes	3			3	4	100	10	LNGS12	English and Academic Writing	3			3	4	100	10
			14	9	6	19	30	750	60			14	7	7	19	30	750	60
Level 4	PET431	Reservoir Fluid Properties	2	2	2	3	5	125	10	BSC4XX	FR Elective Pool 1	2	2		3	5	125	10
	PET451	Petroleum Refinery Engineering	2	2	1	3	5	125	10	PET452	Transportation and Storage of Petroleum and Gas	2	1		2	3	75	5
	BSC4XX	FR Elective Pool 1	2	2		3	5	125	10	PET432	Reservoir Rock Properties.	2	2	2	3	5	125	10
	PET411	Petroleum & Natural Gas Exploration	2	1		2	3	75	5	PET421	Drilling Engineering 1	2	1		3	3	75	5
	ENG4XX	FR Elective Pool 2	2	2	1	3	5	125	10	PET413	Well Logging	2	2	1	2	4	100	10
	PET412	Surveying & Field Courses for Petroleum Engineers	2	2	2	3	4	100	10	ENG4XX	FR Elective Pool 2	2	2		3	5	125	10
	LNG411	Technical Report Writing and Communication	2			2	3	75	5	ENG424	Heat and Mass Transfer	2	2	1	3	5	125	10
									IND411	Industrial Training 1								
			14	11	6	19	30	750	60			14	12	4	19	30	750	60
Level 5	PET531	Petroleum Reservoir Engineering	2	2	1	3	5	125	10	PET533	Reservoir Modelling and Simulation.	2		2	3	5	125	10
	PET511	Geostatistics for petroleum	2	1	1	3	5	125	10	PET534	Computer Applications in Petroleum Engineering.	1		3	3	4	100	10
	BSC5XX	FR Elective Pool 3	2	1	1	2	3	75	5	PET551	Corrosion in the Oil and Gas Industry	2	2		3	5	125	10
	PET512	Petroleum Development Geology	2	2	1	3	5	125	10	PET552	Unit Operation	2	2	1	3	5	125	10
	PET513	Well Testing	2		2	3	4	100	10	PET553	Natural Gas Processing	2	2		3	5	125	10
	PET541	Oil and Gas Production 1	2	2	1	3	5	125	10	PET5XX	UR Elective Pool 1	2	1		2	3	75	5
	PET5XX	UR Elective Pool 1	2	1		2	3	75	5	PET545	Safety & Environment in Petroleum Industry	2	1		2	3	75	5
									IND511	Industrial Training 2								
			14	9	7	19	30	750	60			13	8	6	19	30	750	60
Level 6	PET691	Graduation Research Project				3	5	125	10	PET691	Graduation Research Project				3	5	125	10
	PET692	Graduation Design Project				3	5	125	10	PET692	Graduation Design Project				3	5	125	10
	PET631	Enhanced Hydrocarbon Recovery	2	2		3	5	125	10	PET621	Drilling Engineering II	2	2		3	5	125	10
	PET632	Gas Condensate Reservoir Engineering	2	2		3	5	125	10	PET634	Field Development and Reservoir Management	2	2		3	5	125	10
	PET633	Natural Gas Reservoir Engineering	2	2	2	3	5	125	10	PET6XX	PR Elective Pool 1	2	2		3	5	125	10
	PET641	Oil and Gas Production 2	2	1	2	3	5	125	10	PET6XX	PR Elective Pool 1	2	2		3	5	125	10
			8	7	4	18	30	750	60			8	8	0	18	30	750	60

**Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Petroleum Engineering & Gas Technology Program)**

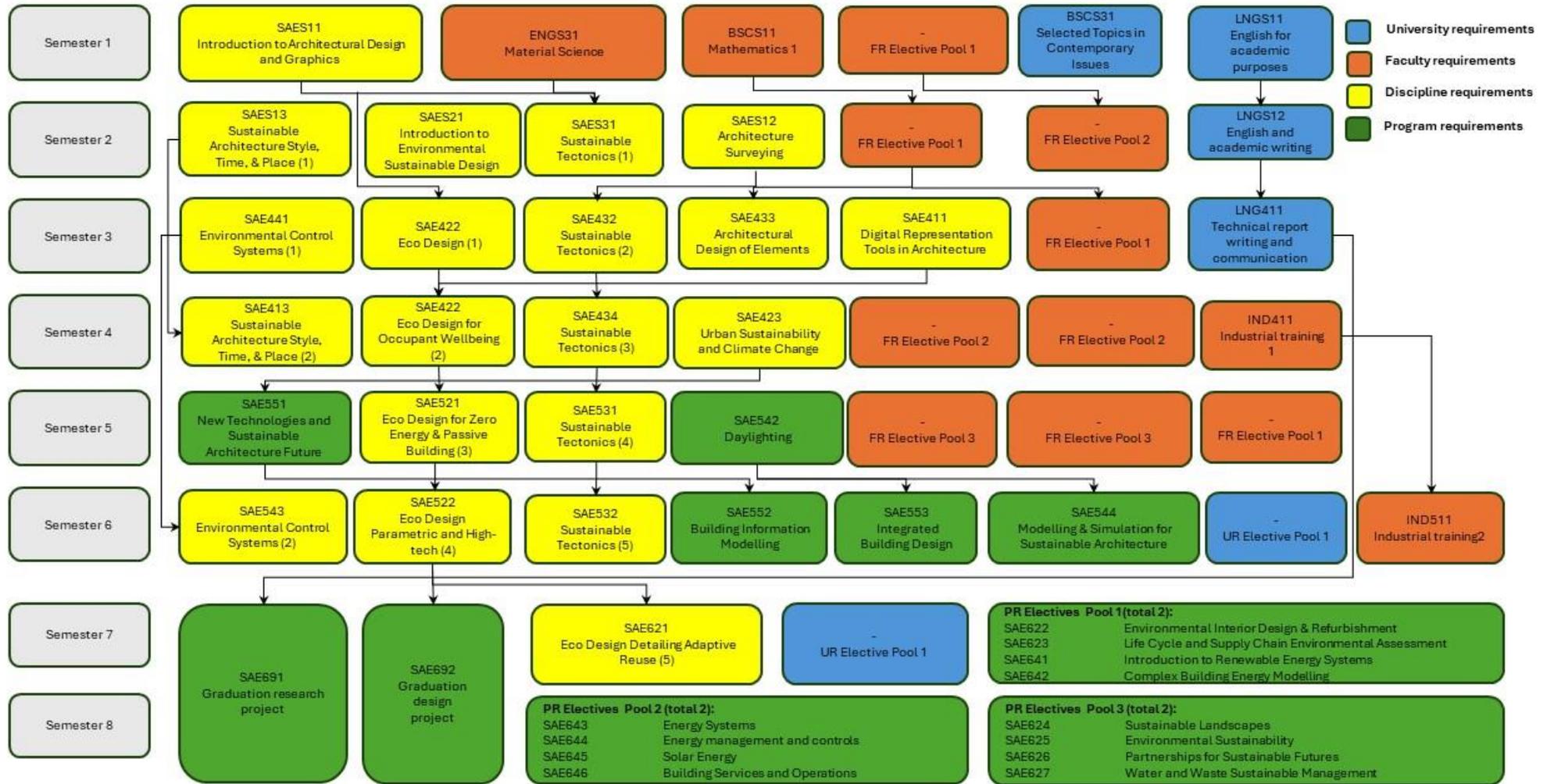




	Code	Semester 1	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR	Code	Semester 2	Lec	Tut	Lab	Cr	ECTS	SWL	UK CR
Level 3	ENGS31	Materials Science	2	2	1	3	5	125	10	SAES21	Introduction to Environmental Sustainable Design	2		3	3	4	100	10
	SAES11	Introduction to architectural design and graphics	3		5	5	8	200	15	BIOSXX	FR Elective Pool 1	2	2	2	3	5	125	10
	BSCSXX	FR Elective Pool 1	2	2	2	3	5	125	10	ENGSXX	FR Elective Pool 2	2	2		3	5	125	10
	BSCS11	Mathematics 1	2	2		3	5	125	10	SAES12	Architecture Surveying	1	1	2	2	4	100	5
	BSCS31	Selected Topics in Contemporary Issues	2	1		2	3	75	5	SAES31	Sustainable Tectonics (1)	2		3	3	5	125	10
	LNGS11	English for Academic Purposes	3			3	4	100	10	SAES13	Sustainable Architecture style, time, & place (1)	2			2	3	75	5
										LNGS12	English and Academic Writing	3			3	4	100	10
			14	7	8	19	30	750	60			14	5	10	19	30	750	60
Level 4	SAE4XX	FR Elective Pool 1	2	2		3	5	125	10	ENG4XX	FR Elective Pool 2	2	2	1	3	5	125	10
	SAE432	Sustainable Tectonics (2)	2		3	3	4	100	10	SAE4XX	FR Elective Pool 2	2	2		3	5	125	10
	SAE441	Environmental Control Systems (1)	2	1		2	3	75	5	SAE422	Eco Design for occupant wellbeing (2)	2		6	4	7	175	15
	SAE421	Eco Design (1)	2		6	4	7	175	15	SAE413	Sustainable Architecture style, time, & place (2)	2			2	3	75	5
	SAE433	Architectural design of Elements	2	2		3	5	125	10	SAE423	Urban Sustainability and Climate Change	2		3	3	4	100	10
	SAE411	Digital Representation tools in Architecture	1		3	2	3	75	5	SAE434	Sustainable Tectonics (3)	2		3	3	4	100	10
	LNG411	Technical Report Writing and Communication	2			2	3	75	5	IND411	Industrial Training 1							0
			13	5	12	19	30	750	60			12	4	13	18	28	700	60
Level 5	BSCSXX	FR Elective Pool 1	2	2	1	3	5	125	10	SAE552	Building Information Modelling	1	2		2	3	75	5
	ENG5XX	FR Elective Pool 3	2		1	2	3	75	5	SAE553	Integrated Building Design	2	2		3	5	125	10
	SAE531	Sustainable Tectonics (4)	2		3	3	4	100	10	SAE543	Environmental Control Systems (2)	2	1		2	3	75	5
	SAE551	New technologies and Sustainable Architecture Future	2			2	3	75	5	SAE532	Sustainable Tectonics (5)	2		3	3	4	100	10
	SAE521	Eco Design for Zero Energy & Passive Building (3)	2		6	4	7	175	15	SAE544	Modelling & Simulation for Sustainable Architecture	2		3	3	5	125	10
	SAE5XX	FR Elective Pool 3	2		2	2	3	75	5	SAE522	Eco Design Parametric and High-tech (4)	2		6	4	7	175	15
	SAE542	Daylighting	2	1	2	3	5	125	10	SAE5XX	UR Elective Pool 1	2			2	3	75	5
									IND511	Industrial Training 2								
			14	3	15	19	30	750	60			13	5	12	19	30	750	60
Level 6	SAE691	Graduation Research Project				2	3	75	5	SAE691	Graduation Research Project				2	3	75	5
	SAE692	Graduation Design Project	2		8	5	9	225	15	SAE692	Graduation Design Project	2		8	5	9	225	15
	SAE621	Eco Design Detailing Adaptive Reuse (5)	2		6	4	7	175	15	SAE6XX	PR Elective Pool 2	2	2		3	5	125	10
	SAE6XX	UR Elective Pool 1	2	1		2	3	75	5	SAE6XX	PR Elective Pool 2	2	2		3	5	125	10
	SAE6XX	PR Elective Pool 1	2	2		3	4	100	10	SAE6XX	PR Elective Pool 3	2	2		3	4	100	10
	SAE6XX	PR Elective Pool 1	2	2		3	4	100	10	SAE6XX	PR Elective Pool 3	2	2		3	4	100	10
			10	5	14	19	30	750	60			10	8	8	19	30	750	60



**Faculty of Energy and Environmental Engineering Bachelor of Science in Engineering Bylaws
(Architecture Engineering - Sustainable Building Design Program)**



The British University in Egypt, upon the request of the Faculty of Energy and Environmental Engineering Council, awards the Bachelor of Science (B.Sc.) Degree in one of the Programs listed in the below table, which are the Programs offered by the Faculty of Energy and Environmental Engineering, The British University in Egypt. The programs are divided into Specialized and Inter-Disciplinary programs.

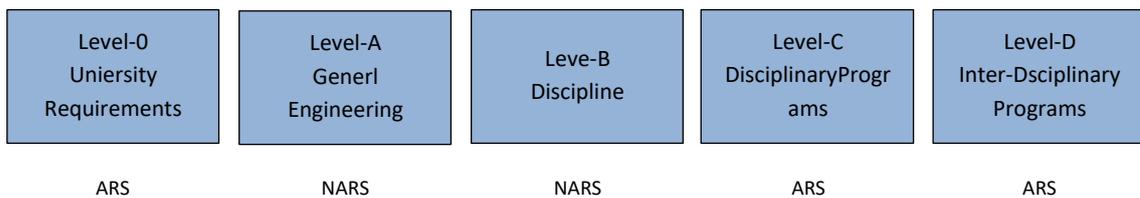
Energy & Environmental Engineering Programs	Specialized Programs	Architecture Engineering - Sustainable Building Design Program
		Petroleum Engineering and Gas Technology Program
		Biochemical Engineering Program
	Inter-Disciplinary Programs	<ol style="list-style-type: none"> 1. Mechanical Engineering – Renewable Energy 2. Electrical Engineering – Renewable Energy

According to the Supreme Council of Universities Terms of Reference for Undergraduate Engineering Programs, the courses in any program are divided into the following categories:

1. University requirements.
2. Faculty requirements.
3. Discipline requirements.
4. Program requirements.

The Figure below shows the different levels of competences as per National Academic Reference Standards (NARS-2018) as published by NAQAAE. These Levels of competences determine the allocation of courses in different competency level with respect to the level requirements.

NATIONAL ACADEMIC REFERENCE STANDARDS (NARS-2018)



The below table summarizes the overall data about the programs included in these bylaws. The rest of this Part D will show the list of standards for each level and the courses required to achieve these standards for each program.

#	Program	NC	Credits and SWL			Total Contact Hours				4 Requirements				BS	EC
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR		
1	Mechanical Engineering - Renewable Energy	52	150	240	6000	98	75	39	212	14 CH 9%	31 CH 21%	105 CH 70%		26 CH 17%	38 CH 25%
2	Electrical Engineering - Renewable Energy	52	150	240	6000	98	73	40	211	14 CH 9%	31 CH 21%	105 CH 70%		26 CH 17%	38 CH 25%
3	Biochemical Engineering	51	149	240	6000	98	74	38	209	14 CH 9%	31 CH 21%	65 CH 44 %	39 CH 26%	28 CH 19%	41 CH 28%
4	Petroleum Engineering and Gas Technology	52	150	240	6000	99	71	40	210	14 CH 9%	31 CH 21%	61 CH 40%	45 CH 30%	25 CH 17%	35 CH 23%
5	Architecture Engineering - Sustainable Building Design	50	152	240	6000	101	41	91	233	14 CH 9%	31 CH 21%	61 CH 40%	45 CH 30%	20 CH 13%	47 CH 31%

NC Total number of Courses
 CH Credit Hour
 ECTS European Credit Transfer System
 SWL Student Workload
 Lec Lectures
 Tut Tutorials
 Lab Laboratory
 TT Total

UR University Requirement
 FR Faculty Requirement
 DR Discipline Requirement
 PR Program Requirement
 BS Basic Sciences Percentage, Credit Hours
 EC Elective Courses Percentage, by Credit Hours

Section-1: University Requirements

The university is considered a core of Human Thinking at its highest level, and the source of investment and development of human resources. It is concerned with the rise of the Arabian Civilization and the Historical Heritage of the Egyptian Society, and its traditions. It is also concerned with the education of Religion, Morals and Nationalism (Egyptian National Law for Universities, Law 49 for Year 1972). Therefore, The British University in Egypt graduate should be (0-Level):

1. Aware of national, regional and international contemporary issues, to have an intellectual and enlightened personality and to interact effectively in the community through different communication skills.

To achieve this goal, The British University in Egypt has designed a number of courses planned to build the student personality, develop his skills, and increase his awareness of different topics. These courses are called University Requirements. The Faculty of Energy and Environmental Engineering has selected some of these courses to be offered within the Energy and Environmental Engineering Programs. These courses are listed in the table below.

A placement test in English Language will be conducted for some admitted students to the Faculty of Energy and Environmental Engineering. If the student passes this test, then he will be exempted from taking the Technical English Language Course. The Technical English Language course is a pre-requisite for all Faculty requirements courses.

List of University Requirement Courses

Compulsory Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
LNGS11	English for Academic Purposes	2	3	4	100	3	--	--	3
LNGS12	English and Academic Writing	N/A	3	4	100	3	--	--	3
BSCS31	Selected Topics in Contemporary Issues	2	2	3	75	2	1	--	3
LNG411	Technical Report Writing and Communication	N/A	2	3	75	2	--	--	2
	Elective University Requirement Pool 1 (2 modules)	--	4	6	150	--	--	--	--
Total			14	20	500				

Elective Courses

Elective University Requirement Pool 1									
Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENG552	Project Management	2	2	3	75	2	1		3
ENG556	Engineering Economics	2	2	3	75	2	1		3
BIO452	Project Management and Engineering Economics	2	2	3	75	2	1		3
BIO551	Environmental Legislations and Regulations	2	2	3	75	2	1		3
PET532	Project Management for Petroleum Engineering	2	2	3	75	2	1		3
PET535	Petroleum Economics and Legislation	2	2	3	75	2	1		3
SAE523	Energy and human development	2	2	3	75	2			2
SAE611	Sustainable Project Management & Costing	2	2	3	75	2	1		3

Section-2: Faculty Requirements

All the programs offered at the Faculty of Energy and Environmental Engineering, at the British University in Egypt are Engineering Programs. The graduates have the privilege of being Engineers and are automatically enrolled in the Egyptian Engineering Syndicate (EES).

According to the National Academic Reference Standards (NARS-2018), The Engineering Graduate must be able to (A-Level):

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
- A2. Develop and conduct appropriate experimentation and/or simulation, analyse and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
- A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
- A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
- A5. Practice research techniques and methods of investigation as an inherent part of learning.
- A6. Plan, supervise and monitor implementation of engineering projects.
- A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
- A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
- A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
- A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

To achieve these Competencies, a set of courses must be completed as a Faculty Requirement. These courses are divided into Basic Applied Science Courses and Basic Engineering Science Courses. These courses are listed in the table below.

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

Faculty Requirements List of Courses

Compulsory Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS31	Materials Science	2	3	5	125	2	2	1	5
BSCS11	Mathematics 1	2	3	5	125	2	2		4
IND411	Industrial training 1	N/A	--			--	--	--	--
IND511	Industrial training 2	N/A	--			--	--	--	--
	Elective Faculty Requirement Basic Applied Science Pool 1 (4 modules)		12	20	500				
	Elective Faculty Requirement Basic Engineering Science Pool 2 (3 modules)		9	15	375				
	Elective Faculty Requirement Basic Engineering Science Pool 3 (2 modules)		4	6	150				
			31	51	1275				

Elective Courses

Elective Faculty Requirement Basic Applied Science Pool 1									
Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BSCS21	Physics	2	3	5	125	2	2	2	6
BSCS12	Mathematics 2	2	3	5	125	2	2		4
BSC411	Calculus	2	3	5	125	2	2		4
BSC412	Differential equations and Numerical solutions	2	3	5	125	2	2	1	5
BSC413	Differential Equations	2	3	5	125	2	2		4
BSC513	Statistics, Numerical Methods	2	3	5	125	2	2	1	5
BIOS34	Chemistry	2	3	5	125	2	2	2	6
SAE431	Geotechnics	2	3	5	125	2	2		4

Elective Faculty Requirement Basic Engineering Science Pool 2									
Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS32	Engineering Drawings and CAD Design	3	3	5	125	1		3	4
ENGS71	Electronics	2	3	5	125	2	2	1	5
ENG422	Fluid Mechanics 1	2	3	5	125	2	2	1	5
BIOS32	Organic Chemistry	2	3	5	125	2	2	2	6
BSC512	Probability and Statistics	2	3	5	125	2	2		4
ENG433	Stress Analysis	2	3	5	125	2	2		4
ENGS13	Engineering mechanics & Structural Analysis	2	3	5	125	2	2		4
ENG425	Fluids Mechanics and built environment	2	3	5	125	2	2	1	5
SAE412	Building Regulations & Rating Systems	2	3	5	125	2	2		4

Elective Faculty Requirement Basic Engineering Science Pool 3									
Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS61	Electric Circuits 1	2	2	3	75	2	1	1	4
ENGS33	Workshop Technology and Solid Modeling	2	2	3	75	1		3	4
ENGS34	Engineering Drawing and Workshop	3	2	3	75	1		3	4
BSC511	Numerical Methods	2	2	3	75	2	1	1	4
ENG563	Electricity and the built environment	2	2	3	75	2		1	3
ENG522	Thermo-dynamics and heat transfer	2	2	3	75	2		2	4

Section-3: Discipline Requirements

1-Biochemical Engineering Program

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) the Basic Chemical Engineering graduate must be able to (B-Level):

- B1. Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including: Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design.
- B2. Engage in the recent technological changes and emerging fields relevant to chemical engineering to respond to the challenging role and responsibilities of a professional chemical engineer.
- B3. Apply numerical modeling methods and/or computational techniques appropriate to chemical engineering.
- B4. Adopt suitable national and international standards and codes to: design, operate, inspect and maintain chemical engineering systems.

To achieve these Competencies, a set of courses must be completed as a Basic Chemical Engineering Requirement. These courses are listed in the table below.

References:

B: NAQAAE 2018 basic Chemical Engineering Competencies

Biochemical Engineering Discipline List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS22	Thermodynamics	2	3	5	125	2	2	1	5
BIO421	Mass and Energy Balances	2	3	5	125	2	2		4
BIO531	Physical Chemistry	2	2	4	100	2	1		3
BIO431	Inorganic Chemistry	2	3	4	100	2	2	2	6
BIO432	Electrochemistry	2	3	5	125	2	2	2	6
ENG424	Heat and Mass Transfer	2	3	5	125	2	2	1	5
BIO521	Introduction to Biochemical Engineering	2	3	5	125	2	2		4
BIO551	Biochemistry	2	3	4	100	2	1	1	4
BIO533	Microbiology	2	2	3	75	2	1	1	4
BIO451	Environmental Chemistry	2	3	5	125	2	2	1	5
BIO441	Biophysics	2	3	4	100	2	1	1	4
BIO453	Analytical Chemistry	2	3	5	125	2	2	2	6
BIO433	Principles of Process Design	2	2	3	75	2	1		3
BIO442	Computer Programming	2	2	3	75	1		3	4
BIO511	Biorenewable Energy and Hydrogen Production	2	3	5	125	2	2	1	5
BIO521	Mass Transfer	2	3	5	125	2	1	2	5
BIO512	Biofuels	2	3	5	125	2	1	2	5
BIO531	Bioremediation	2	3	5	125	2	1	2	5
BIO541	Bioreactor Design	2	3	4	100	2	2		4
BIO552	Biomaterials Science	2	3	5	125	2	2	1	5
BIO542	Modelling and Simulation	2	3	5	125	2	1	2	5
BIO513	Bionanotechnology	2	3	5	125	2	2	2	6
BIO532	Petroleum Bioprocessing	2	3	5	125	2	2		4
			65	104	2600	45	35	27	107

2-Petroleum Engineering and Gas Technology Program

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) the Basic Petroleum Engineering graduate must be able to (B-Level):

- B1. Analyze geological data, interpret well-logs, estimate hydrocarbon reserves and evaluate reservoir performance by applying the principles and basic concepts of: geology, geophysics and reservoir engineering.
- B2. Plan and construct oil wells, develop oilfield production programs, design early surface facilities plants and field evacuation plans by applying the principles and basic concepts of: drilling engineering, production engineering, phase equilibrium, fluid mechanics and flow through porous media.
- B3. Use specialist computer applications and mathematical models to maximize the performance of all petroleum engineering stages.
- B4. Apply the concepts of project economics and resources evaluation methods for design and decision making under conditions of risk and uncertainty.

To achieve these Competencies, a set of courses must be completed as a Basic Petroleum Engineering Requirement. These courses are listed in the table below.

References:

B: NAQAAE 2018 basic Petroleum Engineering Competencies

Petroleum Engineering and Gas Technology Discipline List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BIOS31	Physical Chemistry	2	2	4	100	2	1		3
ENGS72	Electrical Engineering for Petroleum Engineers	2	3	5	125	2	1	2	5
ENG424	Heat and Mass Transfer	2	3	5	125	2	2	1	5
PETS11	Introduction to oil and gas Industry	2	3	5	125	2	2		4
PETS12	Geological Principles for Petroleum Engineering	2	3	4	100	2	1	2	5
PETS21	Drilling Fluids Laboratory	2	2	3	75	1		2	3
PET451	Petroleum Refinery Engineering	2	3	5	125	2	2	1	5
PET411	Petroleum & Natural Gas Exploration	2	2	3	75	2	1		3
PET412	Surveying & Field Courses for Petroleum Engineers	2	3	4	100	2	2	2	6
PET431	Reservoir Fluid Properties.	2	3	5	125	2	2	2	6
PET432	Reservoir Rock Properties.	2	3	5	125	2	2	2	6
PET421	Drilling Engineering 1	2	2	3	75	2	1		3
PET413	Well Logging	2	3	4	100	2	2	1	5
PET452	Transportation and Storage of Petroleum and Gas	2	2	3	75	2	1		3
PET531	Petroleum Reservoir Engineering	2	3	5	125	2	2	1	5
PET511	Geostatistics for petroleum	2	3	5	125	2	1	1	4
PET512	Petroleum Development Geology	2	3	5	125	2	2	1	5
PET513	Well Testing	2	3	4	100	2		2	4
PET551	Corrosion in the Oil and Gas Industry	2	3	5	125	2	2		4
PET534	Computer Applications in Petroleum Engineering.	2	3	4	100	1		3	4
PET545	Safety & Environment in Petroleum Industry	2	2	3	75	2	1		3
PET533	Reservoir Modelling and Simulation.	2	3	5	125	2		2	4
Total			61	95	2375	42	29	25	96

3- Architecture Engineering - Sustainable Building Design Program

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) the Basic Architectural Engineering graduate must be able to (B-Level):

- B1. Create architectural, urban and planning designs that satisfy both aesthetic and technical requirements, using adequate knowledge of: history and theory, related fine arts, local culture and heritage, technologies and human sciences.
- B2. Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.
- B3. Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.
- B4. Transform design concepts into buildings and integrate plans into overall planning within the constraints of: project financing, project management, cost control and methods of project delivery; while having adequate knowledge of industries, organizations, regulations and procedures involved.
- B5. Prepare design project briefs and documents, and understand the context of the architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.

To achieve these Competencies, a set of courses must be completed as a Basic Architectural Engineering Requirement. These courses are listed in the table below.

References:

B: NAQAAE 2018 basic Architectural Engineering Competencies

Architecture Engineering - Sustainable Building Design Discipline List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAES11	Introduction to architectural design and graphics	3	5	8	200	3	--	5	8
SAES21	Introduction to Environmental Sustainable Design	2	3	4	100	2		3	5
SAES12	Architecture Surveying	2	2	4	100	1	1	2	4
SAES31	Sustainable Tectonics (1)	3	3	5	125	2		3	5
SAE432	Sustainable Tectonics (2)	3	3	4	100	2		3	5
SAES13	Sustainable Architecture style, time, & place (1)	2	2	3	75	2			2
SAE421	Eco Design (1)	N/A	4	7	175	2		6	8
SAE433	Architectural design of Elements	2	3	5	125	2	2		4
SAE411	Digital Representation tools in Architecture	N/A	2	3	75	1		3	4
SAE441	Environmental Control Systems (1)	2	2	3	75	2	1		3
SAE422	Eco Design for occupant wellbeing (2)	N/A	4	7	175	2		6	8
SAE413	Sustainable Architecture style, time, & place (2)	2	2	3	75	2			2
SAE423	Urban Sustainability and Climate Change	3	3	4	100	2		3	5
SAE434	Sustainable Tectonics (3)	3	3	4	100	2		3	5
SAE531	Sustainable Tectonics (4)	3	3	4	100	2		3	5
SAE521	Eco Design for Zero Energy & Passive Building (3)	N/A	4	7	175	2		6	8
SAE543	Environmental Control Systems (2)	2	2	3	75	2	1		3
SAE532	Sustainable Tectonics (5)	3	3	4	100	2		3	5
SAE522	Eco Design Parametric and High-tech (4)	N/A	4	7	175	2		6	8
SAE621	Eco Design Detailing Adaptive Reuse (5)	N/A	4	7	175	2		6	8
			61	96	2400	39	5	61	105

Section-4: Program Requirements

1-Mechanical Engineering - Renewable Energy Program

Mechanical Engineering - Renewable Energy Program Graduate attributes:

In addition to the general Engineering attributes mentioned above, the Mechanical Engineering - Renewable Energy engineer should be able to:

1. Apply his knowledge in Combustion and Fuels, Turbo Machinery, Storage Energy Technologies and Solar Energy Systems.
2. Apply/Adopt system analysis tools in Renewable Energy Engineering, Wind energy systems, Thermal Power Plants and Power Generation and Conversion Systems
3. Use and/or develop computer software, necessary for design, communication and visualization of industrial systems and projects.
4. Analyze, synthesize, and design open-ended Renewable Energy Engineering systems, understand the associated uncertainties, and evaluate the economic impact.
5. Contribute in the activities of Modelling and Simulation for Renewable Energy Systems, Energy Harvesting Technologies, Network Interfacing of Renewable Resources, Energy Markets, Laws and Economics.
6. Use and/or develop computer software, necessary for the design, analysis, interpretation, and solving problems in Special Topics in Renewable Energy, & Renewable Energy System.
7. Find better lower-cost methods used in Process Design and Simulation.
8. Lead or supervise a group of designers or technicians and other work force.

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level), the Mechanical Engineering - Renewable Energy program graduate must be able to (D-Level):

- D1. Select and apply appropriate systematic analysis methods to critically evaluate and solve complex renewable energy engineering problems.
- D2. Analyse different energy resources and conversion processes using analytical modelling, experimental techniques and numerical simulations.
- D3. Critically access the use of renewable energy systems to mitigate climate change and improve the environment and social welfare.
- D4. Make and justify decisions for selecting and optimising renewable energy products and systems based on technical, environmental, economic, risk and social criteria.
- D5. Develop innovative solutions to meet the current global sustainability and renewable energy challenges.

D6. Demonstrate the application of legal and ethical requirements associated with renewable energy in an industrial environment.

To achieve these Competencies, a set of courses must be completed as a Mechanical Engineering - Renewable Energy Requirement. These courses are listed in the table below.

Reference: Coventry University MSc Renewable Energy Engineering

Mechanical Engineering - Renewable Energy Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS21	Thermodynamics 1	2	3	5	125	2	2	1	5
ENG424	Heat and mass transfer	2	3	5	125	2	2	1	5
ENG442	Measurements Lab and statistics	2	3	4	100	2	1	2	5
ENGS11	Introduction to Renewable Energy	2	3	5	125	2	2		4
ENGS12	Computers and Programming for renewable energy	2	2	3	75	1		3	4
ENG471	Electrical Machines 1	2	3	4	100	2	2	1	5
ENG441	Automatic Control 1	2	3	4	100	2	2	1	5
ENG451	Energy Conversion and Storage Systems	2	3	5	125	2	2	1	5
ENG431	Materials for Renewable Energy 2	2	2	4	100	2	1	1	4
ENG511	Solar Energy: PV systems	2	3	5	125	2	2	1	5
ENG512	Wind Energy systems	2	3	5	125	2	2	1	5
ENG571	Power Electronics	2	3	5	125	2	2	1	5
ENG551	Environmental Pollution and Management	2	2	3	75	2	1		3
ENG553	Power Plant Technology	2	3	5	125	2	2	1	5
ENG555	Modeling and simulations of RE systems (Elect. & Thermal)	N/A	2	3	75	1		3	4
ENG573	Electrical Drives	2	3	5	125	2	2	1	5
ENG652	Safety and Environment risk analysis	2	3	5	125	2	2		4
ENG423	Fluid Mechanics 2	2	3	5	125	2	2	1	5
ENG421	Thermodynamics 2	2	3	5	125	2	2	1	5
ENG443	Mechatronics and Robotics for Renewable Energy	2	2	3	75	2	1		3
ENG432	Structure and stress analysis	2	2	3	75	2	1		3
ENG521	Combustion and Fuels	2	3	4	100	2	2		4
ENG513	Solar thermal energy systems 1	2	3	5	125	2	2	1	5
ENG554	Energy efficiency and management	2	3	5	125	2	2		4
ENG514	Fuel Cell and Hydrogen Technology	2	3	5	125	2	2		4
ENG543	Data acquisition and sensors	2	3	4	100	2	2		4
ENG611	Solar thermal energy systems 2	2	3	5	125	2	2	2	6
ENG621	Refrigeration and air conditioning systems (HVAC)	2	3	5	125	2	1	2	5
ENG622	Fundamentals of Turbomachinery	2	3	5	125	2	2		4
ENG623	Water desalination and treatment technologies	2	3	5	125	2	2		4
ENG6XX	Elective course pool 1 (1 module)		3	5	125				
ENG6XX	Elective course pool 2 (2 modules)		6	10	250				
ENG691	Graduation Research Project	N/A	6	10	250				0
ENG692	Graduation Design Project	N/A	6	10	250				0
Total			105	169	4225	58	50	24	134

Elective Pool 1									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENG616	Geothermal and bioenergy systems	2	3	5	125	2	2		4
ENG681	Hydrology and Hydropower Systems	2	3	5	125	2	2		4
ENG625	Heat Transfer Equipment	2	3	5	125	2	2		4
ENG682	Pipeline system design and analysis	2	3	5	125	2	2		4

Elective Pool 2									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENG683	Basics of pneumatic and hydraulic systems	2	3	5	125	2	2		4
ENG654	Lifecycle assessment of renewable energy systems	2	3	5	125	2	2		4
ENG617	Concentrated solar power generation	2	3	5	125	2	2		4
ENG655	Compressed air system energy optimization	2	3	5	125	2	2		4
ENG626	Steam system energy optimization	2	3	5	125	2	2		4
ENG627	Pump system energy optimization	2	3	5	125	2	2		4
ENG656	Sustainable energy economics	2	3	5	125	2	2		4
ENG628	Turbomachinery Applications	2	3	5	125	2	2		4
ENG629	Advanced Air Conditioning Systems	2	3	5	125	2	2		4

2- Electrical Engineering - Renewable Energy Program

Electrical Engineering - Renewable Energy Program Graduate attributes:

In addition to the general Engineering attributes mentioned above, the Electrical Engineering - Renewable Energy engineer should be able to:

1. Apply his knowledge in Electrical Machinery Energy & Storage Techniques and Solar Energy Systems.
2. Apply/Adopt system analysis tools in Renewable Energy Engineering, Electrical Power Plants and Power Generation and Conversion Systems
3. Use and/or develop computer software, necessary for design, communication and visualization of industrial systems and projects.
4. Analyze, synthesize, and design open-ended Renewable Energy Engineering systems, understand the associated uncertainties, and evaluate the economic impact.
5. Contribute in the activities of Modelling and Simulation for Renewable Energy Systems, Energy Harvesting Technologies, Network Interfacing of Renewable Resources, Energy Markets, Laws and Economics.
6. Use and/or develop computer software, necessary for the design, analysis, interpretation, and solving problems in Special Topics in Renewable Energy, Design of Electrical & Renewable Energy System.
7. Find better lower-cost methods used in Process Design and Simulation.
8. Lead or supervise a group of designers or technicians and other work force.

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level), the Electrical Engineering - Renewable Energy graduate must be able to (D-Level):

- D1. The scientific and engineering principles underpinning energy and sustainability in the context of electrical power engineering.
- D2. Advanced concepts in specialist areas of electric power networks, such as energy generation, transmission and distribution engineering.
- D3. Specify and design aspects of electrical power systems with attention to a wide range of outcomes, including technical, practical, efficiency/sustainability and security.
- D4. Evaluate energy and sustainability projects with regard to environmental Impact, safety and reliability.
- D5. Find, read, understand and explain literature related to advanced and specialised areas of electrical power engineering, including scientific publications, industrial documentation, standards, ethical, legal and environmental guidance.

D6. Plan and manage a research project involving an advanced and specialised aspect of electrical power engineering, using appropriate state of the art techniques, technologies and/or tools.

D7. Use specialist tools for the design, realisation and evaluation of electrical power systems.

To achieve these Competencies, a set of courses must be completed as an Electrical Engineering - Renewable Energy Requirement. These courses are listed in the table below.

Reference: University of Southampton MSc Energy and Sustainability with Electrical Power Engineering

Electrical Engineering - Renewable Energy Program List of Course

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGS21	Thermodynamics 1	2	3	5	125	2	2	1	5
ENG424	Heat and mass transfer	2	3	5	125	2	2	1	5
ENG442	Measurements Lab and statistics	2	3	4	100	2	1	2	5
ENGS11	Introduction to Renewable Energy	2	3	5	125	2	2		4
ENGS12	Computers and Programming for renewable energy	2	2	3	75	1		3	4
ENG471	Electrical Machines 1	2	3	4	100	2	2	1	5
ENG441	Automatic Control 1	2	3	4	100	2	2	1	5
ENG451	Energy Conversion and Storage Systems	2	3	5	125	2	2	1	5
ENG431	Materials for Renewable Energy 2	2	2	4	100	2	1	1	4
ENG511	Solar Energy: PV systems	2	3	5	125	2	2	1	5
ENG512	Wind Energy systems	2	3	5	125	2	2	1	5
ENG571	Power Electronics	2	3	5	125	2	2	1	5
ENG551	Environmental Pollution and Management	2	2	3	75	2	1		3
ENG553	Power Plant Technology	2	3	5	125	2	2	1	5
ENG555	Modeling and simulations of RE systems (Elect. & Thermal)	N/A	2	3	75	1		3	4
ENG573	Electrical Drives	2	3	5	125	2	2	1	5
ENG652	Safety and Environment risk analysis	2	3	5	125	2	2		4
ENG461	Electric Circuits 2	2	3	5	125	2	2	1	5
ENG462	Electric Energy Installation and Systems	2	2	3	75	2		2	4
ENG444	Logic Design	2	3	5	125	2	2	1	5
ENG472	Electrical Machines 2	2	2	3	75	2	1	1	4
ENG561	Electrical Power Transmission	2	3	4	100	2	2		4
ENG541	Automatic Control 2	2	3	5	125	2	2	1	5
ENG542	Design, Maintenance, Economics and Control of PV system	2	3	5	125	2	2		4
ENG562	Power system analysis	2	3	5	125	2	2		4
ENG572	Network Interfacing of Renewable Resources and smart grid	2	3	4	100	2	2		4
ENG612	Selected Topics in Renewable energy	2	3	5	125	2	2		4
ENG661	Electrical Distribution systems	2	3	5	125	2	1	2	5
ENG651	High Voltage Engineering	2	3	5	125	2	2		4
ENG662	Power system Protection	2	3	5	125	2	2		4
ENG6XX	Elective course pool 1 (1 module)	2	3	5	125				
ENG6XX	Elective course pool 2 (2 modules)	2	6	10	250				
ENG691	Graduation Research Project	N/A	6	10	250				0

ENG692	Graduation Design Project	N/A	6	10	250				0
Total			99	159	3975	58	49	27	134

Elective Pool 1

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENG653	Energy Efficiency in Electrical Systems	2	3	5	125	2	2		4
ENG657	Energy Economics	2	3	5	125	2	2		4
ENG671	Power Quality	2	3	5	125	2	2		4
ENG672	Wind Energy Converters	2	3	5	125	2	2		4
ENG613	Advanced Photovoltaic	2	3	5	125	2	2		4

Elective Pool 2

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENG641	Optimization algorithms and Machine Learning in Electrical Power Engineering	2	3	5	125	2	2		4
ENG673	FACTS and HVDC in Electric Power Systems	2	3	5	125	2	2	2	6
ENG674	Modulation of Power Electronic Converters	2	3	5	125	2	2		4
ENG642	Model Predictive Control	2	3	5	125	2	2		4
ENG663	Computer Applications in Power Systems	2	3	5	125	2	2	2	6
ENG614	Hydropower- Technology, Economy, Sustainability	2	3	5	125	2	2		4
ENG624	Water Desalination	2	3	5	125	2	2		4
ENG615	Fuel Cell Technologies	2	3	5	125	2	2	1	5
ENG664	Smart Grid Fundamentals	2	3	5	125	2	2		4

3-Biochemical Engineering Program

Biochemical Engineering Program Graduate attributes:

In addition to the general Engineering attributes mentioned above, the Biochemical engineer should be able to:

1. Apply his knowledge in Fundamentals of microbiology, Biomass and Bioremediation of environmental pollutant.
2. Apply/Adopt system analysis tools in Biochemical Engineering, Green Fuel and Biofuel and Nano-biotechnology and Energy.
3. Use and/or develop computer software, necessary for design, communication and visualization of industrial systems and projects.
4. Analyze, synthesize, and design open-ended Nanotechnology Biochemical systems, understand the associated uncertainties, and evaluate the economic impact.
5. Contribute in the activities of Bioenergy Modeling and Simulation, Climate Change and Bioenergy, Economics of Bioenergy, Management for Technology and projects.
6. Use and/or develop computer software, necessary for the design, analysis, interpretation, and solving problems in Special Topics in Bioenergy, Principles of process plant design and Bioreactor Design.
7. Find better lower-cost methods used in Process Design and Simulation.
8. Lead or supervise a group of designers or technicians and other work force.

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) , the Biochemical Engineering Program graduate must be able to (C-Level):

- C1. Knowledge of the principles and practice of biochemical engineering in the industrial biotechnology and biopharmaceutical industries.
- C2. Understand strategy design and development, techniques and frameworks for crafting strategic options, competitive challenges of a global market environment, implementation of strategy and change.
- C3. Professional and ethical responsibilities including the regulatory framework and the global and social context of biochemical engineering.
- C4. Hands-on experience of facility and process design for either the industrial biotechnology and biopharmaceutical industries.
- C5. Produce solutions to problems through the application of biological and engineering knowledge and understanding.

To achieve these Competencies, a set of courses must be completed as a Biochemical Engineering Requirement. These courses are listed in the table below.

Reference: University of Sheffield MSc Biochemical Engineering

Biochemical Engineering Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BIO543	Bioproduct Design	2	3	5	125	2	2		4
BIO651	Occupational, Health and Safety Engineering	2	3	5	125	2	2		4
BIO611	Valorization of Waste and Biomass	2	3	5	125	2	2		4
BIO631	Renewable Water Desalination Technologies	2	3	5	125	2	2		4
BIO632	Biolubricants for Tribological Engineering	2	3	5	125	2	2		4
BIO6XX	Elective Course Pool 1 (2 modules)		6	10	250				
BIO6XX	Elective Course Pool 2 (2 modules)		6	10	250				
BIO691	Graduation Research Project	N/A	6	10	250				0
BIO692	Graduation Design Project	N/A	6	10	250				0
Total			39	65	1625	10	10	0	20

Elective Pool 1

Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BIO633	Fundamentals of Corrosion Science	2	3	5	125	2	2	2	6
BIO652	Climate Change and Bioenergy	2	3	5	125	2	2		4
BIO634	Fermentation Engineering	2	3	5	125	2	2		4
BIO641	Process Design and Simulation	2	3	5	125	2	2		4
BIO642	Principles of plant design	2	3	6	150	2	2	--	4

Elective Pool 2

Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BIO653	Environmental Risk Analysis	2	3	5	125	2	2		4
BIO635	Food Processing Equipment	2	3	5	125	2	2		4
BIO636	Process Plant Operation	2	3	5	125	2	2		4
BIO643	Advanced Control Systems	2	3	5	125	2	2		4
BIO654	Circular Economy	2	3	5	125	2	2	2	4

4-Petroleum Engineering and Gas Technology Program

Petroleum Engineering and Gas Technology Program Graduate attributes:

In addition to the general Engineering attributes mentioned above, the Petroleum Engineering and Gas Technology engineer should be able to:

1. Apply his/her knowledge in petroleum exploration and well construction (drilling and completion) production and reservoir engineering, well services and enhanced oil recovery methods.
2. Apply/Adopt system analysis tools in well design, reservoir simulation, production optimization and well services interpretation, and drilling optimization.
3. Use and/or develop computer software, necessary for design, communication and visualization of industrial systems and projects.
4. Analyze, synthesize, and design open-ended petroleum engineering systems, understand the associated uncertainties, and evaluate the economic impact.
5. Contribute in the activities of petroleum exploration and drilling, production and reservoir engineering, formation evaluation and well logging (well services) enhanced oil recovery methods, and projects.
6. Use and/or develop computer software, necessary for the design, analysis, interpretation, and solving problems in petroleum exploration and drilling, production and reservoir engineering, well services, management services.
7. Find better lower-cost methods used in enhanced oil recovery (EOR).
8. Lead or supervise a group of designers or technicians and other work force.

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) and the competencies for the General Electrical Engineering Discipline (B-Level), the Petroleum Engineering and Gas Technology Program graduate must be able to (C-Level):

- C1. Operate effectively as petroleum engineer.
- C2. Students promote the ethos of synergy within the integrated, multidisciplinary teams of petroleum engineers and petroleum geoscientists in the exploration and development of oil and gas resources.
- C3. Students are trained in best current industry workflows and work practices, in order to be able to work effectively, either independently or as a member of an integrated team.
- C4. The obtaining of oil from an oil reservoir - a quantitative demonstration of porosity, permeability, relative permeability, entrapment etc.
- C5. Porosity and permeability determinations - a demonstration of the processes and difficulties involved in measuring these parameters.

C6. Rock resistivity - shows the basic principles of rock resistivity using saline solutions.

C7. Phase Flow - a study of horizontal, vertical and inclined 2- phase flow patterns.

To achieve these Competencies, a set of courses must be completed as a Petroleum Engineering and Gas Technology Requirement. These courses are listed in the table below.

Reference: Imperial College London MSc Petroleum Engineering

Petroleum Engineering and Gas Technology Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
PET541	Oil and Gas Production 1	2	3	5	125	2	2	1	5
PET552	Unit Operation	2	3	5	125	2	2	1	5
PET553	Natural Gas Processing	2	3	5	125	2	2		4
PET631	Enhanced Hydrocarbon Recovery	2	3	5	125	2	2		4
PET632	Gas Condensate Reservoir Engineering	2	3	5	125	2	2		4
PET633	Natural Gas Reservoir Engineering	2	3	5	125	2	2	2	6
PET641	Oil and Gas Production 2	2	3	5	125	2	1	2	5
PET621	Drilling Engineering II	2	3	5	125	2	2		4
PET634	Field Development and Reservoir Management	2	3	5	125	2	2		4
PET6XX	Elective course Pool 1 (2 modules)		6	10	250				
PET691	Graduation Research Project	N/A	6	10	250				0
PET692	Graduation Design Project	N/A	6	10	250				0
Total			45	75	1875	18	17	6	41

Elective Pool 1									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
PET622	Rock Mechanics for Drilling and Completion	2	3	5	125	2	2		4
PET611	Advanced Production Logging	2	3	5	125	2	2		4
PET642	Well Intervention and Stimulation	2	3	5	125	2	2		4
PET651	Advanced Petroleum Refining Engineering	2	3	5	125	2	2		4
PET623	Special Topics in Advanced Drilling	2	3	5	125	2	2		4
PET635	Nanotechnology and its application oil & gas	2	3	5	125	2	2		4
PET652	Energy Conservation	2	3	5	125	2	2		4
PET653	Automatic Control in Chemical Operations	2	3	5	125	2	2		4
PET643	Well Control	2	3	5	125	2	2		4
PET624	Horizontal Oil Well Drilling Technology	2	3	5	125	2	2		4
PET612	Petroleum geoscience	2	3	5	125	2	2		4

5- Architecture Engineering - Sustainable Building Design Program

Architecture Engineering - Sustainable Building Design Program Graduate attributes:

In addition to the general Engineering attributes mentioned above, the Architecture Engineering - Sustainable Building Design Engineer should be able to:

1. Apply his knowledge in sustainability and its role in architecture. This includes knowledge of the historical and cultural context of sustainability and environmental design.
2. Analyze, synthesize, and Design buildings that have a positive impact on their environment. This includes the ability to develop sustainable solutions for new and existing buildings and evaluate the economic impact.
3. Apply/Adopt construction materials that won't contribute to landfills and systems and equipment with high energy-efficiency ratings. focusing on resource efficiency, such as using locally produced materials and selecting durable materials that won't need to be replaced.
4. Use and/or develop Digital tools and use artificial intelligence AI, necessary for for the design, analysis, interpretation, and solving problems in Special Topics in Sustainable Building Design.
5. Contribute in improving building energy efficiency and providing healthy indoor air. This includes the use of natural ventilation, capitalizing on natural light, and incorporating solar energy and water-conservation.
6. Apply/Adopt the technical and scientific understanding required to develop sustainable solutions used in Building Information Modelling.
7. Lead or supervising different work force.

According to the National Academic Reference Standards (NARS-2018), each discipline graduate has to meet specific competences.

In addition to the Competencies for all Engineering Programs (A-Level) and the competencies for the General Architecture Engineering Discipline (B-Level), the Architecture Engineering - Sustainable Building Design Program graduate must be able to (C-Level):

- C1. Demonstrate a detailed knowledge of the theories, concepts and principles of architecture and environmental design with specific reference to the design process, climatic context and historical development.
- C2. Demonstrate a detailed knowledge of energy systems and fluxes in the built environment and the relationship between conventional building services, low-energy practices and climatic applicability of passive design strategies for the provision of comfort in buildings.
- C3. Develop more sophisticated techniques for the conceptualization and embedding of bioclimatic, cultural and social theories and practices in the architectural design and refinement of the design process and representation.

- C4. Demonstrate fluent and systematic knowledge of the theories, concepts and principles of architecture and environmental design with specific reference to the application and integration of such principles to the architectural design process.
- C5. Demonstrate systematic and proficient knowledge of the architectural integration of environmental strategies and low-energy systems towards energy demand reduction and of methods for the quantification of building performance.
- C6. Formulate and articulate briefs and design proposals which embed principles of environmental and bioclimatic design conceptualising a variety of physical and socio- cultural contexts and being able to communicate and exemplify design through a number of representation and making skills.

To achieve these Competencies, a set of courses must be completed as an Architecture Engineering - Sustainable Building Design Requirement. These courses are listed in the table below.

Reference: University of Westminster BSc Architecture and Environmental Design

Architecture Engineering - Sustainable Building Design Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAE551	New technologies and Sustainable Architecture Future	2	2	3	75	2			2
SAE542	Daylighting	2	3	5	125	2	1	1	4
SAE552	Building Information Modelling	2	2	3	75	1	2		3
SAE553	Integrated Building Design	2	3	5	125	2	2		4
SAE544	Modelling & Simulation for Sustainable Architecture	N/A	3	5	125	2		3	5
SAE6XX	Elective Course Pool 1 (2 modules)		6	8	200				
SAE6XX	Elective Course Pool 2 (2 modules)		6	10	250				
SAE6XX	Elective Course Pool 3 (2 modules)		6	8	200				
SAE691	Graduation Research Project	N/A	4	6	150				0
SAE692	Graduation Design Project	N/A	10	18	450	2		8	10
Total			45	71	1775	11	4	12	28

Elective Pool 1									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAE622	Environmental Interior Design & Refurbishment	2	3	4	100	2	2		4
SAE623	Life Cycle and Supply Chain Environmental Assessment	2	3	4	100	2	2		4
SAE641	Introduction to Renewable Energy Systems	2	3	4	100	2	2		4
SAE642	Complex Building Energy Modelling	2	3	4	100	2	2		4

Elective Pool 2									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAE643	Energy Systems	2	3	5	125	2	2	1	5
SAE644	Energy management and controls	2	3	5	125	2	2		4
SAE645	Solar Energy	2	3	5	125	2	2	1	5
SAE646	Building Services and Operations	2	3	5	125	2	2		4

Elective Pool 3									
Code	Elective Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAE624	Sustainable Landscapes	2	3	4	100	2	2		4
SAE625	Environmental Sustainability	2	3	4	100	2	2		4
SAE626	Partnerships for Sustainable Futures	2	3	4	100	2	2		4
SAE627	Water and Waste Sustainable Management	2	3	4	100	2	2		4

Part E: Details of the Offered Minor Programs

1- Mechanical Engineering - Renewable Energy

Mechanical Engineering - Renewable Energy Minor Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGM31	Materials for Renewable Energy	2	3	5	125	2	1	1	4
ENGM21	Combustion and Fuels	2	3	4	100	2	2		4
ENGM11	Solar thermal energy systems	2	3	5	125	2	2	1	5
ENGM12	Wind Energy systems	2	3	5	125	2	2	1	5
ENGM22	Refrigeration and air conditioning systems (HVAC)	2	3	5	125	2	1	2	5
ENGM51	Power Plant Technology	2	3	5	125	2	2	1	5

2- Electrical Engineering - Renewable Energy

Electrical Engineering - Renewable Energy Minor Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
ENGM71	Electrical Machines	2	3	5	125	2	2	1	5
ENGM61	Electrical Power Transmission	2	3	4	100	2	2		4
ENGM11	Solar Energy: PV systems	2	3	5	125	2	2	1	5
ENGM12	Wind Energy systems	2	3	5	125	2	2	1	5
ENGM62	Power system analysis	2	3	5	125	2	2		4
ENGM51	High Voltage Engineering	2	3	5	125	2	2		4

3-Biochemical Engineering Program

Biochemical Engineering Minor Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
BIOM21	Introduction to Biochemical Engineering	2	3	5	125	2	2		4
BIOM11	Biofuels	2	3	5	125	2	1	1	4
BIOM12	Biorenewable Energy and Hydrogen Production	2	3	5	125	2	2	1	5
BIOM31	Bioremediation	2	3	5	125	2	1	2	5
BIOM61	Valorization of Waste and Biomass	2	3	5	125	2	2		4
BIOM32	Renewable Water Desalination Technologies	2	3	5	125	2	2		4

4-Petroleum Engineering and Gas Technology Program

Petroleum Engineering and Gas Technology Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
PETM31	Reservoir Rock and Fluid Properties	2	3	5	125	2	2	2	6
PETM61	Petroleum Geology	2	3	5	125	2	2	2	6
PETM62	Formation Evaluation	2	3	5	125	2	2	2	6
PETM32	Reservoir Engineering	2	2	4	100	2	1		3
PETM41	Production Engineering	2	3	5	125	2	2	2	6
PETM21	Drilling Engineering	2	2	3	75	2	1		3
PETM71	Refinery Engineering	2	2	3	75	2	1		3

5- Architecture Engineering - Sustainable Building Design Program

Architecture Engineering - Sustainable Building Design Program List of Courses

Code	Course Title	Exam Time (H)	Cr & SWL			Contact Hours			
			CH	ECTS	SWL	Lec	Tut	Lab	TT
SAEM11	Introduction to architectural design and graphics	3	5	9	225	3	--	5	8
SAEM12	Digital Representation tools in Architecture	N/A	2	3	75	1		3	4
SAEM13	Architecture Surveying	2	2	4	100	1	1	2	4
SAEM31	Sustainable Tectonics (1)	3	3	5	125	2		3	5
SAEM14	Sustainable Architecture style, time, & place (1)	2	2	3	75	2			2
SAEM21	Eco Design (1)	N/A	4	7	175	2		6	8

Part F: Course Pool

All the programs use courses from the Faculty Departments. There are 5 departments at the Faculty of Energy and Environmental Engineering, The British University in Egypt. They are listed in the following table:

Field	#	Department	Courses
Language	1	Language	3
Basic Science	2	Basic Science	23
Mechanical Engineering	3	Energy Engineering	126
Electrical Engineering			
Chemical Engineering	4	Bioenergy Engineering	51
Petroleum Engineering	5	Petroleum Engineering & Gas Technology	53
Architectural Engineering	6	Sustainable Architecture Engineering	50
Total number of courses			306

1-Modules Delivered by the Language Department

Code	Course Title	Cr & SWL			Contact Hours				Classification			
		CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
LNGS11	English for Academic Purposes	3	4	100	3			3	X			
LNGS12	English and Academic Writing	3	4	100	3			3	X			
LNG411	Technical Report Writing and Communication	2	3	75	2			2	X			
		8	11	275	8	--	--	8				

Course Description of Modules Delivered by the Basic Language Department to All Programs

LNGS11	English for Academic Purposes			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Reading strategies- skimming and scanning for information, identifying main and supporting ideas, understanding context clues, evaluating texts and drawing inferences., • Listening for gist, for details and for note taking • Writing academically: coherence and cohesion, academic register and style, summarising • Developing oral communication skills, role play and presenting ideas in short talks. 				
Used in Program / Level				
Program Name or requirement				Study Level
University Requirement				S
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Oral Exam	Final Exam	
20%	20%	10%	50%	

LNGS12	English and Academic Writing			3
Prerequisites	LNGS11			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Reading critically and annotating texts to take notes., • Process of writing: planning, synthesising, integrating sources, referencing, proofreading and editing., • Developing presentation skills and responding to questions. 				
Used in Program / Level				
Program Name or requirement				Study Level
University Requirement				S
Assessment Criteria				
Individual presentation	In-Class Assessment	Essay	Final Exam	
20%	20%	60%	0%	

LNG411	Technical Report Writing and Communication			2
Prerequisites	LNGS12			
Number of weekly Contact Hours				

Lecture	Tutorial		Laboratory
2	0		0
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to technical reports • Identification of the problem • Identification of audiences and readers • Mechanisms of technical writing, and how to write good technical reports • What is technical writing • Relation between sender and receiver • Ethical considerations • How to write an effective paragraph • How to develop ideas • Technical definitions • Description of a mechanism • Description of a process • Analysis of written paragraphs • Writing proposals • Laboratory and project reports. 			
Used in Program / Level			
Program Name or requirement			Study Level
University Requirement			4
Assessment Criteria			
Lab coursework	Project	In-Class Assessment	Final Exam
40%	60%	0%	0%

2-Modules Delivered by the Basic Science Department

	Code	Course Title	Cr & SWL			Contact Hours				Classification			
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
All	BSCS31	Selected Topics in Contemporary Issues	2	3	75	2	1		3	X			
	BSCS11	Mathematics 1	3	5	125	2	2		4		X		
	BSCS21	Physics	3	5	125	2	2	2	6		X		
REN	BSC411	Calculus	3	5	125	2	2		4		X		
	BSCS12	Mathematics 2	3	5	125	2	2		4		X		
	BSC412	Differential equations and Numerical solutions	3	5	125	2	2	1	5		X		
BIO	BSCS12	Mathematics 2	3	5	125	2	2		4		X		
	BSC411	Calculus	3	5	125	2	2		4		X		
	BSC413	Differential Equations	3	5	125	2	2		4		X		
	BSC512	Probability and Statistics	3	5	125	2	2		4		X		
	BSC511	Numerical Methods	2	3	75	2	1	1	4		X		
PET	BSCS12	Mathematics 2	3	5	125	2	2		4		X		
	BSC411	Calculus	3	5	125	2	2		4		X		
	BSC413	Differential Equations	3	5	125	2	2		4		X		
	BSC511	Numerical Methods	2	3	75	2	1	1	4		X		
SAE	BSC513	Statistics, Numerical Methods	3	5	125	2	2	1	5		X		

Course Description of Modules Delivered by the Basic Science Department to All Programs

BSCS31	Selected Topics in Contemporary Issues			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
Hot contemporary topics related to society, resources, science, natural environment: Notions, Approaches, Cause Roots, Consequences, Roles and Responsibilities of Engineers				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement			S	
Assessment Criteria				
Project	In-Class Assessment	Practical Exam	Final Exam	
20%	20%	0%	60%	

BSCS11	Mathematics 1			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Functions: definition and algebra of functions, Rational functions and trigonometric functions. • Trigonometric identities, Graphs of functions. • The limit of a function: definition and techniques for finding limits, One-sided limits, limits at infinity, Infinite limits. • Continuity of a function: definition; types of discontinuity. • The derivative of a function: definition; the power rule. • Algebra of derivatives, The chain rule, Derivatives of trigonometric functions. • The mean value theorem, Increasing and decreasing functions, Local extreme values. • Indeterminate forms. • Definite integral: definition, area and integration, Properties of the definite integral. • The fundamental theorem of integral calculus, substitution in definite integrals, Transcendental functions: the logarithm and exponential functions and their derivatives. • Inverse trigonometric and hyperbolic functions and their derivatives and integrals. • Techniques of integration: integration by parts; trigonometric integrals, Integrals of rational functions, Reduction formulae. 				

<ul style="list-style-type: none"> Improper integrals. 			
Used in Program / Level			
Program Name or requirement			Study Level
Faculty Requirement			S
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSCS21	Physics		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to electricity and magnetism covering the electric field. Coulomb's law. The idea of scalar and vector field and the electric field. Gauss's law, Ampere's Law. Electrostatic potential, Capacitors and dielectrics, DC circuit and resistance. Kirchhoff's rules, Combination of resistors. Magnetic fields, Inductors Applications. AC circuits-LC, LR, and LCR circuits. 			
Used in Program / Level			
Program Name or requirement			Study Level
Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

Course Description of Modules Delivered by the Basic Science Department to the
Mechanical and Electrical Engineering Renewable Energy Programs

BSCS12	Mathematics 2			3
Prerequisites	BSCS11			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Polar coordinates; area in polar coordinates; curves given parametrically. • Arc length. • The area of a surface of revolution; volume of solids of revolution. • Sequences; convergent or divergent series; positive terms series; convergence tests; alternating series and absolute convergence; power series. • Maclaurin and Taylor series. • Matrices: algebraic operations on matrices; Powers of a matrix, Transpose of a matrix, The identity matrix and the null matrix, Determinants and their properties, Inverse of a matrix. • Eigenvalues and eigenvectors of a matrix, Diagonalization theorem, Linear operators on vectors and their, geometric interpretation, The inverse operator, Systems of linear equations and their solutions. • Applications of linear systems, Algebraic operations on complex numbers, Powers of a complex number and De Moivre's theorem, The nth roots of unity. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Faculty Requirement Elective				S
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BSC411	Calculus			3
Prerequisites	BSCS12			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Functions of several variables. • Partial and directional derivatives. • Tangent planes. • Normal lines. • Double, triple, line and surface integrals. • Cylindrical and spherical coordinates systems. • Jacobian of a transformation. 				

<ul style="list-style-type: none"> • Differentiation of vector functions. • Surfaces gradient fields. • Divergence and curl of vector fields. • Green's theorem. • Flux of a vector field. • Gauss divergence theorem. • Stoke's theorem. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSC412	Differential equations and Numerical solutions		3
Prerequisites	BSCS12		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • First order differential equations. Mathematical models and Numerical methods involving first order differential equations. Second order differential equations. • La Place Transform. Numerical Methods. • Interpolation and polynomial approximation using Lagrange. • Newton divided differences. • Newton forward and backward. • Central differences. • Least square regression. • Numerical integration using trapezoidal and Simpson. • Partial differential equations. Series solution to differential equations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	20%	20%	60%

Course Description of Modules Delivered by the Basic Science Department to the
Biochemical Engineering Program

BSCS12	Mathematics 2			3
Prerequisites	BSCS11			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Polar coordinates; area in polar coordinates; curves given parametrically. • Arc length. • The area of a surface of revolution; volume of solids of revolution. • Sequences; convergent or divergent series; positive terms series; convergence tests; alternating series and absolute convergence; power series. • Maclaurin and Taylor series. • Matrices: algebraic operations on matrices; Powers of a matrix, Transpose of a matrix, The identity matrix and the null matrix, Determinants and their properties, Inverse of a matrix. • Eigenvalues and eigenvectors of a matrix, Diagonalization theorem, Linear operators on vectors and their, geometric interpretation, The inverse operator, Systems of linear equations and their solutions. • Applications of linear systems, Algebraic operations on complex numbers, Powers of a complex number and De Moivre's theorem, The nth roots of unity. 				
Used in Program / Level				
Program Name or requirement				Study Level
Biochemical Faculty Requirement Elective				S
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BSC411	Calculus			3
Prerequisites	BSCS12			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Functions of several variables. • Partial and directional derivatives. • Tangent planes. • Normal lines. • Double, triple, line and surface integrals. • Cylindrical and spherical coordinates systems. • Jacobian of a transformation. • Differentiation of vector functions. 				

<ul style="list-style-type: none"> • Surfaces gradient fields. • Divergence and curl of vector fields. • Green's theorem. • Flux of a vector field. • Gauss divergence theorem. • Stoke's theorem. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSC413	Differential Equations		3
Prerequisites	BSCS12		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • First order differential equations. • Linear, Separable, Bernoulli and Cauchy-Euler equations. • Exact equations and integrating factors. • Second order linear differential equations. • Homogeneous equations with constant coefficients. • Non-homogeneous equations using the method of differential operators and the method of variation of parameters. • Second order linear differential equations with variable coefficients. • Series solution of differential equations. • Laplace transforms and inverse laplace transform. • Convolution theorem. • Solution of initial and boundary value problems using laplace transform. • Special functions, gamma and beta functions. Partial differential equations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSC511	Numerical Methods		2
Prerequisites	BSC413		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	

Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Types of errors. • Algorithms and convergence. • Solution of nonlinear equations in one variable using bisection and Newton-Raphson. • Solution of linear systems using iteration methods, the Jacobi, and the Gauss-seidel. • Interpolation and polynomial approximation using Lagrange. • Newton divided differences. • Newton forward and backward. • Central differences. • Least square regression. • Numerical integration using trapezoidal and Simpson. • Numerical solution of ordinary differential equations using Euler's method, Runge-Kutta, and multi-step methods. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			5
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	20%	20%	60%

BSC512	Probability and Statistics		3
Prerequisites	BSC511		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Statistics: The Collection, organization and representation of numerical data, measures of central tendency, dispersion, kurtosis and skewing. • Elements of probability; main probability distributions (continuous, normal, binomial, exponential and Poisson), significance testing and confidence intervals, quality control, chi square and F distributions, curve fitting, regression and correlation, mathematical expectation, analysis of variance. . • Theory of probability: theory of sets, conditional probabilities, random variables, probability distribution functions, random distribution functions, continuous and discrete distribution functions. • Applications on biochemical engineering 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			5
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

Course Description of Modules Delivered by the Basic Science Department to the Petroleum Engineering & Gas Technology Program

BSCS12	Mathematics 2			3
Prerequisites	BSCS11			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Polar coordinates; area in polar coordinates; curves given parametrically. • Arc length. • The area of a surface of revolution; volume of solids of revolution. • Sequences; convergent or divergent series; positive terms series; convergence tests; alternating series and absolute convergence; power series. • Maclaurin and Taylor series. • Matrices: algebraic operations on matrices; Powers of a matrix, Transpose of a matrix, The identity matrix and the null matrix, Determinants and their properties, Inverse of a matrix. • Eigenvalues and eigenvectors of a matrix, Diagonalization theorem, Linear operators on vectors and their, geometric interpretation, The inverse operator, Systems of linear equations and their solutions. • Applications of linear systems, Algebraic operations on complex numbers, Powers of a complex number and De Moivre's theorem, The nth roots of unity. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Faculty Requirement Elective			S	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BSC411	Calculus			3
Prerequisites	BSCS12			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Functions of several variables. • Partial and directional derivatives. • Tangent planes. • Normal lines. • Double, triple, line and surface integrals. • Cylindrical and spherical coordinates systems. • Jacobian of a transformation. 				

<ul style="list-style-type: none"> • Differentiation of vector functions. • Surfaces gradient fields. • Divergence and curl of vector fields. • Green's theorem. • Flux of a vector field. • Gauss divergence theorem. • Stoke's theorem. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSC413	Differential Equations		3
Prerequisites	BSCS12		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • First order differential equations. • Linear, Separable, Bernoulli and Cauchy-Euler equations. • Exact equations and integrating factors. • Second order linear differential equations. • Homogeneous equations with constant coefficients. • Non-homogeneous equations using the method of differential operators and the method of variation of parameters. • Second order linear differential equations with variable coefficients. • Series solution of differential equations. • Laplace transforms and inverse laplace transform. • Convolution theorem. • Solution of initial and boundary value problems using laplace transform. • Special functions, gamma and beta functions. Partial differential equations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BSC511	Numerical Methods		2
Prerequisites	BSC413		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	

2		1		1	
Required SWL	75	Equivalent ECTS	3		
Course Content					
<ul style="list-style-type: none"> • Types of errors. • Algorithms and convergence. • Solution of nonlinear equations in one variable using bisection and Newton-Raphson. • Solution of linear systems using iteration methods, the Jacobi, and the Gauss-seidel. • Interpolation and polynomial approximation using Lagrange. • Newton divided differences. • Newton forward and backward. • Central differences. • Least square regression. • Numerical integration using trapezoidal and Simpson. • Numerical solution of ordinary differential equations using Euler's method, Runge-Kutta, and multi-step methods. 					
Used in Program / Level					
Program Name or requirement				Study Level	
Petroleum Faculty Requirement Elective				5	
Assessment Criteria					
Assignments & Projects	In-Class Assessment	Practical Exam		Final Exam	
0%	20%	20%		60%	

Course Description of Modules Delivered by the Basic Science Department to the Architecture Engineering - Sustainable Building Design Program

BSC513	Statistics, Numerical Methods			3
Prerequisites	BSCS11			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduce statistics and computer science as a tool for manipulating field data in architectural and planning problem solving processes. • Statistics, probability, random variables, distribution functions, estimation and significant tests. • Ordinary differential equations (ODEs) relevant to the analysis of engineering topics. • Computer science software and hardware, programs and programming, computer languages and applications. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Faculty Requirement Elective			5	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
20%	20%	0%	60%	

3-Modules Delivered by the Energy Engineering Department

	Code	Course Title	Cr & SWL			Contact Hours				Classification			
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
All	ENGS31	Materials Science	3	5	125	2	2	1	5		X		
BIO	ENG422	Fluid Mechanics 1	3	5	125	2	2	1	5		X		
	ENGS22	Thermodynamics	3	5	125	2	2	1	5				X
	ENGS34	Engineering Drawing and Workshop	2	3	75	1		3	4		X		
	ENG424	Heat and Mass Transfer	3	5	125	2	2	1	5				X
PET	ENG433	Stress Analysis	3	5	125	2	2		4		X		
	ENG422	Fluid Mechanics 1	3	5	125	2	2	1	5		X		
	ENGS34	Engineering Drawing and Workshop	2	3	75	1		3	4				
	ENGS72	Electrical Engineering for Petroleum Engineers	3	5	125	2	1	2	5				X
	ENG424	Heat and Mass Transfer	3	5	125	2	2	1	5				X
SAE	ENGS13	Engineering mechanics & Structural Analysis	3	5	125	2	2		4		X		
	ENG425	Fluids Mechanics and built environment	3	5	125	2	2	1	5		X		
	ENGS63	Electricity and the built environment	2	3	75	2		1	3		X		
	ENG522	Thermo-dynamics and heat transfer	2	3	75	2		2	4		X		
REN All	ENG552	Project Management	2	3	75	2	1		3	X			
	ENG556	Engineering Economics	2	3	75	2	1		3	X			
	ENGS32	Engineering Drawings and CAD Design	3	5	125	1		3	4		X		
	ENGS71	Electronics	3	5	125	2	2	1	5		X		
	ENG422	Fluid Mechanics 1	3	5	125	2	2	1	5		X		
	ENGS61	Electric Circuits 1	2	3	75	2	1	1	4		X		
	ENGS33	Workshop Technology and Solid Modeling	2	3	75	1		3	4		X		
	ENGS21	Thermodynamics 1	3	5	125	2	2	1	5				X
	ENG424	Heat and mass transfer	3	5	125	2	2	1	5				X
	ENG442	Measurements Lab and statistics	3	4	100	2	1	2	5				X
	ENGS11	Introduction to Renewable Energy	3	5	125	2	2		4				X
	ENGS12	Computers and Programming for renewable energy	2	3	75	1		3	4				X
	ENG471	Electrical Machines 1	3	4	100	2	2	1	5				X
	ENG441	Automatic Control 1	3	4	100	2	2	1	5				X
	ENG451	Energy Conversion and Storage Systems	3	5	125	2	2	1	5				X
	ENG431	Materials for Renewable Energy 2	2	4	100	2	1	1	4				X
	ENGS11	Solar Energy: PV systems	3	5	125	2	2	1	5				X
	ENGS12	Wind Energy systems	3	5	125	2	2	1	5				X
	ENGS71	Power Electronics	3	5	125	2	2	1	5				X
	ENGS51	Environmental Pollution and Management	2	3	75	2	1		3				X
	ENGS53	Power Plant Technology	3	5	125	2	2	1	5				X
	ENGS55	Modeling and simulations of RE systems (Elect. & Thermal)	2	3	75	1		3	4				X
	ENGS73	Electrical Drives	3	5	125	2	2	1	5				X
ENG652	Safety and Environment risk analysis	3	5	125	2	2		4				X	
REN MEC	ENG423	Fluid Mechanics 2	3	5	125	2	2	1	5				X
	ENG421	Thermodynamics 2	3	5	125	2	2	1	5				X
	ENG443	Mechatronics and Robotics for Renewable Energy	2	3	75	2	1		3				X
	ENG432	Structure and stress analysis	2	3	75	2	1		3				X
	ENG521	Combustion and Fuels	3	4	100	2	2		4				X
	ENGS13	Solar thermal energy systems 1	3	5	125	2	2	1	5				X
	ENGS54	Energy efficiency and management	3	5	125	2	2		4				X
	ENGS14	Fuel Cell and Hydrogen Technology	3	5	125	2	2		4				X

	ENG543	Data acquisition and sensors	3	4	100	2	2		4				X
	ENG611	Solar thermal energy systems 2	3	5	125	2	2	2	6				X
	ENG621	Refrigeration and air conditioning systems (HVAC)	3	5	125	2	1	2	5				X
	ENG622	Fundamentals of Turbomachinery	3	5	125	2	2		4				X
	ENG623	Water desalination and treatment technologies	3	5	125	2	2		4				X
	ENG691	Graduation Research Project	6	10	250				0				X
	ENG692	Graduation Design Project	6	10	250				0				X
	ENG616	Geothermal and bioenergy systems	3	5	125	2	2		4				X
	ENG681	Hydrology and Hydropower Systems	3	5	125	2	2		4				X
	ENG625	Heat Transfer Equipment	3	5	125	2	2		4				X
	ENG682	Pipeline system design and analysis	3	5	125	2	2		4				X
	ENG683	Basics of pneumatic and hydraulic systems	3	5	125	2	2		4				X
	ENG654	Lifecycle assessment of renewable energy systems	3	5	125	2	2		4				X
	ENG617	Concentrated solar power generation	3	5	125	2	2		4				X
	ENG655	Compressed air system energy optimization	3	5	125	2	2		4				X
	ENG626	Steam system energy optimization	3	5	125	2	2		4				X
	ENG627	Pump system energy optimization	3	5	125	2	2		4				X
	ENG656	Sustainable energy economics	3	5	125	2	2		4				X
	ENG628	Turbomachinery Applications	3	5	125	2	2		4				X
	ENG629	Advanced Air Conditioning Systems	3	5	125	2	2		4				X
	ENG461	Electric Circuits 2	3	5	125	2	2	1	5				X
	ENG462	Electric Energy Installation and Systems	2	3	75	2		2	4				X
	ENG444	Logic Design	3	5	125	2	2	1	5				X
	ENG472	Electrical Machines 2	2	3	75	2	1	1	4				X
	ENG561	Electrical Power Transmission	3	4	100	2	2		4				X
	ENG541	Automatic Control 2	3	5	125	2	2	1	5				X
	ENG542	Design, Maintenance, Economics and Control of PV system	3	5	125	2	2		4				X
	ENG562	Power system analysis	3	5	125	2	2		4				X
	ENG572	Network Interfacing of Renewable Resources and smart grid	3	4	100	2	2		4				X
	ENG612	Selected Topics in Renewable energy	3	5	125	2	2		4				X
	ENG661	Electrical Distribution systems	3	5	125	2	1	2	5				X
	ENG651	High Voltage Engineering	3	5	125	2	2		4				X
	ENG662	Power system Protection	3	5	125	2	2		4				X
	ENG691	Graduation Research Project	6	10	250				0				X
	ENG692	Graduation Design Project	6	10	250				0				X
	ENG653	Energy Efficiency in Electrical Systems	3	5	125	2	2		4				X
	ENG657	Energy Economics	3	5	125	2	2		4				X
	ENG671	Power Quality	3	5	125	2	2		4				X
	ENG672	Wind Energy Converters	3	5	125	2	2		4				X
	ENG613	Advanced Photovoltaic	3	5	125	2	2		4				X
	ENG641	Optimization algorithms and Machine Learning in Electrical Power Engineering	3	5	125	2	2		4				X
	ENG673	FACTS and HVDC in Electric Power Systems	3	5	125	2	2	2	6				X
	ENG674	Modulation of Power Electronic Converters	3	5	125	2	2		4				X
	ENG642	Model Predictive Control	3	5	125	2	2		4				X
	ENG663	Computer Applications in Power Systems	3	5	125	2	2	2	6				X
	ENG614	Hydropower- Technology, Economy, Sustainability	3	5	125	2	2		4				X
	ENG624	Water Desalination	3	5	125	2	2		4				X
	ENG615	Fuel Cell Technologies	3	5	125	2	2	1	5				X
	ENG664	Smart Grid Fundamentals	3	5	125	2	2		4				X
R E	ENGM31	Materials for Renewable Energy	3	5	125	2	1	1	4				X

	ENGM21	Combustion and Fuels	3	4	100	2	2		4				X
	ENGM11	Solar thermal energy systems	3	5	125	2	2	1	5				X
	ENGM12	Wind Energy systems	3	5	125	2	2	1	5				X
	ENGM22	Refrigeration and air conditioning systems (HVAC)	3	5	125	2	1	2	5				X
	ENGM51	Power Plant Technology	3	5	125	2	2	1	5				X
REN ELC Minor	ENGM71	Electrical Machines	3	5	125	2	2	1	5				X
	ENGM61	Electrical Power Transmission	3	4	100	2	2		4				X
	ENGM11	Solar Energy: PV systems	3	5	125	2	2	1	5				X
	ENGM12	Wind Energy systems	3	5	125	2	2	1	5				X
	ENGM62	Power system analysis	3	5	125	2	2		4				X
	ENGM51	High Voltage Engineering	3	5	125	2	2		4				X

Course Description of Modules Delivered by the Energy Engineering Department to All Programs

ENGS31	Material Science			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Brief introduction on: atomic structure of matter and crystal structure for all types of materials. • Comparison between structure of metals and alloys, polymers, and ceramics. • Iron carbon; Diagrams and types of steels: carbon steels, alloy steels, cast iron. • Some types of non-ferrous. • Metals and alloys. • Ceramics and composite materials. • Correlating materials properties with data learnt from phase diagrams and microstructure identification. • Basics of corrosion with relevance to type of material. • Case studies on materials used in petroleum engineering applications. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			S	
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

Course Description of Modules Delivered by the Energy Engineering Department to
Biochemical Engineering Programs

ENG422	Fluid Mechanics 1			3
Prerequisites	ENGS22			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to thermofluids engineering, • Fluid Properties, • Fluid Statics, • Basic Fluid Flow, • Laminar and Turbulent Flow in pipes • Continuity and Momentum Equations. • Pressure Losses. • Pipe Lines. • laminar and turbulent flow. • Solution of the Navier- Stokes equations and Examples. • Boundary layer flows • Pressure and fluid statics • Bernoulli and conservation of energy equations 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical Faculty Requirement Elective			4	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	20%	10%	60%	

ENGS22	Thermodynamics			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> - Terminology of thermodynamics. Thermodynamic properties, temperature scales and measurement, properties of pure substances. 1st, 2nd and 3rd laws of thermodynamics, reversible and irreversible processes, Carnot cycles, heat engines and thermal efficiency, First law applied to flow processes. - Entropy, the entropy and directional law of nature. Causes of entropy changes. Entropy changes in various thermodynamic processes. The third law of thermodynamics. Chemical equilibrium, phase equilibrium, thermodynamics of solutions, dilute and multi-component solutions, Gibbs 				

energy, equilibrium diagrams. Chemical reaction in combustion systems. Applications on the second law of thermodynamics.			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			S
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

ENGS34	Engineering Drawing and Workshop		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Engineering materials, primary production processes, cutting and non-cutting processes, inspection, measuring equipment, industrial organization and safety. Workshop: Identification and application of tools for: marking out a measuring, cutting, shaping, drilling, threading, tapping, finishing, dismantling, assembling, soldering and welding, casting, and forging. Using tools: hazards, techniques, and safety procedures. Engineering Drawing Techniques, Geometrical Constructions, Principles of Descriptive Geometry, Introduction to AutoCAD Software, Projection, Views and Sectional Views, Intersections, Dimensioning, Introduction to Steel Structural Drawings. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			S
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	40%	20%	40%

ENG424	Heat and Mass Transfer		3
Prerequisites	ENG422		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to heat transfer, heat conduction: Fourier's law, steady heat conduction for rectangular, circular, and spherical geometries, convection heat transfer Newton's law of cooling, free convection, forced convection: internal and external flows, introduction to mass transfer. 			



• Heat radiation			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Discipline Requirement		4	
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

Course Description of Modules Delivered by the Energy Engineering Department to
Petroleum Engineering Programs

ENG433	Stress Analysis			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Equilibrium, stress-strain diagram - Normal force, shearing force, bending and twisting moment diagrams. • Stresses in simply loaded elastic bars: axial loading, bending and torsion, deformation, stiffness, strain energy. • Combined loading, eccentric normal load, combined bending and torsion. • Two-dimensional stresses, principal stresses, maximum shear stress, allowable stresses, Mohr's circle representation. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Faculty Requirement Elective			4	
Assessment Criteria				
Lab coursework	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	
ENG422	Fluid Mechanics 1			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to thermofluids engineering, • Fluid Properties, • Fluid Statics, • Basic Fluid Flow, • Laminar and Turbulent Flow in pipes • Continuity and Momentum Equations. • Pressure Losses. • Pipe Lines. • laminar and turbulent flow. • Solution of the Navier- Stokes equations and Examples. • Boundary layer flows • Pressure and fluid statics • Bernoulli and conservation of energy equations 				
Used in Program / Level				
Program Name or requirement			Study Level	

Petroleum Faculty Requirement Elective			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENGS34	Engineering Drawing and Workshop		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Engineering materials, primary production processes, cutting and non-cutting processes, inspection, measuring equipment, industrial organization and safety. Workshop: Identification and application of tools for: marking out a measuring, cutting, shaping, drilling, threading, tapping, finishing, dismantling, assembling, soldering and welding, casting, and forging. Using tools: hazards, techniques, and safety procedures. Engineering Drawing Techniques, Geometrical Constructions, Principles of Descriptive Geometry, Introduction to AutoCAD Software, Projection, Views and Sectional Views, Intersections, Dimensioning, Introduction to Steel Structural Drawings. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Faculty Requirement Elective		S	
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	40%	20%	40%

ENGS72	Electrical Engineering for Petroleum Engineers		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Basic definitions of current, voltage and power. DC and AC circuits: Voltage and current sources, resistors, inductors, capacitors, reactance and impedance. Circuit Theory Assumptions And Circuit Diagrams: Ohm's law, Kirchhoff's laws, combining resistors, combining capacitors and inductors, Star-Delta Transformations, voltage And Current Source Transformation, Thevenin's And Norton's Theorems, Superposition Theorem, Voltage And Current Divider Circuits, mesh And Nodal Analysis, Maximum Power Transfer. Sinusoidal waveforms, impedance, rms values, phasors and complex numbers. 			

<ul style="list-style-type: none"> RC, RL and RLC circuits: general methods for solving RC and RL circuits, Transient Circuits, Producing a Step Function, circuits with multiple transients. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG424	Heat and Mass Transfer		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Introduction to heat transfer, heat conduction: Fourier's law, steady heat conduction for rectangular, circular, and spherical geometries, convection heat transfer Newton's law of cooling, free convection, forced convection: internal and external flows, introduction to mass transfer. Heat radiation 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

Course Description of Modules Delivered by the Energy Engineering Department to the
Architecture Engineering - Sustainable Building Design Program

ENGS13	Engineering Mechanics & Structural Analysis			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to engineering mechanics. Vector analysis. Forces on particles. Equilibrium of particles. Forces and moments. Kinematics of particles. Displacement, velocity and acceleration using scalar and vector methods. Kinetics of particles. Newton's law . • Equilibrium, stress-strain diagram - Normal force, shearing force, bending and twisting moment diagrams - Stresses in simply loaded elastic bars: axial loading, bending and torsion, deformation, stiffness, strain energy. Combined loading, eccentric normal load, combined bending and torsion. Two-dimensional stresses, principal stresses, maximum shear stress, allowable stresses, Mohr's circle representation. 				
Used in Program / Level				
Program Name or requirement				Study Level
Environmental Faculty Requirement Elective				S
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

ENG425	Fluids Mechanics and built environment			3
Prerequisites	BSCS21			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Fluid Mechanics and Mass Transfer • Fluid Properties, Fluid Statics; Basic Fluid Flow; Laminar and Turbulent Flow in pipes; • Continuity and Momentum Equations; Pressure Losses; Pipelines; laminar and turbulent flow; • First law applied to flow processes; Boundary layer flows; Become familiar with the analysis of practical problems of fluid flow and heat transfer in several applications related to buildings environment . • Analysis of flow through piped water systems and the design of hot and cold water services. • Applications to practical problems in building environment design. 				
Used in Program / Level				

Program Name or requirement		Study Level	
Environmental Faculty Requirement Elective		4	
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
0%	20%	20%	60%

ENG563	Electricity and the built environment		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	1	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to the role of electricity in controlling the environment within buildings and the wider built environment. • Basic definitions of current, voltage and power. Circuit theory assumptions and circuit diagrams. DC and AC circuits: Voltage and current sources; resistors, inductors, capacitors, reactance and impedance; • Ohm's law, Kirchoff's laws, combining resistors, combining capacitors and combining inductors; star-delta transformations, voltage and current source transformation ; • Transient circuits: Producing a step function; RC, RL and RLC circuits; • General methods for solving RC and RL circuits; circuits with multiple transients. • Case studies in the application of electric circuits in the built environment. 			

Used in Program / Level			
Program Name or requirement		Study Level	
Environmental Faculty Requirement Elective		5	
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

ENG522	Thermo-dynamics and heat transfer		2
Prerequisites	ENG425		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	2	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • The principles of thermodynamics and the thermodynamics concepts relevant to applications in building environment engineering . • Some of the topics covered include thermal properties, thermodynamic systems, work and heat transfer processes, perfect (ideal) gases, 1st Law and 2nd Law of thermodynamics, steam table and the Ranking cycle. 			

- How thermodynamics are applied in the expression and solution of simple engineering problems as well as thermofluids and its application within building environment engineering .
- Fundamentals of HVAC systems in architecture, and practice the schematic design of such systems .
- Refrigeration cycle analysis, refrigerants, criteria for equipment design and selection, cold stores, cryogenics and liquefaction of gases .
- Analysis and selection of air conditioning systems (including renewable A/C systems), psychometric processes, and performance .
- Heating and cooling load estimates.
- Analysis and design of heating and cooling systems for residential and industrial applications, design calculations are conducted for sizing of some components.
- Environmental implications in the use/design of HVAC systems .

Used in Program / Level			
Program Name or requirement		Study Level	
Environmental Faculty Requirement Elective		5	
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
15%	25%	0%	60%

Course Description of Modules Delivered by the Energy Engineering Department to the
Mechanical and Electrical Engineering 0 Renewable Energy Programs

ENG552	Project Management			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Introduction to project management • Definitions in project management • Project organizational structure • Project management body of knowledge • Project life cycle • Project network diagrams (AON & AOA) • Critical path methods • Project Management Tools and Techniques • Gant Chart • Work Breakdown Structure • Project Crashing • Project resources allocation • Cash flow analysis • Breakeven and payback • Time value of money • Inflation and discount factors • ROI, IRR • Use of commercial project management software 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable University Requirement Elective				5
Assessment Criteria				
Project	Lab coursework	In-Class Assessment	Final Exam	
20%	0%	20%	60%	

ENG556	Engineering Economics			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Economic Theory; theories of supply and demand and their application, price and cost analysis , • Nominal and effective interest rates, continuous compounding 				

<ul style="list-style-type: none"> • Cash flow diagrams: interest formulas and uniform series and uniform gradient and geometric sequence • Alternatives: Comparing alternatives: equal useful lifetimes, Comparing alternatives: incremental approach, Comparing alternatives: unequal useful lifetimes. • Break-even analysis. • Depreciation 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable University Requirement Elective			5
Assessment Criteria			
Project	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

ENGS32	Engineering Drawings and CAD Design		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to engineering drawing and CAD design, • Manual sketching, and scaling, • Drawing of surfaces, • Types of engineering drawings, • Computer-aided drafting (CAD) in two-dimensions, • Computer-aided drafting (CAD) in three-dimensions. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
30%	20%	0%	50%

ENGS71	Electronics		3
Prerequisites	ENGS61		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Semiconductors and PN junctions . • Diodes models (Ideal, practical, complete, and exponential diode model), small signal model, application of diodes (voltage regulation, logic gates (AND and 			

<p>OR gates) using diodes, half wave rectifiers, full wave rectifiers (center-tape and bridge rectifiers), signal limiters, Zener diode ,</p> <ul style="list-style-type: none"> • Operation and characteristics of bipolar junction transistors (BJT), the BJT operation modes, DC biasing of BJT, small signal analysis, voltage gain, current gain and power gain, input and output resistance , • Field effect transistors (FET) and MOSFET, its operation modes, biasing of FET . • Operational Amplifiers inverted and non-inverted gains. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG422	Fluid Mechanics 1		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to thermofluids engineering, • Fluid Properties, • Fluid Statics, • Basic Fluid Flow, • Laminar and Turbulent Flow in pipes • Continuity and Momentum Equations. • Pressure Losses. • Pipe Lines. • laminar and turbulent flow. • Solution of the Navier- Stokes equations and Examples. • Boundary layer flows • Pressure and fluid statics • Bernoulli and conservation of energy equations 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENGS61	Electric Circuits 1		2
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	1		1
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Basic definitions of current, voltage and power. • DC and AC circuits: Voltage and current sources, resistors, inductors, capacitors, reactance and impedance. • Circuit Theory Assumptions And Circuit Diagrams: Ohm's law, Kirchhoff's laws, combining resistors, combining capacitors and inductors, Star-Delta Transformations, voltage And Current Source Transformation, Thevenin's And Norton's Theorems, Superposition Theorem, Voltage And Current Divider Circuits, mesh And Nodal Analysis, Maximum Power Transfer. • Sinusoidal waveforms, impedance, rms values, phasors and complex numbers. • RC, RL and RLC circuits: general methods for solving RC and RL circuits, Transient Circuits, Producing A Step Function, circuits with multiple transients. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENGS33	Workshop Technology and Solid Modeling		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
1	0		3
Required SWL	75	Equivalent ECTS	3
Course Content			
<p>The course is split in two parts; the first is focusing on using 3D CAD package to develop solid models in order to generate assemblies and 2D drawings. The second part (2/3 of the contact hours) is focusing on workshop technology manifested in different machining and forming technologies: this includes (turning, milling, drilling, grinding, sheet metalworks and basic formic operations).</p>			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	0%	20%	60%

ENGS21	Thermodynamics 1		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to thermofluids engineering, • Introduction and basic concepts of thermodynamics • Thermodynamic properties. • Temperature scales and measurement. • Energy transfer and analysis, • Properties of pure substances. • First, 2nd and 3rd laws of thermodynamics: closed and open systems. • Reversible and irreversible processes. • Carnot cycles. • Heat engines and thermal efficiency. • Refrigerators and heat pumps. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENG424	Heat and mass transfer		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to heat transfer, heat conduction: • Fourier's law, steady heat conduction for rectangular, circular, and spherical geometries, convection heat transfer • Newton's law of cooling, free convection, forced convection: internal and external flows, introduction to mass transfer. • Heat radiation 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG442	Measurements Lab and statistics		3
Prerequisites	ENG422		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	1		2
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> Introduction to the fundamental principles associated with measurement and instrumentation. General instrument characteristics, calibration, measurement uncertainty, Error analysis, sensors, signal conditioning and data presentation elements, and power supplies. Measurements of temperature, pressure, flow rates, viscosity, flash points, force and torques, power, emissions. Evaluating the performance of different energy and environmental equipment such as internal combustion engines performance, PV and wind Measurements. Laboratory activities include: Design of experiments and analysis of designed experiments, Data analysis and optimization, Regression analysis, and correlation. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	10%	20%	50%

ENGS11	Introduction to Renewable Energy		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> History of energy usage, forms of energy, present energy consumption, environmental problems. Conventional and sustainable energy sources: energy and power. Fossil fuels. Solar thermal energy: solar radiation resource, passive and active solar heating, solar concentrators. Solar photovoltaics: basic PV operation, PV technologies, electrical characteristics. Solar thermal systems Biomass: definitions, biomass resource, extracting biomass energy, fuel crops, anaerobic digestion, landfill gas, waste to energy, energy balances and economics. Hydroelectricity: the resource, hydropower equation, turbines, large and small scale systems, pumped storage. Tidal power: the tides, tidal resource, system operation, environmental factors. Wave energy: the wave resource, the fundamental power equation. Onshore and off-shore wave energy extraction systems. 			

<ul style="list-style-type: none"> • Wind energy: generation of the winds, wind resource, basic aerodynamics (lift versus drag) and the fundamental power equations. • Geothermal energy: basic physics, resource quantification, rock permeability, volcanic based systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENGS12	Computers and Programming for renewable energy		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to computers and programming, • Programming languages, • Flowcharts and code generation, • Introduction to MATLAB, • Programming in MATLAB. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
30%	0%	30%	40%

ENG471	Electrical Machines 1		3
Prerequisites	ENGS61		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Magnetic Circuit, construction and theory, analogy with Electric Circuit • Three phase systems and AC power components • Transformers: Theory and design: Fundamental concepts, Power transformers, Transformers at load, Voltage regulation, Three phase transformers, Auto • Transformer, Tap changers, On load tap changers, Harmonics, Transformers testing, Transformer design, Insulation, Cooling, Calculation of transformer characteristics different connection of three phase transformer. 			
Used in Program / Level			

Program Name or requirement		Study Level	
Renewable Program Requirement		4	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG441	Automatic Control 1		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Development of dynamic equations (equilibrium equations) of physical systems (mechanical, electrical, and hydraulic systems) • Modelling in frequency domain (Transfer function) • Modelling of transformers and gears, analogy between systems , • Modelling of hybrid electromechanical system (DC motor), time domain modelling (State Space), signal flow graph, block diagram reduction , • Transient performance of first order systems and second order systems. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Renewable Program Requirement		4	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG451	Energy Conversion and Storage Systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Fundamental concepts about energy storage. • Energy storage: electrical, mechanical, hydraulic, compressed air, thermal, and chemical approaches. • Selection of storage systems. Cost analysis. Advantages and disadvantages of each system. • Techniques for conversion between different systems. • Supper Capacitors: structure, ratings, characteristics, use with the wind power plant, fuel cells, and photovoltaic interface., • Superconducting magnetic energy storage (SMES): structure, operation, Batteries: types, characteristics and operation, charge and discharge., 			

<ul style="list-style-type: none"> Fuel cell: types, electrochemical model, performance, Flywheels energy storage, microbial fuel cell. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	10%	20%	60%

ENG431	Materials for Renewable Energy 2		2
Prerequisites	ENGS31		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
Materials for energy production and storage such as: <ul style="list-style-type: none"> Fuel cells, Wind turbines, Solar cells, Solar thermal collectors, Offshore structures, Biomass, Nuclear materials, Nanotechnology, Processing techniques, The role of materials engineering in circular economy. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENG511	Solar Energy: PV systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Physics and engineering aspects of photovoltaic: PV energy conversion, technologies, and systems . Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays; solar PV concentrators . 			

<ul style="list-style-type: none"> • Standalone system: Power processing schemes and control for stand-alone applications; PV and battery sizing and Solar water pumping system . • Grid connected system: PV inverters Grid-connected single phase PV inverter schemes and control; power electronic converters used in single phase PV systems and their operation; transformer less inverters, centralized grid-connected three-phase inverters for large PV installations . • DC-DC converters and the grid and schemes for maximum power point tracking. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	10%	20%	60%

ENG512	Wind Energy systems		3
Prerequisites	ENG423		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to wind energy systems, • Basics of wind energy conversion, • Wind resource assessment, • Physical principles of wind energy conversion, • Rotor aerodynamics, • Characteristics of wind, • Analysis of HAWTs, • Types of wind energy generators, • Operation and maintenance of wind energy systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENG571	Power Electronics		3
Prerequisites	ENGS71		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			

<ul style="list-style-type: none"> • Introduction to power electronics, Power electronics devices: power diodes, thyristors, power transistors, Characteristics, Firing circuits and gate requirements, rectifier circuits, Line frequency converters: single-phase and three-phase circuits. Static switches. AC voltage controllers: The single-phase ac thyristor controller, Three phase controller, Phase control of ac controllers, Integral cycle control. • DC/DC converters. DC/AC converters (Inverters): Single phase circuits, three-phase inverter, modulation techniques. PWM rectifiers (Active rectifiers), Inverter and rectifier mode of operations of converters. Cyclo-converters and Matrix converters. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENG551	Environmental Pollution and Management		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to environmental pollution: gases, dissolved substances, liquids, particles; transfer and interaction of pollutants within media, environmental risk of pollutants, assessment, monitoring and measurements/instrumentations of pollutants within different environmental media, • Causes of global warming, ozone depletion, enhanced N & S emissions, • Pollution due to nuclear fuel cycle. • Biodegradable materials. • Procedures and prospects for reducing unwanted emissions to the environment and remediation of already polluted systems 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG553	Power Plant Technology		3
Prerequisites	ENG521		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	

Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to power plant technologies, • Components design and analysis: steam boilers, cooling towers and condensers, steam turbines, pumps, steam cycle power plants, gas turbine and combined cycle power plants, diesel and gas engine power plants, cogeneration systems, renewable energy power plants, load curves and power plant economics, environmental impact of power plants. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG555	Modeling and simulations of RE systems (Elect. & Thermal)		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	75	Equivalent ECTS	3
Course Content			
Introduction to modeling, simulation and optimization of various renewable energy systems, basics of thermal system design and analysis, components design; renewable energy applications and relevant modeling and simulation tools (modular basis).			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
40%	0%	60%	0%

ENG573	Electrical Drives		3
Prerequisites	ENG571		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Definitions and Dynamics of Electric Drives: • Concept of electric drive and its classifications, • Types of loads, Four-quadrant drive, • Dependence of load torque on various factors, 			

- Dynamics of motor-load combination, Steady state stability of an electric drive system, Load Equalization.
- Drive Features of Importance: Multi-quadrant operations of DC and AC motors, Energy relations during starting and braking.
- Static Control of Motors: Contactors and relays for electric drives, Control circuits for automatic starters of DC and AC motors.
- Estimation of Motors Rating: Thermal modeling of motors, Types of duty cycles, Calculation of motor rating for duty cycles, Overload factor calculation for short and intermittent duty cycle, Use of load diagrams.
- Solid State Controlled Drives: Control of DC drives fed through single-phase and three phase semi-converter and full-converter phase-controlled configurations, their analysis,
- Regeneration and braking through static power converters, control of three phase induction motors by stator voltage and frequency control for speeds below and above synchronous speed,
- Static rotor resistance control, Static Kramer and Scherbius drives, V/f and Vector control,
- Energy efficient drives, losses in electrical drive system, Energy conservation in electric drives

Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG652	Safety and Environment risk analysis		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to safety and environment risk analysis, • Safety management principles, • Hazard identification and assessment methods, • Safety procedures and inherently safe design, • Failure analysis and maintenance, • Definition of risk in the context of environmental management, • Perceptions of risk, exposure and consequence assessment and analysis models, • Effect of risk communication, • Challenges related to ecological risk assessment, • Applications of risk assessment concepts to specific environmental risks. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Program Requirement			6

Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

Course Description of Modules Delivered by the Energy Engineering Department to the
Mechanical Engineering - Renewable Energy Program

ENG423	Fluid Mechanics 2			3
Prerequisites	ENG422			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Fluid kinematics, • The conservation of angular momentum equation • Introduction to turbomachinery, • Internal flow (pipe flow with losses), • External flow (drag and lift), • Dimensional analysis and modeling, • Introduction to CFD. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Mechanical Program Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

ENG421	Thermodynamics 2			3
Prerequisites	ENGS21			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Entropy, • Exergy, • Gas power cycles, • Vapor and combined power cycles, • Refrigeration cycles, • Gas mixtures. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Mechanical Program Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	20%	10%	60%	

ENG443	Mechatronics and Robotics for Renewable Energy			2
Prerequisites	ENG441			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Introduction to mechatronics, • Types of robots, • Forward kinematics, • Mechanical system design and performance, • Electrical system design and performance, • Actuators, theory of automatic control and modeling, • Embedded circuit design, • Inverse kinematics, • Signals and sensors, • Applications in the renewable energy field. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Mechanical Program Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG432	Structure and Stress Analysis			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Equilibrium, stress-strain diagram - Normal force, shearing force, bending and twisting moment diagrams. • Stresses in simply loaded elastic bars: axial loading, bending and torsion, deformation, stiffness, strain energy. • Combined loading, eccentric normal load, combined bending and torsion. • Two-dimensional stresses, principal stresses, maximum shear stress, allowable stresses, Mohr's circle representation. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Mechanical Program Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

ENG521	Combustion and Fuels			3
Prerequisites	ENG421			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Introduction to combustion and fuels, • Combustion analysis basics, • Chemical and phase equilibrium, • Chemical kinetics, • Conventional and alternative fuels, • Flames and burners, • Pollutants and emissions, • Combustion applications. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable Mechanical Program Requirement			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

ENG513	Solar thermal energy systems 1			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • The solar Energy resources, • Available solar radiation, • Radiation characteristics of opaque materials, • Radiation transmission through glazing, • Types of solar collectors; • Flat plate and concentrating solar collectors, • Design and performance analysis of solar collectors, • Applications. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Mechanical) Program Requirement			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
20%	30%	0%	50%	

ENG554	Energy efficiency and management			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to energy efficiency, • Basic concepts and energy economics, • Energy efficiency in thermal systems: • Combustion systems (boilers, furnaces and burner systems), • Waste heat recovery systems, • Cogeneration systems. • Introduction to energy efficiency in electrical systems 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement				5
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG514	Fuel Cell and Hydrogen Technology			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to fuel cell and hydrogen technologies, • Energy analysis of fuel cells; • High and low temperature fuel cells; • Design, fuels and systems. • Hydrogen generation, processing and storage, • Applications of fuel cells and hydrogen, • Hydrogen as an energy storage medium. • Environmental analysis and markets for fuel cells and hydrogen. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement				5
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG543	Data acquisition and sensors			3
Prerequisites	ENG571			

Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Types of sensor devices used in measurement. • Operations monitoring and condition monitoring tasks. • Actuators and control systems used to control equipment. • Methods used to relay data from equipment installed at a remote site to a centralized data assimilation and monitoring station. • Practical limits to accuracy and repeatability of practical observation, design, assembly and deployment of sensing and data logging systems used in the assessment of renewable energy. • Data transmission systems for remote monitoring and control tasks. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG611	Solar thermal energy systems 2		3
Prerequisites	ENG513		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Solar Energy Systems, • Solar thermal heat transfer fluids, • Solar thermal energy storage, • Solar process loads, • Solar system thermal calculations, • Passive and active solar thermal systems, • Solar process economics. • Solar thermal power generation and industrial process heat, • Space heating and cooling, solar desalination. • Modeling and Simulation of solar thermal systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	0%	40%	40%

ENG621	Refrigeration and air conditioning systems (HVAC)		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to refrigeration and air conditioning systems, • Mechanical vapor compression refrigeration systems, • Absorption refrigeration systems, • Basics of air conditioning systems, • Air conditioning processes. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENG622	Fundamentals of Turbomachinery		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to turbomachinery systems, • Basic Concepts and Laws of Fluid Mechanics, • Similarity of Fluid Machines, • One-Dimensional Flow in Turbomachines, • Two-Dimensional Flow in Turbomachines, • Three-Dimensional Flow in Turbomachines • Energy transfer considerations. • Theory and design of pumps, turbines, and compressors performance characteristics. • Selection criteria. • Operations and system. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG623	Water desalination and treatment technologies			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to water desalination and treatment systems, • Saline and brackish water analysis, • RO desalination systems: basic design and performance analysis, • Thermal desalination systems: basic design and performance analysis of MSF and MED systems. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement				6
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG691	Graduation Research Project			6
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		0		0
Required SWL	250	Equivalent ECTS	10	
Course Content				
<ul style="list-style-type: none"> • Students will carry out a substantially based industrial research project on an individual basis. • The topic and content will be relevant to their degree program. • The project will be supervised by an individual member of academic staff and may involve experimental test work, field work, design work and possibly work based at an industrial organisation. • Each student will be responsible for the planning, execution and interpretation of their own work. • Each student will present individual written reports including a project plan, an interim report at the end of the first semester and a final report at the end of the second semester together with an oral presentation 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement				6
Assessment Criteria				
Individual report	Dissertation	Oral exam	Individual presentation	
15%	60%	15%	10%	

ENG692	Design Project			6
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	0		0	
Required SWL	250	Equivalent ECTS	10	
Course Content				
<ul style="list-style-type: none"> Students will work together in a team, a process plant or other industrial operation. Each project will be supervised by a member of academic staff who will act as project coordinator and will be responsible for the organization and assessment of that project. Students will meet with the coordinator on a regular basis to ensure good communications within the project; they will also attend a series of lectures and seminars dealing with relevant aspects of the planning, design and evaluation of the project. Students will be responsible for the organization and delivery of relevant aspects required in the project, as prescribed. Each individual student or team will be required to produce a project plan detailing the planning and execution of the project, an interim report covering basic aspects and relevant literature in the field, and a final report covering detailed technical, financial and environmental aspects of the project. Other reports may be required by the project coordinator. Students will also be required to make a verbal presentation on their findings at the end of the project. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Mechanical) Program Requirement			6	
Assessment Criteria				
Project	Dissertation	Practical Exam	Group Presentation	
20%	50%	20%	10%	

ENG616	Geothermal and bioenergy systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Alternative energy sources using geothermal and bioenergy. Basic concepts and types of geothermal reservoirs and tidal energy. Biomass resources (organic animal and plant material) as an alternative source of energy. Biofuels and biogas. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Mechanical) Program Requirement Elective			6	
Assessment Criteria				

Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG681	Hydrology and Hydropower Systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to hydrology and hydropower systems, • Rainfall and precipitation, • Hydraulic turbines, • Hydropower systems: • Design and performance analysis. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Mechanical) Program Requirement Elective			6	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG625	Heat Transfer Equipment			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Revision of heat transfer applications, • Steam generators, • Condensers, • Cooling towers, • Feedwater heaters, • Waste heat boilers, • Thermal desalination equipment. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Mechanical) Program Requirement Elective			6	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG682	Pipeline system design and analysis			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Review of internal flow, System components: piping, pumps, valves, controls, system design and analysis, applications. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement Elective				6
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG683	Basics of pneumatic and hydraulic systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Introduction, Components: pumps, actuators, pressure control valves, directional control valves, flow control valves, fluid conditioning, heat exchangers, reservoirs, check valves, accessory components, fluid conductors, schematics, System design 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Program Requirement Elective				6
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG654	Lifecycle assessment of renewable energy systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Introduction to lifecycle assessment of renewable energy systems, Importance of life cycle assessment, 				

<ul style="list-style-type: none"> Life cycle assessment (LCA) methodology to assess the environmental impact of various goods and services, including energy system. LCA of energy systems taking into account environmental impact categories, such as global warming, acidification and toxicity... Theoretical methodology based on the ISO standards and the use of the Simapro software, applications of LCA on various renewable energy systems 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG617	Concentrated solar power generation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction, Review on solar geometry for concentrators, Types of solar concentrators, Analysis of parabolic trough collectors, Fresnel collectors, CPC collectors, Solar power towers, System design and performance analysis. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG655	Compressed air system energy optimization		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to compressed air systems, Understanding compressed air, Supply side: compressors and their applications, 			

<ul style="list-style-type: none"> • Air treatment, • Demand side: eliminating compressed air waste, distribution, pressure profile, • Compressed air storage and system energy balance, • System control, • Compressed air system assessment, • Heat recovery options. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG626	Steam system energy optimization		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to steam systems, • Fundamentals, • Industrial steam systems, • Modeling of steam systems, • Steam generation optimization opportunities, • Steam distribution optimization opportunities, • Steam end-use optimization opportunities, • Steam condensate recovery, • Combined heat and power using steam systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG627	Pump system energy optimization		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Pump System Optimization and Prescreening, • Pump Systems and Process Demands, 			

<ul style="list-style-type: none"> • Pump types, • Basic hydraulics, • Pump performance, • Pump system energy use, • Pump drives, • Control methods. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG656	Sustainable energy economics		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Technical, economic, environmental, and social implications of energy supply, distribution, and use in the context of transitioning toward a sustainable energy future. • Renewable and non-renewable energy options for electricity, heating and transportation. • Indicators of sustainability related to greenhouse gas (GHG) emissions and climate change, air and water quality, human health and safety, energy security, wildlife and the environment, technological efficiency and availability. • The effect of policies (e.g., carbon prices, emissions targets, efficiency requirements, renewable portfolio standards, feed-in tariffs) on these indicators and tradeoffs. • Brief introductions to environmental life cycle assessment (LCA), social benefit cost analysis (SBCA) and multi-criteria decision analysis (MCDA), as they apply to energy issues. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Program Requirement Elective			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG628	Turbomachinery Applications		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	

2		2		0	
Required SWL	125	Equivalent ECTS	5		
Course Content					
<ul style="list-style-type: none"> Hydraulic Turbines. Pumps, Compressors, Fans and Blowers, Gas Turbines, Steam Turbines, Wind Turbines. 					
Used in Program / Level					
Program Name or requirement				Study Level	
Renewable (Mechanical) Program Requirement Elective				6	
Assessment Criteria					
Lab Coursework	In-Class Assessment	Project	Final Exam		
0%	20%	20%	60%		

ENG629	Advanced Air Conditioning Systems			3	
Prerequisites	N/A				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125	Equivalent ECTS	5		
Course Content					
<ul style="list-style-type: none"> Review of air conditioning processes, Space heating and cooling system design and performance analysis, Load estimations, Duct design, Piping design, Applications. 					
Used in Program / Level					
Program Name or requirement				Study Level	
Renewable (Mechanical) Program Requirement Elective				6	
Assessment Criteria					
Lab Coursework	In-Class Assessment	Project	Final Exam		
0%	20%	20%	60%		

Course Description of Modules Delivered by the Energy Engineering Department to the
Electrical Engineering - Renewable Energy Program

ENG461	Electric Circuits 2			3
Prerequisites	ENGS61			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Two Port networks, • Circle Diagram (Locus Diagram), • Resonant Circuits; that covers series and parallel resonance, • Fourier analysis and harmonics, • Wave Filters Low pass, high pass, low stop, high stop, band pass and band stop., • Operational Amplifier applications, summation, subtraction, integrator, differentiator, inverting and non-inverting. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Electrical Program Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	20%	10%	60%	

ENG462	Electric Energy Installation and Systems			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		2
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • General requirements on material equipment, workmanship and quality • Installation methodology section: installation of wiring systems; Wiring in Steel trunking System; installation of power cables, cable trays and cable ladders • Installation of general lighting and power; Installation of domestic appliances; installation of busbar trunking system • Installation of earthing system • Wiring system: cables, conduits, trunking, and accessories; wiring accessories and measuring instruments. • Power cables and associated cabling facilities; switchgear and associated equipment. • Panel board, Different types of CBs . • Short circuit estimation. 				
Used in Program / Level				

Program Name or requirement		Study Level	
Renewable Electrical Program Requirement		4	
Assessment Criteria			
Lab Coursework	Practical Exam	Project	Final Exam
0%	40%	0%	60%

ENG444	Logic Design		3
Prerequisites	ENG441		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Numbering systems, • Addition, Subtraction, Multiplication, and Division of binary, octal and hexadecimal systems, • Boolean Algebra. • Combinational circuit analysis and design. • K-map and tabulation methods. • Multiplexers, decoders, adders/subtractors and PLD devices. • Sequential circuit analysis and design, D-Latch ; Flip-Flops, Registers, and counters. 			

Used in Program / Level			
Program Name or requirement		Study Level	
Renewable Electrical Program Requirement		4	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG472	Electrical Machines 2		2
Prerequisites	ENG471		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Synchronous machines: Theory and design : Introduction, Cylindrical-rotor and salient-pole synchronous machines, Types of windings in ac machines, Winding coefficients, Generator performance, Motor performance, Phasor diagrams in three phase synchronous machines, Synchronous impedance steady state operation, Voltage regulation, Parallel operation, Synchronous machine to an infinite bus, The synchronization process, The V curves, power angle characteristics, The two reaction theory, Open circuit characteristics, Short circuit characteristics, Zero-power-factor characteristic, Damper bars, Testing of synchronous machines, Construction, Design, Main dimensions. 			

<ul style="list-style-type: none"> • Induction machines: Theory and design: Introduction, Construction of three-phase. • Induction motors, The magnetic circuit, Slip ring induction motors, Cage motors, Performance at constant flux, Electromotive force, Currents, Torque, Equivalent circuits, Torque speed curves, Phasor diagrams, The circle diagram, Starting methods, Classification of induction motors, High starting torque types, Performance with higher harmonics, Testing of induction motors. Single phase induction motor, theory, different types, starting techniques. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Electrical Program Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	0%	20%	60%

ENG561	Electrical Power Transmission		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Introduction, • Applying Transmission lines generalized constants, • Representation of power systems, • Parameters of transmission lines, • Models of transmission lines, • Series impedance, • Electrical capacitance, • Representation of capacitance in parallel with transmission lines, • Voltage and current relationships in transmission lines, • Operation characteristics, • Symmetrical components, • Unsymmetrical faults on transmission lines, • Introduction to underground cables, • Design of transmission lines, • Mechanical design, • High-voltage dc overhead transmission lines, • Insulated electrical cables, • Determination of faults in underground cables, • Design of electrical distribution systems, Substations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Electrical Program Requirement			5
Assessment Criteria			

Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG541	Automatic Control 2			3
Prerequisites	ENG441			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Steady state analyses (steady state error) for unity feedback systems, Stability analyses (Routh-Hurwitz criterion), Root locus, Proportional controller design via root locus, Lead-lag compensator design via root locus, PID controller, observability and controllability, State feedback controller, Bode plot, Phase and gain margins. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Electrical) Program Requirement			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	20%	10%	60%	

ENG542	Design, Maintenance, Economics and Control of PV system			3
Prerequisites	ENG511			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Different techniques to design a PV plant. Obtaining the required data, components. Effect of design methodology on the cost, performance. Control methods, software, SCADA used for control. Plants performance. Problems, errors, and maintenance of PV plants. Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation. PV installation, Roof top installation Ground Mounted. Economic evaluation of all the systems. 				

Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			5
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

ENG562	Power system analysis		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
<ul style="list-style-type: none"> • Introduction to power system components, • Per-unit systems, • Change of per-unit systems for different power and voltage ratings, • Network matrices, • Different load flow techniques, • Capacitor application on power systems, • Power System Stability, • Equal area criteria. 			

Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			5
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG572	Network Interfacing of Renewable Resources and smart grid		3
Prerequisites	ENG571		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4

Course Content			
<ul style="list-style-type: none"> • Concept of distributed generation, • Interconnection standards, • Type of interface, • Static synchronous generators, • Control of active power and voltage regulation, • Current control mode vs. voltage control mode, • Wind power interface: direct connection, back to back converters, matrix converters, and fuel cell and photovoltaic interface topologies. 			

Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			5
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG612	Selected Topics in Renewable energy		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
The contents of this module are selected based on the needs of studying many topics related to Renewable Energy Systems such as: Solar Thermal Energy, Fuel Cell, Biomass, Hydropower, Distributed Generation, Smart and microgrid, etc.			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG661	Electrical Distribution systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Distribution System Fundamentals, • Load Characteristics, • Load modeling and demand response, • Substations & primary feeders, • Underground distribution, • Voltage regulation, • Load forecasting, • Advanced methodologies, • Introduction to protection system. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			6
Assessment Criteria			

Lab Report	In-Class Assessment	Project	Final Exam
20%	0%	20%	60%

ENG651	High Voltage Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Phenomenon of over-voltages in power systems, • Lightning and lightning protection, • Over-voltages in HV systems caused by switching operations, • HV, circuit breakers, digital protection, faults/short-circuit analysis, short-circuit calculations, protection operation, • HV testing, • HV in solids, liquids and gases 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Electrical) Program Requirement				6
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

ENG662	Power system Protection			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Fundamentals of electromechanical relays and digital protective Relaying. • Introduction to Digital Relays. Overcurrent protection and coordination. • Protection of Series Compensated Transmission Line. • Differential protection, Distance protection. • Definition of wide-area protection, Architectures of wide-area protection, concept of synchronized sampling, wide area phasor measurement technology, concept of Adaptive relaying, advantageous of adaptive relaying and its application 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Electrical) Program Requirement				6
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	

0%	20%	20%	60%
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ENG691	Graduation Research Project			6
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	0		0	
Required SWL	250	Equivalent ECTS	10	
Course Content				
<ul style="list-style-type: none"> Students will carry out a substantially based industrial research project on an individual basis. The topic and content will be relevant to their degree program. The project will be supervised by an individual member of academic staff and may involve experimental test work, field work, design work and possibly work based at an industrial organisation. Each student will be responsible for the planning, execution and interpretation of their own work. Each student will present individual written reports including a project plan, an interim report at the end of the first semester and a final report at the end of the second semester together with an oral presentation 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Electrical) Program Requirement			6	
Assessment Criteria				
Individual report	Dissertation	Oral exam	Individual presentation	
15%	60%	15%	10%	

ENG692	Design Project			6
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	0		0	
Required SWL	250	Equivalent ECTS	10	
Course Content				
<ul style="list-style-type: none"> Students will work together in a team, a process plant or other industrial operation. Each project will be supervised by a member of academic staff who will act as project coordinator and will be responsible for the organization and assessment of that project. Students will meet with the coordinator on a regular basis to ensure good communications within the project; they will also attend a series of lectures and seminars dealing with relevant aspects of the planning, design and evaluation of the project. Students will be responsible for the organization and delivery of relevant aspects required in the project, as prescribed. Each individual student or team will be required to produce a project plan detailing the planning and execution of the project, an interim report covering 				

<p>basic aspects and relevant literature in the field, and a final report covering detailed technical, financial and environmental aspects of the project.</p> <ul style="list-style-type: none"> Other reports may be required by the project coordinator. Students will also be required to make a verbal presentation on their findings at the end of the project. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Program Requirement			6
Assessment Criteria			
Project	Dissertation	Practical Exam	Group Presentation
20%	50%	20%	10%

ENG653	Energy Efficiency in Electrical Systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution, and transformer losses . Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors . Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

ENG657	Energy Economics		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to Energy Economics: Define Energy Economics; Energy Resources and Energy Commodities; 			

<ul style="list-style-type: none"> • Properties of Energy, Energy Conservation and Energy Efficiency. • Energy Crisis: Understanding the Energy Crisis– Past to Present. Economics of Energy Supply Classify energy on the basis of sources – renewable or non-renewable; • Economic and Environmental Effects of Energy Production; • Life Cycle of Energy Sources. • Energy Demand Analysis: Demand for Energy as a Derived Demand; • Demand Substitution among Energy Commodities. • Trends in Energy Conservation; • Economic Pricing of Energy Sources;. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

ENG671	Power Quality		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Power and Voltage Quality: General, classes of Power Quality Problems, Power quality terms, Power frequency variations, the power quality evaluation procedure . • Voltage quality: Transients, long and short duration Voltage variations, Voltage imbalance, waveform distortion, Voltage Flicker . • Sags and Interruptions , • Fundamentals of Harmonics . • Distributed Generation and Power Quality. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG672	Wind Energy Converters		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
<ul style="list-style-type: none"> This module will cover the principles of wind energy and wind power, as well as the design and operation of different types of wind energy converters. It will include machines for water pumping, remote area power supply and grid electricity generation. It will cover issues of site selection, monitoring and analysing wind data, estimating output from wind generators, integrating wind generators into hybrid power systems or the grid, economics, standards and environmental impacts. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG613	Advanced Photovoltaic		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Measurement devices of PV, Grid-connected PV plant topologies and architectures, DC and AC side protection protocols, Excess PV power management and penetration levels, Virtual Inertia compensation, Environmental Impact assessment on PV plants, Loss mechanisms in solar cells, Crystal structures and defects, Perovskites PV cells, Organic PV cells, Light trapping techniques, PV codes, Safe Installation, Commissioning and, Trouble Shooting, Wiring Diagrams and Modeling. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

ENG641	Optimization algorithms and Machine Learning in Electrical Power Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Mathematical programming problem, conditions for optimality, Classical optimization techniques. • Linear programming, Simplex algorithm, duality, revised simplex algorithm, sensitivity analysis. • Nonlinear programming: Unconstrained optimization, gradient based methods, Newton's method, Quasi Newton's method. Machine Learning: Linear Regression and Feature Selection, Analysis of variance for regression, Linear Classification, Support Vector Machines and Artificial Neural Networks, • Bayesian Learning and Decision Trees, Evaluation Measures, Hypothesis Testing, Ensemble Methods, Clustering, Graphical Models, Learning Theory and Expectation Maximization, Introduction to Reinforcement Learning. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Elective (Electrical) Program Requirement				6
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG673	FACTS and HVDC in Electric Power Systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Review of power quality issues, definitions, and standards, causes and effects of power quality issues, measurements. • Harmonic studies: Fourier analysis, FFT Analysis, HVDC systems and harmonics in HVDC Systems. • Improvement techniques: Conventional compensators, Passive (RLC) compensators: shunt/series, Active (synchronous condensers). • FACTS compensators: Shunt compensators: Passive/ variable z type Active/switched converter type. • Series compensators: Passive/ variable z type. • Active/switched converter type. • Hybrid compensators. Harmonic Filters: Passive filters, tuned filters, design problems, Active filters-shunt, series, hybrid. 				

<ul style="list-style-type: none"> • Applications and Design problems. • Estimation of rate/cost reduction due to hybrid filters. Active filter control schemes/algorithms: Time-domain and Frequency-domain algorithms, AI based control algorithms, analog/digital implementation. • Case studies. • Review of improved power quality converters and applications. Custom power parks concept: Custom power devices and applications. • Lab Experiments: Simulation and Hardware experiments in Conventional/FACTS/Harmonic compensators. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG674	Modulation of Power Electronic Converters		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Circuit modelling, fundamental mathematics, • Harmonics in single-phase and three-phase systems. Survey of modulation principles. • Relation between modulation and the development of power-semiconductors. • Carrier-based methods, SPWM and space vector modulation. • Influence of sampling. • Fixed pulse-patterns, harmonic elimination. • Tolerance band modulation. • Harmonics in power systems and electric railway traction, norms, and standards. • Influence of harmonics on electrical machines. • Survey of harmonic filters. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG642	Model Predictive Control		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Analysis of properties of linear systems in discrete time • Linear and quadratic programming to determine open loop control of linear systems in discrete time • Dynamic programming to determine optimal observers and linear control systems Quadratic objective functions in the control input and the system states (LQG control) • Receding-horizon control and how model predictive control (MPC) on LQG to handle hard limitations on control inputs and system states • Design of MPC controllers for technical systems and how different design parameters should be chosen to satisfy the performance requirements that are set on the closed system • Stability properties of MPC controllers • MPC controllers either as an explicit non-linear control system (that is determined off-line) or through real time optimization in each sample 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENG663	Computer Applications in Power Systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Modeling of Power System Components: modeling of power system, different areas of power system analysis. Models of non-electrical components like boiler, steam & hydro-turbine & governor system. Transformer modeling such as auto-transformer, tap-changing & phase shifting transformer. • Synchronous machine modeling: Model required for steady-state analysis. The development of model required for dynamic studies. The current & flux linkage models using Park's transformation leading to simulation as linear model. Synchronous machine connected to an infinite bus, its simulation for steady-state condition. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable Elective (Electrical) Program Requirement			6
Assessment Criteria			

Lab Report	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

ENG614	Hydropower- Technology, Economy, Sustainability			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial	Laboratory		
2	2	0		
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to hydrology and hydropower systems, • Rainfall and precipitation, • Hydraulic turbines, • Hydropower systems • Design and performance analysis. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable Elective (Electrical) Program Requirement			6	
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG624	Water Desalination			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial	Laboratory		
2	2	0		
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to water desalination and treatment systems, • Saline and brackish water analysis, • RO desalination systems: • Basic design and performance analysis, • Thermal desalination systems: • Basic design and performance analysis of MSF and MED systems. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable Elective (Electrical) Program Requirement			6	
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENG615	Fuel Cell Technologies			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • The history of hydrogen and fuel cell technologies, their application, instrumentation, specifications, types, codes, system designs and materials. • Basic thermodynamics and heat/mass transfer. • Specific licensing, permits, and safety issues. • Fuel cells based on other fuels and bio-fuels, practical fuel cells. • Different applications of fuel cells. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Elective (Electrical) Program Requirement				6
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

ENG664	Smart Grid Fundamentals			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to Smart Grid: What is Smart Grid? Working definitions of Smart Grid and Associated Concepts, Smart Grid Functions, Comparison of Traditional Power Grid and Smart Grid, New Technologies for Smart Grid, Advantages, Key Challenges for Smart Grid. • Performance Analysis Tools for Smart Grid Design: Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Stability Analysis Tools For Smart Grid • Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable Elective (Electrical) Program Requirement				6
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

Minor Course Description of Modules Delivered by the Energy Engineering Department
to the Mechanical Engineering - Renewable Energy Program

ENGM31	Materials for Renewable Energy			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
Materials for energy production and storage such as: <ul style="list-style-type: none"> • Fuel cells, • Wind turbines, • Solar cells, • Solar thermal collectors, • Offshore structures, • Biomass, • Nuclear materials, • Nanotechnology, • Processing techniques, • The role of materials engineering in circular economy. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Mechanical) Minor Program Requirement				Minor
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	20%	10%	60%	

ENGM21	Combustion and Fuels			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Introduction to combustion and fuels, • Combustion analysis basics, • Chemical and phase equilibrium, • Chemical kinetics, • Conventional and alternative fuels, • Flames and burners, • Pollutants and emissions, • Combustion applications. 				
Used in Program / Level				
Program Name or requirement				Study Level

Renewable (Mechanical) Minor Program Requirement		Minor	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

ENGM11	Solar thermal energy systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • The solar Energy resources, • Available solar radiation, • Radiation characteristics of opaque materials, • Radiation transmission through glazing, • Types of solar collectors; • Flat plate and concentrating solar collectors, • Design and performance analysis of solar collectors, • Applications. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Renewable (Mechanical) Minor Program Requirement		Minor	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	30%	0%	50%

ENGM12	Wind Energy systems		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to wind energy systems, • Basics of wind energy conversion, • Wind resource assessment, • Physical principles of wind energy conversion, • Rotor aerodynamics, • Characteristics of wind, • Analysis of HAWTs, • Types of wind energy generators, • Operation and maintenance of wind energy systems. 			

Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENGM22	Refrigeration and air conditioning systems (HVAC)		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to refrigeration and air conditioning systems, • Mechanical vapor compression refrigeration systems, • Absorption refrigeration systems, • Basics of air conditioning systems, • Air conditioning processes. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENGM51	Power Plant Technology		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to power plant technologies, • Components design and analysis: steam boilers, cooling towers and condensers, steam turbines, pumps, steam cycle power plants, gas turbine and combined cycle power plants, diesel and gas engine power plants, cogeneration systems, renewable energy power plants, load curves and power plant economics, environmental impact of power plants. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Mechanical) Minor Program Requirement			Minor
Assessment Criteria			



Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

Minor Course Description of Modules Delivered by the Energy Engineering Department
to the Electrical Engineering - Renewable Energy Program

ENGM71	Electrical Machines			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Magnetic Circuit, construction and theory, analogy with Electric Circuit • Three phase systems and AC power components • Transformers: Theory and design: Fundamental concepts, Power transformers, Transformers at load, Voltage regulation, Three phase transformers, Auto Transformer, Tap changers, On load tap changers, Harmonics, Transformers testing, Transformer design, Insulation, Cooling, Calculation of transformer characteristics different connection of three phase transformer. 				
Used in Program / Level				
Program Name or requirement				Study Level
Renewable (Electrical) Minor Program Requirement				Minor
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

ENGM61	Electrical Power Transmission			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Introduction, • Applying Transmission lines generalized constants, • Representation of power systems, • Parameters of transmission lines, • Models of transmission lines, • Series impedance, • Electrical capacitance, • Representation of capacitance in parallel with transmission lines, • Voltage and current relationships in transmission lines, • Operation characteristics, • Symmetrical components, • Unsymmetrical faults on transmission lines, • Introduction to underground cables, • Design of transmission lines, • Mechanical design, 				

<ul style="list-style-type: none"> • High-voltage dc overhead transmission lines, • Insulated electrical cables, • Determination of faults in underground cables, • Design of electrical distribution systems, Substations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

ENGM11	Solar Energy: PV systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Physics and engineering aspects of photovoltaic: PV energy conversion, technologies, and systems . • Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays; solar PV concentrators . • Standalone system: Power processing schemes and control for stand-alone applications; PV and battery sizing and Solar water pumping system . • Grid connected system: PV inverters Grid-connected single phase PV inverter schemes and control; power electronic converters used in single phase PV systems and their operation; transformer less inverters, centralized grid-connected three-phase inverters for large PV installations . • DC-DC converters and the grid and schemes for maximum power point tracking. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Electrical) Minor Program Requirement			Minor	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
10%	10%	20%	60%	

ENGM12	Wind Energy systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				

<ul style="list-style-type: none"> • Introduction to wind energy systems, • Basics of wind energy conversion, • Wind resource assessment, • Physical principles of wind energy conversion, • Rotor aerodynamics, • Characteristics of wind, • Analysis of HAWTs, • Types of wind energy generators, • Operation and maintenance of wind energy systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Renewable (Electrical) Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	20%	10%	60%

ENGM62	Power system analysis			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to power system components, • Per-unit systems, • Change of per-unit systems for different power and voltage ratings, • Network matrices, • Different load flow techniques, • Capacitor application on power systems, • Power System Stability, • Equal area criteria. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Renewable (Electrical) Minor Program Requirement			Minor	
Assessment Criteria				
Lab Report	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

ENGM51	High Voltage Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	

Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Phenomenon of over-voltages in power systems, • Lightning and lightning protection, • Over-voltages in HV systems caused by switching operations, • HV, circuit breakers, digital protection, faults/short-circuit analysis, short-circuit calculations, protection operation, • HV testing, • HV in solids, liquids and gases 			
Used in Program / Level			
Program Name or requirement		Study Level	
Renewable (Electrical) Minor Program Requirement		Minor	
Assessment Criteria			
Lab Report	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

4-Modules Delivered by the Bioenergy Engineering Department

	Code	Course Title	Cr & SWL			Contact Hours				Classification			
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
PET	BIOS32	Organic Chemistry	3	5	125	2	2	1	5		X		
	BIOS31	Physical Chemistry	2	4	100	2	1		3			X	
SAE	BIOS34	Chemistry	3	5	125	2	2	2	6		X		
BIO	BIO452	Project Management and Engineering Economics	2	3	75	2	1		3	X			
	BIO551	Environmental Legislations and Regulations	2	3	75	2	1		3	X			
	BIOS32	Organic Chemistry	3	5	125	2	2	2	6		X		
	BIO421	Mass and Energy Balances	3	5	125	2	2		4				X
	BIOS31	Physical Chemistry	2	4	100	2	1		3				X
	BIO431	Inorganic Chemistry	3	4	100	2	2	2	6				X
	BIO432	Electrochemistry	3	5	125	2	2	2	6				X
	BIOS21	Introduction to Biochemical Engineering	3	5	125	2	2		4				X
	BIO551	Biochemistry	3	4	100	2	1	1	4				X
	BIOS33	Microbiology	2	3	75	2	1	1	4				X
	BIO451	Environmental Chemistry	3	5	125	2	2	1	5				X
	BIO441	Biophysics	3	4	100	2	1	1	4				X
	BIO453	Analytical Chemistry	3	5	125	2	2	2	6				X
	BIO433	Principles of Process Design	2	3	75	2	1		3				X
	BIO442	Computer Programming	2	3	75	1		3	4				X
	BIO511	Biorenewable Energy and Hydrogen Production	3	5	125	2	2	1	5				X
	BIO521	Mass Transfer	3	5	125	2	1	2	5				X
	BIO512	Biofuels	3	5	125	2	1	2	5				X
	BIO531	Bioremediation	3	5	125	2	1	2	5				X
	BIO541	Bioreactor Design	3	4	100	2	2		4				X
	BIO552	Biomaterials Science	3	5	125	2	2	1	5				X
	BIO542	Modelling and Simulation	3	5	125	2	1	2	5				X
	BIO513	Bionanotechnology	3	5	125	2	2	2	6				X
	BIO532	Petroleum Bioprocessing	3	5	125	2	2		4				X
	BIO543	Bioproduct Design	3	5	125	2	2		4				X
	BIO651	Occupational, Health and Safety Engineering	3	5	125	2	2		4				X
	BIO611	Valorization of Waste and Biomass	3	5	125	2	2		4				X
	BIO631	Renewable Water Desalination Technologies	3	5	125	2	2		4				X
	BIO632	Biolubricants for Tribological Engineering	3	5	125	2	2		4				X
	BIO691	Graduation Research Project	6	10	250				0				X
	BIO692	Graduation Design Project	6	10	250				0				X
	BIO633	Fundamentals of Corrosion Science	3	5	125	2	2	2	6				X
	BIO652	Climate Change and Bioenergy	3	5	125	2	2		4				X
	BIO634	Fermentation Engineering	3	5	125	2	2		4				X
BIO641	Process Design and Simulation	3	5	125	2	2		4				X	
BIO642	Principles of plant design	3	6	150	2	2	--	4				X	
BIO653	Environmental Risk Analysis	3	5	125	2	2		4				X	
BIO635	Food Processing Equipment	3	5	125	2	2		4				X	
BIO636	Process Plant Operation	3	5	125	2	2		4				X	
BIO643	Advanced Control Systems	3	5	125	2	2		4				X	
BIO654	Circular Economy	3	5	125	2	2	2	4				X	
BIO Minor	BIOM21	Introduction to Biochemical Engineering	3	5	125	2	2		4				X
	BIOM11	Biofuels	3	5	125	2	1	1	4				X
	BIOM12	Biorenewable Energy and Hydrogen Production	3	5	125	2	2	1	5				X
	BIOM31	Bioremediation	3	5	125	2	1	2	5				X
	BIOM61	Valorization of Waste and Biomass	3	5	125	2	2		4				X
	BIOM32	Renewable Water Desalination Technologies	3	5	125	2	2		4				X

Course Description of Modules Delivered by the Bioenergy Engineering Department to the Petroleum Engineering Program

BIOS32	Organic Chemistry			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Chemical Bonding, Organic Structures, and Alkanes. • Acids, Bases, and Arrows - Writing Organic Mechanisms. • More on Frontier Molecular Orbitals (FMO) • Chemistry of Alkenes. Stereochemistry. • Cyclic Compounds and Stereochemistry of Reactions. Introduction to Alkyl Halides, Alcohols, Ethers, Thiols, and Sulfides. • Chemistry of Alkyl Halides. Nuclear Magnetic Resonance Spectroscopy. • Infrared, Mass, and Nuclear Magnetic Resonance Spectroscopy. • Chemistry of Alcohols, Glycols, Thiols, Ethers, Epoxides, and Sulfides. Alkyne Chemistry and Organic Synthesis. • Aromaticity and Electrophilic Aromatic Substitution. Electrophilic and Nucleophilic Aromatic Substitution. • Aldehydes and Ketones - Carbonyl Addition. Chemistry of Carboxylic Acids and their Derivatives. • Introduction to carbohydrates, peptides, and proteins. Chemistry of Amines. 				
Used in Program / Level				
Program Name or requirement				Study Level
Petroleum Faculty Requirement Elective				S
Assessment Criteria				
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam	
20%	20%	0%	60%	

BIOS31	Physical Chemistry			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Properties of gases. • Kinetic theory and transport properties of gases and its applications. • Spontaneity criteria of processes. • Stoichiometry and limiting reactant calculations,. • Colligative properties of solutions,. • Chemical kinetics and rate of reactions. 				



• Phase diagrams,.			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Discipline Requirement		S	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

Course Description of Modules Delivered by the Bioenergy Engineering Department to
the Architecture Engineering - Sustainable Building Design Program

BIOS34	Chemistry			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to general chemistry; atomic structures and chemical bonding, intermetallic forces, phase diagrams, gas laws. States of matter, chemical reactions and principles of electrochemistry. principles of physical chemistry				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Faculty Requirement Elective			S	
Assessment Criteria				
Lab coursework	In-Class Assessment	Practical Exam	Final Exam	
20%	20%	0%	60%	

Course Description of Modules Delivered by the Bioenergy Engineering Department to the Biochemical Engineering Program

BIO452	Project Management and Engineering Economics			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Economic Theory, • Theories of supply and demand and their application, • Price and cost analysis, • Break-even analysis. • The theory and techniques of management including, motivation, delegation, team working and presentational skills. • Responsibilities of managers in the working environment. • Project Management, techniques and methodologies, decision analysis, risk and uncertainty, critical path analysis, decision trees and rollback analysis. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical University Requirement Elective			4	
Assessment Criteria				
Project	In-Class Assessment	Practical Exam	Final Exam	
20%	20%	0%	60%	

BIO551	Environmental Legislations and Regulations			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Work legislation. • Environmental legislation. • Air regulation. • Water regulation. • Waste regulation. • Biotechnology, ethics and society • Basic foundation in the economic, legal, and political aspects of energy • Regulation, renewable energy, and energy efficiency. • Theories and applied technologies for production and • Conversion of biomass into energy and co-products 				
Used in Program / Level				
Program Name or requirement			Study Level	

Biochemical University Requirement Elective		5	
Assessment Criteria			
Project	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BIOS32	Organic Chemistry		3
Prerequisites	BIOS51		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Chemical Bonding, Organic Structures, and Alkanes. • Acids, Bases, and Arrows - Writing Organic Mechanisms. • More on Frontier Molecular Orbitals (FMO) • Chemistry of Alkenes. Stereochemistry. • Cyclic Compounds and Stereochemistry of Reactions. Introduction to Alkyl Halides, Alcohols, Ethers, Thiols, and Sulfides. • Chemistry of Alkyl Halides. Nuclear Magnetic Resonance Spectroscopy. • Infrared, Mass, and Nuclear Magnetic Resonance Spectroscopy. • Chemistry of Alcohols, Glycols, Thiols, Ethers, Epoxides, and Sulfides. Alkyne Chemistry and Organic Synthesis. • Aromaticity and Electrophilic Aromatic Substitution. Electrophilic and Nucleophilic Aromatic Substitution. • Aldehydes and Ketones - Carbonyl Addition. Chemistry of Carboxylic Acids and their Derivatives. • Introduction to carbohydrates, peptides, and proteins. Chemistry of Amines. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Faculty Requirement Elective			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

BIO421	Mass and Energy Balances		3
Prerequisites	ENGS22		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> - Fundamentals of material and energy balances. Steady state and unsteady state considerations. Black box approach. Process flow diagrams and flow sheets. Mass and energy balance diagrams and tables. Mass balances for non-reacting systems. 			

<ul style="list-style-type: none"> - Mass balances for reacting systems: Law of conservation of mass, Classification of material balance, solving material balance problems without chemical reactions, Energy balance: procedure, sensible heat and heat capacities. Relationship between C_p and C_v, Empirical equations for heat capacities. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
0%	40%	0%	60%

BIOS31	Physical Chemistry			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Properties of gases. • Kinetic theory and transport properties of gases and its applications. • Spontaneity criteria of processes. • Stoichiometry and limiting reactant calculations,. • Colligative properties of solutions,. • Chemical kinetics and rate of reactions. • Phase diagrams,. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical Discipline Requirement			S	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BIO431	Inorganic Chemistry			3
Prerequisites	BIOS32			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		2	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Atomic Theory: Introduction to Quantum theory; Bohr theory; wave theory; periodic classification; properties of electronic configuration. • Nuclear Chemistry: Introductory theory; radioactivity and nuclear reactions; radionuclides and their applications; kinetics of nuclear decay; calculation of nuclear binding energy and mass defect. 				

<ul style="list-style-type: none"> Structures of Inorganic compounds: Unit cells; close packing of spheres; Structures of ionic and covalent crystals; crystals of nonmetallic elements. Chemical bonding and intermolecular attractions: Bonding theories (ionic, covalent, metallic), conductors/semiconductors, alloys; Born Haber Cycle; lattice energy; introduction to molecular orbital theory; shapes of molecules and ions; Intermolecular forces. Coordination Complexes: Warner Theory; nature of metal-ligand bond; complex charges, coordination number, and geometry; ligands; naming of complexes. Main Group Chemistry: Non-transition elements (s and p - block), comparison of their physical and chemical properties, reactions. Practical Program: Selection of practicals in aqueous chemistry and complex formation. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

BIO432	Electrochemistry		3
Prerequisites	BIO431		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> PH calculations. Galvanic Cells Standard Reduction Potentials Cell Potential Electrical Work, and Free Energy Dependence of Cell potential on Concentration Electrochemical cells Types of polarization, Nernst equation, Butler-Volmer Equation Tafel Equation, ionic conduction, Electrochemical reactions Electrochemical applications, electroplating, water electrolysis, fuel cells. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

BIOS21	Introduction to Biochemical Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> History of energy usage, forms of energy, present energy consumption, environmental problems. Conventional energy sources: energy and power; fossil fuel. Biomass: definitions, biomass resource, extracting biomass energy, fuel crops, anaerobic digestion, landfill gas, waste to energy, energy balances and economics. Introduction to biochemical engineering applications (biorenewable energy, biomedical systems, environment) Chemical composition in biological systems Electrolytic conductivity, ions in aqueous solutions, electrochemical cells Reaction methods and enzymes Equilibrium and transition systems 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical Discipline Requirement			S	
Assessment Criteria				
Project	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BIOS51	Biochemistry			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> Definition of biochemistry, history, and applications Basic cellular structure and function Special properties of water and how the aqueous environment influences the behavior of biological macromolecules Structure of amino acids, their chemical properties and their organization into polypeptides and proteins. Methods for isolating and characterizing proteins The basic elements of protein structure Key principles of protein function. Enzymes and how they catalyze reactions as well as enzyme kinetics Structure of carbohydrates, fundamentals and functions of monosaccharides and polysaccharides Structure of different classes of lipids and their roles in biological systems 				

<ul style="list-style-type: none"> Structure and basic function of nucleotides 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

BIOS33	Microbiology		2
Prerequisites	BIOS21		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Scope and role of Microbiology in Biochemical Engineering, Structure of cells: Prokaryotic cells, Eukaryotic cells and comparison, cell fractionation, Cell types, Bacteria, Yeasts, Moulds and Microalgae. Microbiology of soil, aquatic, foods, domestic and waste water, Cycles of life: Oxygen, Carbon, Nitrogen, Phosphorus, Calcium and Sulphur cycles. Biomass production and cell culture: Biomass and cell culture, cell population kinetics, ideal reactors. Kinetics and balanced growth: Monod and transient growth kinetics. Environmental factors affecting growth kinetics, cell growth and kinetic pattern, kinetic patterns in batch fermentation, yield and maintenance coefficients, mass balance and product balance. Other forms of growth kinetics. Estimation of lag time. Isolation and preservation of microbes: Criteria for choice of organisms, Isolation methods utilizing and not utilizing selection of desired characteristics, Screening methods, Preservation: Storage at reduced temperature and dehydrated form. Selection of strains for stable, resistant to infection, non-foaming, resistant to components, morphologically favor. Strain development for producing new fermentation products. Microbial identification: Biochemical and advanced (16s and 18s rDNA). Media for industrial fermentations: Medium formulation: Water, Energy sources, Carbon sources, Nitrogen sources, Minerals, Buffers, Precursors, Inhibitors and Inducers. Oxygen requirements: Fast Metabolism, Rheology and Antifoams. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			S
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO451	Environmental Chemistry			3
Prerequisites	BIOS32			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Chemistry of air, water, and toxic organic compounds as well as how anthropogenic activities affect this chemistry on planet Earth. • Sources, reactions, transport, effects, and fates of chemical species found in air and water as well as the effects of technology thereon. • Atmospheric Chemistry and Air Pollution • Climate Change and Energy • Water Chemistry and Water Pollution • Toxic Organic Compounds. • Soil chemistry • Dissolved oxygen, Biological and chemical oxygen demand 				
Used in Program / Level				
Program Name or requirement				Study Level
Biochemical Discipline Requirement				4
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	30%	10%	60%	

BIO441	Biophysics			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Macromolecular Structure. • Primary Through Quaternary Structure . • Covalent stereochemistry & Force fields . • Non-bonded interactions & Force fields . • Equilibria, Reactions, Binding, and Conformation . • Thermodynamics & Kinetics . • Energy, Entropy, Free energy . • Activation energy & transition states . • Hydrophobic effect . • Statistical mechanics . • Calorimetry . • Membrane proteins, ion channels & pumps . • Action potentials / measurement / synapses . • Crystallographic theory . • Phasing methods - MIR & MAD . 				

- Maps, Models & Refinement .
- Quality assessment & Biochemical interpretation .
- Spectroscopy - Visible & UV .
- Quantum mechanical foundation .
- Absorption .
- Polarization - CD .
- Fluorescence .
- Fluorescence anisotropy .
- FRET .
- Introduction to Magnetic Resonance .
- Spin interactions & relaxation .
- Magnetic Resonance Imaging .
- Biomolecular Structure (Introduction).
- Diffusion and Brownian motion (Langevin eqn, diffusion eqn, Einstein Relation)
- Biological applications (Sedimentation, bacterial metabolism, pattern formation)
- Electrostatic interactions (Physical and mathematical underpinnings, Poisson-Boltzmann eqn and its solution)
- Chemical Forces (Chemical Potential and Chemical reactions, Electrophoresis, Self-assembly, micelles, cell membranes)
- Machines in membranes (Electro-osmotic effects, Ion pumping)
- Nerve Impulses (Action Potentials, Ion Channels)
- Physical Techniques and related biology , (DNA Microarrays, Manipulation of bio-molecules using optical tweezers, Tomography, Patch clamps)

Used in Program / Level

Program Name or requirement	Study Level		
Biochemical Discipline Requirement	4		
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIO453	Analytical Chemistry	3	
Prerequisites	BIO431		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to Analytical Science, Analytical Technique and Skills, Sampling and Sample Preparation. • Significant Figures, Errors, Statistics, and Statistical Control. • Stoichiometry and limiting reactant calculations. • Acids and bases and acid-base equilibria. • Titrations and pH Curves. 			

<ul style="list-style-type: none"> Gravimetric Analysis. Introduction to Titrimetric Analysis (acid-base and redox titrations) and its applications. Ultraviolet – visible spectrophotometry, electromagnetic radiation, interaction of wave with matter, electronic transition, spectral curves, Beer-Lambert’s law, and calibration curves. Atomic absorption and emission spectroscopy. Introduction to chromatography, theory of separation, different kinds of chromatography, mobile phase, stationary phase, band separation, Thin layer chromatography (TLC), Gas chromatography (GCMS), High performance liquid chromatography (HPLC) 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO433	Principles of Process Design		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Theory behind mechanical operations in the chemical industry. Description and operation of equipment used in the chemical industry. Principles of process design of equipment. The operations studied are: Mixing of liquids Storage and transportation of solids Crushing and grinding Screening Flow through porous media Fluidization Filtration Settling operations Sedimentation. Centrifugal operations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO442	Computer Programming		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	

Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to computers and programming, • Programming languages, • Flowcharts and code generation, • Introduction to MATLAB, • Programming in MATLAB. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Discipline Requirement		4	
Assessment Criteria			
Project	In-Class Assessment	Practical Exam	Final Exam
0%	0%	40%	60%

BIO511	Biorenewable Energy and Hydrogen Production		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Different approaches for hydrogen production (grey vs blue vs green hydrogen). • Production of hydrogen by electrolysis . • Biomass conversion and green hydrogen production. • Photolysis to produce green hydrogen . • CO2 Capture and conversion to fuel. • Bio electrochemical systems (e.g. microbial fuel cell) for bioenergy production. • Exploring the exploitation of microalgae for waste water remediation and production of bioenergy and other valuable bio-products. • Field visit to an industrial sector. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Discipline Requirement		5	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIO521	Mass Transfer		3
Prerequisites	ENG424		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			

<ul style="list-style-type: none"> • Molecular, convective, and inter-phase mass transfer; Transport properties; Continuous and • stage-wise mass transfer; absorption/stripping operations; Humidification/drying; Design of • absorption/stripping equipment including hydrodynamic design (loading, flooding, column diameter and height). 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO512	Biofuels		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Biofuel context: The need for bioenergy; problem and debate on first generation biofuel production; biofuel framework and roadmap. • Bioethanol and biobutanol production from lignocellulosic wastes. • Biofuel use: Electricity; heat; transport fuel. • A range of biodiesel production routes. • Algal biodiesel. • Energy balance and thermodynamics in biomass conversion. • Kinetics of biodiesel transesterification reaction. • Biojet. • Biogas. • Biodiesel standard specifications. • Application of biofuel/bioenergy, market prominence, and adaptation of the current fuel infrastructure; biomass choice and supply; principle of conversion process; unit process, operation consideration, and conversion efficiency; co-products, their usage and disposal routes; state-of-the-art of the application of technology around the world. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIO531	Bioremediation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Pollutant biodegradation (Biological principles and intrinsic kinetics): Microbial nutrition and metabolism; microbial growth and energy; enzymes and their structures; effect of environment on enzyme activity; microbial growth and substrate utilization kinetics; biokinetic models; batch and continuous chemostat studies; determination of biokinetic parameters. • Recognize pollutants, characterize the extent and consequences of pollution in the environment, identify and evaluate alternatives for remediation and prevention, and evaluate the economic and political viability of alternatives. • Environmental factors and chemical/physical properties of pollutants affecting biodegradation kinetics; and extrapolation to bioremediation strategies. • Bioremediation for water environment: Biochemical, molecular, and ecological foundations of bioremediation; contaminants in groundwater; in-situ and ex-situ decontamination of groundwater; selecting the bioremediation option (bioaugmentation or biostimulation); process optimization; factors affecting bioremediation; delivery systems for oxygen, nutrients, and inoculation; landfill leachate; industrial wastewater biotreatment technologies; biotreatment of surface waters; biosorption and wastewater treatment. • Bioremediation for air environment: Air Pollution, Acid rain, Effect of Air pollution, Control measures of air pollution. Atmospheric environment for microorganisms; microbial degradation of contaminants in gas phase; biological filtration processes for decontamination of air stream (biofiltration; biotrickling filtration; bioscrubbers). • Biotreatment of metals: Microbial transformation of metals; biological treatment technologies for metals remediation; bioleaching and biobenignification; bioaccumulation; oxidation/reduction processes; biological methylation. • Bioremediation for soil environment: Environment of soil microorganisms; Soil organic matter and characteristics; Soil microorganisms' association with plants; pesticides and microorganisms; petroleum hydrocarbons and microorganisms; industrial solvents and microorganisms; biotechnologies for in-situ and ex-situ remediation of soil; phytoremediation technology for soil decontamination. • Global application of bioremediation technologies. • This module includes a laboratory demonstration of the measurement of biodegradation kinetics and their analysis to select a mathematical model. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			

Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO541	Bioreactor Design			3
Prerequisites	BIO433			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Introduction to bioprocess: Type of fermentation, Measurement of microbial growth: Total cell number, Viable cell number, Cell dry weight, Absorbance, Packed cell volume, Viscosity, ATP, Heat evaluation, Specific growth rate, Product formation rate, Productivity, Chemostst theory, Dilution rate, Fed-batch culture. • Mixing and mass transfer: Mass transfer: oxygen transfer, KLa measurement: Steady state, Dynamic methods, Correlation of KLa for stirred tanks and Airlift reactors, Gas hold up, Liquid mixing, Characterization of agitation, Power consumption, Rheological properties: Newtonian and Non-Newtonian fluids, Laminar and turbulent shear, Shear in ALR. • Design and scale up: Types of bioreactor; Stirred tank bioreactor, Airlift bioreactor, Heat transfer, Scale up of STB and ALR, ALR design: Construction, Hydrodynamics, Three phase flow, Mixing, Oxygen transfer: Isobaric and Non- isobaric method. • Strategies for fermentation control: The control loop, Analogue, Digital, PID, Time-proportioned control, Physical control: Temperature, Airflow, Pressure, Agitation, pH, Dissolved oxygen, Fermented content, Feeding, Vent gas analysis, DDC, Estimation of biomass, Fault diagnosis. • Some examples of bioreactors. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical Discipline Requirement			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

BIO552	Biomaterials Science			3
Prerequisites	ENGS31			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Basic concepts in material science 				

- Understanding of fundamental concepts in material science (e.g., atomic structure and bonding, crystalline structures and defects) and interpretation of phase diagrams
- Understand major classes of materials used in medicine: metals, ceramics and polymers
- Polymers
- Understanding of glassy and rubbery states, ability to correlate structural features to mechanical properties (e.g., moduli, deformation, and viscoelasticity), knowledge of polymerization reactions (e.g., chain vs. step, thermoplastics vs. thermosets), knowledge of degradation mechanisms.
- Metals, Knowledge of the basic structure and types of alloys (e.g., ferrous and nonferrous), ability to correlate structural features created in processing to general mechanical properties (e.g. stress-strain behavior, hardness, impact energy, fracture toughness, fatigue)
- Biological response to biomaterials
- Familiarity with biocompatibility and hemocompatibility
- Understand mechanisms of the foreign body response to implanted biomaterials
- Understand biodegradation of biomaterials: intentional and un-intentional degradation mechanisms
- Knowledge of techniques to modify biomaterial surfaces to control the biological response and instrumentations to examine surface chemistry
- Biomaterial applications
- Knowledge of biomaterial requirements for certain medical applications
- Familiarity of biomaterials used in different medical applications (e.g., soft and hard tissue replacements, cardiovascular, drug delivery, biosensors, and tissue engineering).
- Biomaterials in Engineering Design
- Ability to apply fundamental principles for designing biomaterials to be used in a given medical application
- Familiarity with legal and ethical issues related to biomaterials used in medical applications

Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIO542	Modelling and Simulation		3
Prerequisites	BIO541 & BSC511		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		2
Required SWL	125	Equivalent ECTS	5
Course Content			

- The first part of this course will include revision and completion of the math required in the following topics: numerical methods, linear and nonlinear system analysis, finite element analysis, chaos, Markov chain, Monte Carlo with the use of a selected software (Matlab, simulink, Berkeley Madonna, Comsol...).
- The second part will include the Modelling fundamentals in chemical and petrochemicals engineering and formulation of dynamic model with examples in the equations of state, steady and unsteady mass, energy and momentum balances, chemical kinetics, multistage modelling.
- The student(s) will select a chemical process, and present a model that simulate the process with the aid of a computer software with a certain level of complexity that is chosen by the instructor.

Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Discipline Requirement		5	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	0%	20%	60%

BIO513	Bionanotechnology		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to nanotechnology. • Nanoparticles: types and properties, fullerenes, carbon nano-tubes, quantum dots, nano-core, nano-shells and nano-composites. • Synthesis and characterization of nanomaterials: Top down and bottom up approach, physical methods, ball milling, plasma arcing, laser ablation method, chemical method, sol-gels, chemical vapour deposition, electrodeposition. • An Introduction to Genes and Genomes • Recombinant DNA Technology and Genomics. Proteins as Products • Microbial Biotechnology. Plant Biotechnology. Animal Biotechnology. DNA Fingerprinting and FoENGSic Analysis • Biological methods of synthesis: Use of bacteria, fungi, and algae for nanoparticle synthesis. Magnetotactic bacteria for natural synthesis of magnetic nanoparticles, and mechanism of formation. Viruses as components for the formation of nanostructured materials, synthesis process and application. Role of plants in nanoparticle synthesis. • Need of quantum mechanics, nanobiology concepts, biological nanoobjects. • Environmental nanotechnology research: Nanotechnology for bioremediation of Heavy metals and polluted water. Biosensor technology for monitoring pollutants. 			

<ul style="list-style-type: none"> • General applications of bioscience and nanostructured catalyst systems in oil and gas refining, nano-membranes, nano-separators, nano-adsorbent, corrosion inhibitors, nano-additives for clean fuel, nano-materials from petrochemicals. • Application of nano-biotechnology in medicine: Biocompatible inorganic devices, implant coatings, stents, seeds, drug delivery, cancer treatment, bioconjugated silica nanoparticles for bioanalytical applications, dye doped, biofunctionalization of silica nanoparticles, cellular labeling/detection, DNA analysis, small molecules protein interactions, microarray and genome chips, nano-biosensors and nano-biochips. • Green- and bio- syntheses of NPs. • Biotechnology Regulations. Ethics and Biotechnology 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIO532	Petroleum Bioprocessing		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Microbial enhanced oil recovery. • Biodesulfurisation: Sulphur types; mechanisms. • Bionitrogenation: Nitrogen types; mechanisms. • Biometlisation: Metal types; mechanism. • Prospects for biological upgrading of heavy oils and asphaltene. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Discipline Requirement			5
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO543	Bioproduct Design		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to Bioproduct design. 			

<ul style="list-style-type: none"> • Visual design tools. • Process equipment (1) design & costing, (2) separation processes & chemical reactors, (3) heat transfer & fluid transport. • Capital & operating cost estimation methods. • Computational tools in Bioproduct design & costing. • Principles of flow sheet stimulation. • Physical & thermodynamic properties = VLE. • Design economic optimization. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Program Requirement		5	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO651	Occupational, Health, Safety Engineering		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to management systems <ul style="list-style-type: none"> ○ Basic elements of health, safety and environmental management systems. ○ The main components of management systems and how they can benefit an organization. ○ The key steps in a management system certification process. • Elements of an occupational health and safety management system <ul style="list-style-type: none"> ○ How a management system can benefit the organization? ○ The commitment and resources that will be need in order to successfully implement a management system. ○ How the management system can be adapted to suit the specific needs of an organization? ○ What is the OHSAS 18001? ○ How to create the procedures, policies and other related documents needed to implement an OHSMS that conforms to the 18001:2007 standard? • Elements of an Environmental Management System (EMS) <ul style="list-style-type: none"> ○ How to design an EMS to continually identify and control environmental hazards and decrease their associated risks at the workplace? ○ What is ISO? ○ What is ISO 14001:2004? ○ The benefits of implementing a management system. ○ How to develop an ENS that meets ISO 14001? ○ What is the difference between a program and a management system? 			

<ul style="list-style-type: none"> ○ The plan–do–check–act or plan–do–check–adjust (PDCA) approach used in management system standards. ● Environmental auditing and the main components of the environmental auditing process. ● Methods of auditing specific environmental issues associated with the activities of an organization. ● Practical environmental auditing skills to identify and evaluate the environmental effects of an organization. ● ISO14011 for environmental auditing 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

BIO611	Valorization of Waste and Biomass		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> ● The difference between recycling, upcycling and downcycling. ● Valorisation of waste and biomass (municipal, wastewater, industrial, electronic, wood and paper, bio and oil sludge, agro-industrial, construction and demolition, plastic, mining) for the production of Energy and fuels such as, hydrogen, biogas, biofuel, refuse-derived Fuel/Oil (RD, RDO), and thermal processes products. ● Classification of different generations of waste (first, second, and third generations). ● Introduction to carbohydrates, difference between pentoses, and hexoses. The Haworth formula, monosaccharides, disaccharides and polysaccharides. Glycosidic linkage. ● Lignocellulosic biomass, cellulose, hemicellulose, and lignin. ● Pretreatment and valorization of lignocellulosic biomass. ● Production of furfural by acid hydrolysis of hemicellulose. ● Supercritical fluid extraction potential in valorization . ● Pyrolysis of lignocellulosic waste, biochar, and biofuel. ● Secondary materials- (such as sorbents, enzymes, polymers). ● Anaerobic digestion of biomass to produce methane . ● Syngas reforming to produce green hydrogen. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Program Requirement			6
Assessment Criteria			

Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO631	Renewable Water Desalination Technologies		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Theoretical and practical aspects of seawater/brackish water desalination technologies. Water chemistry Detailed evaluation and technology description of thermal-based (MSF, MED, VC) and membrane-based (RO, NF, ED/EDR) desalination processes Conventional and innovative intake and pretreatment systems (including MF, UF) Process design and system performance Fouling, scaling (including bio-fouling) and cleaning Product water quality and post-treatment. Innovative desalination technologies (Forward Osmosis (FO), Membrane Distillation (MD), Adsorption Desalination (AD)) Energy consumption, environmental impact, economics, hybrid systems, desalination using renewable energy, trends of desalination market, full scale plants and case studies 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Program Requirement		6	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO632	Biolubricants for Tribological Engineering		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to tribology and real surfaces fundamental concepts: major factors that affect tribological performance, Hertzian analysis of the contact of smooth surfaces, the complex nature of real rough surfaces, measurement and characterization of rough surfaces, contact between rough surfaces. Friction and wear of surfaces: Laws of friction, theories of friction, frictional properties of engineering materials, static and dynamic friction, stick-slip, wear 			

<p>mechanisms, laws of wear, analysis of wear, wear properties of engineering materials, oxides and surface films, experimental methods.</p> <ul style="list-style-type: none"> • Lubrication regimes: hydrodynamic lubrication, hydrostatic lubrication, squeeze films, elastohydrodynamic lubrication, mixed and boundary lubrication, practical application of these types of lubrication; plain bearings, rolling element bearings, gears. • Lubricant types and lubrication: Types of lubricants (solid, liquid and gas), lubrication regimes, Stribeck curve, boundary lubrication, fluid film lubrication, the Reynolds equation, mixed lubrication, elastohydrodynamic lubrication, analysis of common bearing types. • Biolubricants: sources, preparation, composition, properties, testing and specifications, condition monitoring, health, safety and environment. • Advantages and disadvantages of biolubricants. • Biodegradation of biolubricants. • The prospects of biolubricants as alternatives in automotive applications. • Current and future status of the biolubricant market. • Engine tribology: lubrication of components, tribological testing, advanced materials. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO691	Graduation Research Project		6
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	0	0	
Required SWL	250	Equivalent ECTS	10
Course Content			
<ul style="list-style-type: none"> • Students will be required to carry out an individual research project in biofuels, industrial biotechnology, biorefining, crop sciences, pre-treatment or life cycle analysis . • The project could be carried out either in a university laboratory or in an industry partner's lab 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Program Requirement			6
Assessment Criteria			
Individual report	Dissertation	Oral exam	Individual presentation
15%	60%	15%	10%

BIO692	Graduation Design Project			6
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		0		0
Required SWL	250	Equivalent ECTS	10	
Course Content				
Students will be required to design of a sustainable biotechnological process.				
Used in Program / Level				
Program Name or requirement				Study Level
Biochemical Program Requirement				6
Assessment Criteria				
Project	Dissertation	Practical Exam	Group Presentation	
20%	50%	20%	10%	

BIO633	Fundamentals of Corrosion Science			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Corrosion chemistry. • Types of chemical corrosion. • Application of electrochemistry in corrosion protection in chemical and petrochemical plants. • Microbial influenced corrosion. • Sulfate reducing bacteria. • Biofilm formation and biofouling. • Corrosion monitoring. • Chemical and green biocides. • Cathodic protection. 				
Used in Program / Level				
Program Name or requirement				Study Level
Biochemical Elective Program Requirement				6
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

BIO643	Advanced Control Systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				

<ul style="list-style-type: none"> • System dynamics: Modelling of typical physical systems; operating point; linearization; differential equation representation. state space representation of systems; laplace transforms; transfer functions; block diagrams; SISO and MIMO systems; time and frequency domain responses of systems. • Feedback control: Positive and negative feedback; stability; methods for stability analysis; closed loop performance specification; PID controllers; Ziegler-Nichols; self-tuning methods. • Enhanced controllers: Cascade control; feedforward control; control of non-linear systems; control of systems with delay. • Digital controllers: Effects of sampling; implementation of PID controller; stability and tuning. • Advanced control topics: Hierarchical control; Kalman filter; system identification; model predictive control; statistical process control; the use of expert systems and neural networks in industrial control. • Design packages for process control systems: Examples including Simulink and MATLAB. • Case studies: Examples will be chosen from a range of industrial systems including mechanical, chemical and fluid systems. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO634	Fermentation Engineering		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • An Introduction to Fermentation Process • Microbial Growth Kinetics • The Isolation Preservation and Improvement of Industrially important microorganisms. • Media for industrial fermentations • Sterilization • The development of Inocula for industrial fermentations • Design of a Fermenter • Instrumentation and control • Aeration and agitation • The recovery and Purification of Fermentation Products • Effluent treatment • Fermentation economics • Applications on biochemical engineering 			

Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO641	Process Design and Simulation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
<ul style="list-style-type: none"> • Process Design <ul style="list-style-type: none"> • Overview: Conceptual process design. Process flowsheeting. • Process synthesis: Overview of a process system. Recycle structure of the flowsheet. Design of reaction and separation systems. • Process integration: Basic concepts of process integration for heat exchanger network design. • Process economic analysis: Equipment capital cost estimation. Process profitability analysis. • Process Modelling, Simulation and Optimization <ul style="list-style-type: none"> • Modelling and simulation: Basic concepts of process modelling. General concepts of simulation. Introduction to steady and dynamic process simulation. Introduction to commercial simulation software packages (ie, Aspen HYSYS) for process flowsheeting, design and analysis. • Process optimisation techniques: Basic principles of optimisation. Nonlinear and linear programming. Model building in mathematical programming. Introduction to algebraic modelling languages (ie, GAMS). Presentation of a number of industrial case studies. • Case Studies: A number of process simulation and optimisation case studies will be carried out using Aspen HYSYS and GAMS. Process modelling and simulation with gPROMS will be demonstrated. 			

Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

BIO642	Principles of Plant Design		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	2		0
Required SWL	150	Equivalent ECTS	6
Course Content			
<ul style="list-style-type: none"> • Induction • Site Survey & Selection: Information required to select a site; Transportation Issues; Utilities; Electrical & Communication Systems; Environmental Quality Control; Fire safety & security; site deatures • Readings siting and risk: Magnitude of the problem; statement of the problem; Bridging the gap between land use planning (LUP) and risk assessment (RM). • Plant layout: General factors in planning layout; Data requirements for the preparation of conceptual layout; Methods of planning layout; Layout economic and technical factors; Sources of information • Plant layout 2: plot plans; input data; project design data; vendor data; internally generated engineering data. • Plant layout 3: Drums & Drum types; location of drums; methods of support; pump locations; reactor location; pipe rack. • Introduction to project management: what is a project; defining the project; the triple constraint; project framework; integration management; time & quality management. • Engineering contracts: What is a contract; contract types • Project deliver system: PDS selection methods; risk mitigation • Project planning: objective of project planning; sources of planning data; activity definition; gantt charts; milestones. • Quality management: quality and business needs; principles for a quality system; principles for quality management • Startup & commissioning: preparation prior to initial start up; normal start-up procedures • Asset management 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab coursework	Mid-Term Exam	Group project	Final Exam
0%	30%	0%	70%

BIO653	Environmental Risk Analysis		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Fundamentals Hazard identification: Introduction to Hazard identification, Epidemiology, Toxicology, Classification of carcinogens, Evaluation of data. Dose-response assessment: Introduction to dose-response assessment, Toxic 			

<p>kinetics and toxic dynamics, Derivation of toxicity values. Exposure assessment: Introduction to exposure assessment, Characterization of exposure settings, Identification of exposure pathways, Quantification of exposure, Exposure modeling and monitoring. Risk characterization: Risk characterization, Uncertainty analysis, Chemical mixtures, Tiered approach. Ecological risk assessment: Problem formulation, Analysis, Risk characterization. Risk perceptions and risk communication: Risk perceptions, Risk communication. Risk management: Options appraisal, Risk control, Implementation and monitoring. Hazard identification: Introduction to Hazard identification, Epidemiology, Toxicology, Classification of carcinogens, Evaluation of data. Dose response assessment: Introduction to dose-response assessment, Toxic kinetics and toxic dynamics, Derivation of toxicity values. Exposure assessment: Introduction to exposure assessment, Characterization of exposure settings, Identification of exposure pathways, Quantification of exposure, Exposure modeling and monitoring. Risk characterization: Risk characterization, Uncertainty analysis, Chemical mixtures, Tiered approach. Ecological risk assessment: Problem formulation, Analysis, Risk characterization. Risk perceptions and risk communication: Risk perceptions, Risk communication. Risk management: Options appraisal, Risk control, Implementation and monitoring, waste industry safety, reducing the risks.</p> <ul style="list-style-type: none"> The course also draws the student's attention to the following topics: Global energy usage and trends. Characteristics and properties of fossil fuels. New fuels. Fuel testing and specification of commercial fuels. Renewable Sources of Energy. Utilization of fuels in boilers and furnaces. Energy losses and optimization of performance. Pollutant emissions. Carbon dioxide issues. Flame propagation and explosions. Fire - Review of relevant concepts. Fire spread. Radiation from fires. Building and factory fires. Assessment of fire hazards and risk of explosions. Fire and explosion prevention. Standard fire tests 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%
BIO635	Food Processing Equipment		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Introduction to material handling and transportation - selection of material handling machines and conveyors, belt conveyor; belt conveyor idlers, idler spacing, belt tension. Bucket elevator: head section, boot section, elevator legs, elevator belts, buckets, drive mechanism, hp requirement. 			

- Screw conveyor: screw conveyor details, various shapes of screw conveyor trough, capacity and horse power.
- Pneumatic conveyor, limitations of pneumatic conveying, chain conveyor.
- Pre-treatment unit operations: cleaning, sorting: fixed aperture sorting.
- Sorting: variable aperture screens, image processing, colour sorting, weight sorting and grading.
- Peeling, dehulling, dehusking.
- Mixing: introduction, agitation, agitated vessels, mixing of liquids.
- Mixing of solids: equipment- ribbon blender, kneader, double cone mixer, tumbling mixers, dough and paste mixers.
- Forming-bread moulders, pie and biscuit formers, confectionery moulders.
- Size reduction: introduction, grinding and cutting, energy used in grinding, kick's law, rittinger's law, bond's law.
- Equipment for size reduction: cutters & grinders, crushers, gyratory crusher, hammer mill, ball mill, tumbling mill.
- Separation by centrifugation and filtration.
- Separation by expression, extraction using solvents.
- Membrane concentration.
- Introduction and importance of physical properties-shape and size of grains, shape and size of fruits, bulk density of the grains, true density of the grains, porosity, angle of repose, test weight.
- Co-efficient of external friction, co-efficient of internal friction, colour of food materials.
- The need to consider hygienic design, hazards, how to approach hygienic design, hygienic design priorities, hygienic design principles, some general design pointers.

Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Elective Program Requirement		6	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIO636	Process Plant Operation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Overview of process plant operations: equipment for resource recovery; raw material preparation; reactions; downstream processing; effluent control and services. • Contactors: Stirred vessels (impeller design, flow patterns; flow and turbulence; power input; mixing; gas-liquid and liquid-liquid contact; non-Newtonian fluids); fluidized beds; packed beds; bubbling columns; two-phase 			

<p>flow; pulsed columns; rotating disc; rushton-oldshue columns.</p> <ul style="list-style-type: none"> • Evaporators: Design of heating calandria; climbing film; boiling heat fluxes; multiple effect; scraped film; vapour recompressions. • Crystallisers: Cooling and evaporative; solubilities; primary and secondary nucleation; crystal growth; size distributions; precipitation. • Dryers: Batch drying; constant and falling rates; diffusion in pores; adiabatic saturation; continuous drying; pneumatic dryers; spray dryers; evaporation from single drop; droplet trajectories; freeze dryers. • Thickeners: Design of sedimentation basins; motion of particles in fluids; stoke's law; hindered settling; size of basing. • Filters: Review of designs; darcy's and ruth's equations; incompressible and compressible cakes constant rate and constant pressure. • Centrifugal separators: Centrifugal principles; basket; disc stack; horizontal bowl; batch and continuous operations. • Effluent control: Gas absorption; packed columns; hydraulics; flooding; mass transfer; solubility; cyclones and hydrocyclones; coalescer designs for liquid-liquid separation; de-misters. • Services: Simultaneous heat and mass transfer in humidification and water cooling; design of water cooling towers. • Scale-up: General rules and specific procedures • Distillation: Vapour-liquid equilibrium; types of distillation; distillation with reflux; distillation column design and operation. • Case Study.

Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Elective Program Requirement		6	
Assessment Criteria			
Individual Report	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO652	Climate Change and Bioenergy		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Global environmental problems: Greenhouse effect, acid rain, El Niño, Ozone depletion, deforestation, desertification, salination, biodiversity loss; chemical and radiation hazards. • Environmental pollution and degradation: Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies; noise pollution; environmental damage by agriculture, perspectives of pollution in urban, industrial and rural areas. • Environmental protection act: Environmental laws, national movements, sustainable development, environmental policies, environmental economics, 			

<p>environmental ethics; holistic approach of environmental protection and conservation, IUCN-role in environmental protection. Concept with reference to UN-declaration, aim and objectives of human right policies with reference to Egypt on the priorities of implementation, Environmental Protection Agency (EPA).</p> <ul style="list-style-type: none"> • Climate change and greenhouse gas (GHG) emissions. • Greenhouse gas rules and regulations. • Environmental aspects of bioenergy. • Bioenergy and petroleum bioprocessing options and social challenges over GHG reduction measures. • Bioenergy emissions and health impacts. • Students engage in literature searches and review climate change policy options. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Individual Report	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

BIO654	Circular Economy		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to the concept of circular economy • The practical application of sustainability principles to organizations, communities and consumers • Theories of sustainability, resource and material flows, • Examples of existing circular economies in society, • Current developments in the field, • Factors that limit the development of circular systems • Relationship between industrial ecology, business, policy and innovation • An understanding of the core concepts of circular economy • Supply chains and waste • Use of critical thinking in practical applications of circular economy concepts in business settings • Provide experience in the expectations of a business environment 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Elective Program Requirement			6
Assessment Criteria			
Lab coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

Minor Course Description of Modules Delivered by the Bioenergy Engineering

Department to the Biochemical Engineering Program

BIOM21	Introduction to Biochemical Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> History of energy usage, forms of energy, present energy consumption, environmental problems. Conventional energy sources: energy and power; fossil fuel. Biomass: definitions, biomass resource, extracting biomass energy, fuel crops, anaerobic digestion, landfill gas, waste to energy, energy balances and economics. Introduction to biochemical engineering applications (biorenewable energy, biomedical systems, environment) Chemical composition in biological systems Electrolytic conductivity, ions in aqueous solutions, electrochemical cells Reaction methods and enzymes Equilibrium and transition systems 				
Used in Program / Level				
Program Name or requirement			Study Level	
Biochemical Minor Program Requirement			Minor	
Assessment Criteria				
Project	In-Class Assessment	Practical Exam	Final Exam	
0%	40%	0%	60%	

BIOM11	Biofuels			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Biofuel context: The need for bioenergy; problem and debate on first generation biofuel production; biofuel framework and roadmap. Bioethanol and biobutanol production from lignocellulosic wastes. Biofuel use: Electricity; heat; transport fuel. A range of biodiesel production routes. Algal biodiesel. Energy balance and thermodynamics in biomass conversion. 				

<ul style="list-style-type: none"> • Kinetics of biodiesel transesterification reaction. • Biojet. • Biogas. • Biodiesel standard specifications. • Application of biofuel/bioenergy, market prominence, and adaptation of the current fuel infrastructure; biomass choice and supply; principle of conversion process; unit process, operation consideration, and conversion efficiency; co-products, their usage and disposal routes; state-of-the-art of the application of technology around the world. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIOM12	Biorenewable Energy and Hydrogen Production		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		1
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Different approaches for hydrogen production (grey vs blue vs green hydrogen). • Production of hydrogen by electrolysis . • Biomass conversion and green hydrogen production. • Photolysis to produce green hydrogen . • CO₂ Capture and conversion to fuel. • Bio electrochemical systems (e.g. microbial fuel cell) for bioenergy production. • Exploring the exploitation of microalgae for waste water remediation and production of bioenergy and other valuable bio-products. • Field visit to an industrial sector. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

BIOM31	Bioremediation		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	1		2
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Pollutant biodegradation (Biological principles and intrinsic kinetics): Microbial nutrition and metabolism; microbial growth and energy; enzymes and their structures; effect of environment on enzyme activity; microbial growth and substrate utilization kinetics; biokinetic models; batch and continuous chemostat studies; determination of biokinetic parameters. • Recognize pollutants, characterize the extent and consequences of pollution in the environment, identify and evaluate alternatives for remediation and prevention, and evaluate the economic and political viability of alternatives. • Environmental factors and chemical/physical properties of pollutants affecting biodegradation kinetics; and extrapolation to bioremediation strategies. • Bioremediation for water environment: Biochemical, molecular, and ecological foundations of bioremediation; contaminants in groundwater; in-situ and ex-situ decontamination of groundwater; selecting the bioremediation option (bioaugmentation or biostimulation); process optimization; factors affecting bioremediation; delivery systems for oxygen, nutrients, and inoculation; landfill leachate; industrial wastewater biotreatment technologies; biotreatment of surface waters; biosorption and wastewater treatment. • Bioremediation for air environment: Air Pollution, Acid rain, Effect of Air pollution, Control measures of air pollution. Atmospheric environment for microorganisms; microbial degradation of contaminants in gas phase; biological filtration processes for decontamination of air stream (biofiltration; biotrickling filtration; bioscrubbers). • Biotreatment of metals: Microbial transformation of metals; biological treatment technologies for metals remediation; bioleaching and biobeneficiation; bioaccumulation; oxidation/reduction processes; biological methylation. • Bioremediation for soil environment: Environment of soil microorganisms; Soil organic matter and characteristics; Soil microorganisms' association with plants; pesticides and microorganisms; petroleum hydrocarbons and microorganisms; industrial solvents and microorganisms; biotechnologies for in-situ and ex-situ remediation of soil; phytoremediation technology for soil decontamination. • Global application of bioremediation technologies. • This module includes a laboratory demonstration of the measurement of biodegradation kinetics and their analysis to select a mathematical model. 			
Used in Program / Level			
Program Name or requirement			Study Level
Biochemical Minor Program Requirement			Minor
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%
BIOM61	Valorization of Waste and Biomass		3
Prerequisites	N/A		

Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • The difference between recycling, upcycling and downcycling. • Valorisation of waste and biomass (municipal, wastewater, industrial, electronic, wood and paper, bio and oil sludge, agro-industrial, construction and demolition, plastic, mining) for the production of Energy and fuels such as, hydrogen, biogas, biofuel, refuse-derived Fuel/Oil (RD, RDO), and thermal processes products. • Classification of different generations of waste (first, second, and third generations). • Introduction to carbohydrates, difference between pentoses, and hexoses. The Haworth formula, monosaccharides, disaccharides and polysaccharides. Glycosidic linkage. • Lignocellulosic biomass, cellulose, hemicellulose, and lignin. • Pretreatment and valorization of lignocellulosic biomass. • Production of furfural by acid hydrolysis of hemicellulose. • Supercritical fluid extraction potential in valorization . • Pyrolysis of lignocellulosic waste, biochar, and biofuel. • Secondary materials- (such as sorbents, enzymes, polymers). • Anaerobic digestion of biomass to produce methane . • Syngas reforming to produce green hydrogen. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Minor Program Requirement		Minor	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

BIOM32	Renewable Water Desalination Technologies	3	
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Theoretical and practical aspects of seawater/brackish water desalination technologies. • Water chemistry • Detailed evaluation and technology description of thermal-based (MSF, MED, VC) and membrane-based (RO, NF, ED/EDR) desalination processes • Conventional and innovative intake and pretreatment systems (including MF, UF) 			

<ul style="list-style-type: none"> • Process design and system performance • Fouling, scaling (including bio-fouling) and cleaning • Product water quality and post-treatment. • Innovative desalination technologies (Forward Osmosis (FO), Membrane Distillation (MD), Adsorption Desalination (AD)) • Energy consumption, environmental impact, economics, hybrid systems, desalination using renewable energy, trends of desalination market, full scale plants and case studies 			
Used in Program / Level			
Program Name or requirement		Study Level	
Biochemical Minor Program Requirement		Minor	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

5-Modules Delivered by the Petroleum Engineering & Gas Technology Department

	Code	Course Title	Cr & SWL			Contact Hours				Classification			
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
PET	PET532	Project Management	2	3	75	2	1		3	X			
	PET535	Petroleum Economics and Legislation	2	3	75	2	1		3	X			
	PET511	Introduction to oil and gas Industry	3	5	125	2	2		4			X	
	PETS12	Geological Principles for Petroleum Engineering	3	4	100	2	1	2	5			X	
	PETS21	Drilling Fluids Laboratory	2	3	75	1		2	3			X	
	PET451	Petroleum Refinery Engineering	3	5	125	2	2	1	5			X	
	PET411	Petroleum & Natural Gas Exploration	2	3	75	2	1		3			X	
	PET412	Surveying & Field Courses for Petroleum Engineers	3	4	100	2	2	2	6			X	
	PET431	Reservoir Fluid Properties.	3	5	125	2	2	2	6			X	
	PET432	Reservoir Rock Properties.	3	5	125	2	2	2	6			X	
	PET421	Drilling Engineering 1	2	3	75	2	1		3			X	
	PET413	Well Logging	3	4	100	2	2	1	5			X	
	PET452	Transportation and Storage of Petroleum and Gas	2	3	75	2	1		3			X	
	PET531	Petroleum Reservoir Engineering	3	5	125	2	2	1	5			X	
	PET511	Geostatistics for petroleum	3	5	125	2	1	1	4			X	
	PET512	Petroleum Development Geology	3	5	125	2	2	1	5			X	
	PET513	Well Testing	3	4	100	2		2	4			X	
	PET551	Corrosion in the Oil and Gas Industry	3	5	125	2	2		4			X	
	PET534	Computer Applications in Petroleum Engineering.	3	4	100	1		3	4			X	
	PET545	Safety & Environment in Petroleum Industry	2	3	75	2	1		3			X	
	PET533	Reservoir Modelling and Simulation.	3	5	125	2		2	4				X
	PET541	Oil and Gas Production 1	3	5	125	2	2	1	5				X
	PET552	Unit Operation	3	5	125	2	2	1	5				X
	PET553	Natural Gas Processing	3	5	125	2	2		4				X
	PET631	Enhanced Hydrocarbon Recovery	3	5	125	2	2		4				X
	PET632	Gas Condensate Reservoir Engineering	3	5	125	2	2		4				X
	PET633	Natural Gas Reservoir Engineering	3	5	125	2	2	2	6				X
	PET641	Oil and Gas Production 2	3	5	125	2	1	2	5				X
	PET621	Drilling Engineering II	3	5	125	2	2		4				X
	PET634	Field Development and Reservoir Management	3	5	125	2	2		4				X
	PET691	Graduation Research Project	6	10	250				0				X
	PET692	Graduation Design Project	6	10	250				0				X
PET622	Rock Mechanics for Drilling and Completion	3	5	125	2	2		4				X	
PET611	Advanced Production Logging	3	5	125	2	2		4				X	
PET642	Well Intervention and Stimulation	3	5	125	2	2		4				X	
PET651	Advanced Petroleum Refining Engineering	3	5	125	2	2		4				X	
PET623	Special Topics in Advanced Drilling	3	5	125	2	2		4				X	
PET635	Nanotechnology and its application oil & gas	3	5	125	2	2		4				X	
PET652	Energy Conservation	3	5	125	2	2		4				X	
PET653	Automatic Control in Chemical Operations	3	5	125	2	2		4				X	
PET643	Well Control	3	5	125	2	2		4				X	
PET624	Horizontal Oil Well Drilling Technology	3	5	125	2	2		4				X	
PET612	Petroleum geoscience	3	5	125	2	2		4				X	
PET Minor	PETM31	Reservoir Rock and Fluid Properties	2	3	5	125	2	2	2	6			X
	PETM61	Petroleum Geology	2	3	5	125	2	2	2	6			X
	PETM62	Formation Evaluation	2	3	5	125	2	2	2	6			X
	PETM32	Reservoir Engineering	2	2	4	100	2	1		3			X

PETM41	Production Engineering	2	3	5	125	2	2	2	6			X
PETM21	Drilling Engineering	2	2	3	75	2	1		3			X
PETM71	Refinery Engineering	2	2	3	75	2	1		3			X

Course Description of Modules Delivered by the Petroleum Engineering and Gas Technology Department to the Petroleum Engineering and Gas Technology Program

PET532	Project Management			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Introduction to project management • Definitions in project management • Project organizational structure • Project management body of knowledge • Project life cycle • Project network diagrams (AON & AOA) • Critical path methods • Project Management Tools and Techniques • Gant Chart • Work Breakdown Structure • Project Crashing • Project resources allocation • Cash flow analysis • Breakeven and payback • Time value of money • Inflation and discount factors • ROI, IRR • Use of commercial project management software 				
Used in Program / Level				
Program Name or requirement				Study Level
Petroleum University Requirement Elective				5
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

PET535	Petroleum Economics and Legislation			2
Prerequisites	PET532			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	75	Equivalent ECTS	3	
Course Content				

<ul style="list-style-type: none"> • Role of petroleum economist; • Cash flows; discounting; profitability indicators; inflation; unit cost and tariffs; production profiles; • Oil and gas prices; • Technical costs; • Contract terms and fiscal regimes; • Risk analysis; decision making; sensitivity analysis; • Local legislation and worldwide business operations: concessions, licenses, production, sharing contracts, joint ventures; • International organizations: OPEC and OAPEC. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum University Requirement Elective			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PETS11	Introduction to oil and gas Industry		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Petroleum definition • Origin of Petroleum • Chemical composition and classification of oil and gas • Physical properties of crude oil and its derivatives • Physical properties of natural gas • Basics of reservoir engineering • Basics of drilling engineering • Basics of production engineering • Basics of formation evaluation • Basics of oil and gas processing • Atmospheric and vacuum distillation • Pipeline transportation of oil and gas 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			S
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PETS12	Geological Principles for Petroleum Engineering			3
Prerequisites	PETS11			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Fundamentals of sedimentology, and structural geology as applied to petroleum related concepts • The earth structure • The geologic time • Origin of oil and gas • Hydrocarbon generation and migration • Oil and gas traps • Reservoir rocks • Oil and gas exploration techniques • Cross sections and contour maps • Integrated data analysis and interpretation 				
Used in Program / Level				
Program Name or requirement				Study Level
Petroleum Discipline Requirement				S
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	10%	30%	60%	

PETS21	Drilling Fluids Laboratory			2
Prerequisites	PETS11			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		2
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Introductions to drilling fluids, function, general nature and composition and circulating system • Different types of drilling • Well completion, work-over fluids, and drilling mud additives • Drilling hazards and their remedies • Pneumatic (air drilling, natural gas, and aerated mud used as drilling fluids) • Calculation of air and horsepower requirements • Hole stability; • The hydrostatic heads of liquids, the hydrostatic heads of mud and cement slurries • Total overburden pressure, formation pressures • Hole problems related to drilling fluid Pressure relations in bore holes • Mud selection for well control, stability and environmental compliance and mud impurities 				

<ul style="list-style-type: none"> • Measurement, analysis and data interpretation (qualitative and quantitative) of physical, chemical rheological properties of drilling fluids (e.g. density, viscosity, filtration, lubrication and electrochemical properties) • Experiments on the use of additives to increase and decrease mud weight, • Experiments on the use of chemicals to control mud filtrate volume and mud cake thickness • Mud calculations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			2
Assessment Criteria			
Lab coursework	Lab Report	Project	Final Exam
50%	0%	0%	50%

PET451	Petroleum Refinery Engineering		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Characteristics, composition and classification of crude oils. • Pretreatment and desalting CDU, VDU, visbreaking, coking, fluidized catalytic cracking, catalytic reforming, hydrocracking, alkylation, somerization and polymerization processes. • Finishing processes including H₂S removal, sweetening, solvent extraction and hydrotreating processes. • Petrochemicals: History of petrochemical industry and alternative sources, techniques involved to produce petrochemicals and their applications. • Feed stock source, process technology, reaction mechanisms, process economics, vulnerabilities and opportunities for innovation. • Derivatives of C₄ hydrocarbons: Iso and n-butanol; Methyl-tert-butyl ether (MTBE); Butylene oxide; Butyl acetate Derivatives of aromatics: BTX, Aniline; Phenol; Benzaldehyde; Terephthalic acid Polymers of Olefins. • Brief description of manufacture, properties and applications of addition polymers Polystyrene; polytetrafluoroethylene. • Copolymers of Ethylene-Propylene and Natural rubber. • Introduction to HYSYS and CHEMCAD software. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

PET411	Petroleum and Natural Gas exploration		2
Prerequisites	PETS12		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		0
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Essentials of petroleum geology; • Tools and techniques for effective petroleum exploration; • Surface and subsurface geological methods; • Prospective geophysical methods: seismic, gravity and magnetic; • Data acquisition and processing; • Geophysical interpretation techniques; • Stratigraphic and structural interpretation using integrated geological/geophysical data; • Examples and case history interpretation from around the world; • Geochemical techniques in petroleum prospecting; • Geological controls of oil and gas occurrence: their impact on exploration risk and success; • Safety and environmental geophysical aspects 			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Discipline Requirement		4	
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET412	Surveying & Field Courses for Petroleum Engineers		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		2
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Maps, charts and plans; • Length and distance measurements; • Levels and leveling; • Theodolite and angular measurements; • Total stations; • Control surveys and reference frames; • Tachometry and contouring • Area computation; • Volume computation; • GPS techniques; • Hydrographic survey • Topographic contour map, wireframe map and 3D surface map of the area 			

(using Surfer software;(<ul style="list-style-type: none"> • Structure contour map on the top of the reservoir; • Structure contour map on the bottom of the reservoir; • Isochore map; • Isoporosity map; • Isosaturation map • Three cross sections generated from the topographic contour and the reservoir structural contour. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Practical assessment	In-Class Assessment	Practical Project	Final Exam
0%	20%	30%	50%

PET431	Reservoir Fluid Properties		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to petroleum reservoir fluids <ul style="list-style-type: none"> • The five reservoir fluids • Applications of reservoir fluid properties • Phase behavior of liquid and gases • Sampling of reservoir fluids • Qualitative phase behaviour of hydrocarbon systems; • Quantitative phase behaviour; • Reservoir fluid characteristics; <ul style="list-style-type: none"> • PVT analysis and fluid correlations • Laboratory tests • Compositional analysis of reservoir fluids • Experimental work for fluid properties 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

PET432	Reservoir Rock Properties		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	

2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Rock porosity (primary, secondary, total, effective); • Fluid saturation; the fluid content of reservoir rocks; • Rock permeability (absolute, effective, relative and average permeability's for both • Flow system (linear flow system and radial flow system in parallel and series bed Connection); application of relative permeability-saturation curve in hydrocarbon recovery • Capillary pressure ;(factors affecting of capillary pressure, capillary pressure in reservoir condition and application of capillary pressure) • Rock wettability; methods will be used to determine rock wettability • Pretrophysics for clean rock, Relation between porosity, permeability, tortuosity and pore radius, Kozeny equation • Electrical resistivity of subsurface reservoirs; Archie's Law water saturation calculation from electrical rock properties, and tortuosity determination for fully and partially saturated rocks. • Experimental work for rock properties 			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Discipline Requirement		4	
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

PET421	Drilling Engineering 1		2
Prerequisites	PETS21		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to drilling Engineering, Well types, Rig types, Basic Rig components. • Rig Systems & Design; Hoisting system, Circulation system, Power System. • Engineering pressures; Formation pressure, fracture pressure, overburden pressure. • Prediction of abnormal pressure before, while and after drilling. • Drill String Design; Drill pipe design, Drill collar design, BHA accessories, BHA design for Vertical well. • Casing Design; Selection of Casing setting depth, Selection of Casing sizes and selection of casing grades. • Casing design loads; Collapse, burst, tension, Bending and Shock loads, Graphical methods of casing design. 			

<ul style="list-style-type: none"> • Cementing; Classification, Process, Types of cementing, Equipment of cementing. • Cementing Program Design; Slurry Density, Slurry yield, Thickening time, Displacement time and Job time. • Well Control: BOP Equipment, Kick indications, Kick detections, well control Methods, Calculation and design of killing operation (Kill sheet.) • Drill Bits; Types, Design factors; IADC Classification & Dual Grading and selection of Bit Performance. • Introduction of directional drilling; Reasons of directional drilling, types of well profile, Directional drilling terminologies 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET413	Well Logging		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Well logging objectives; • Invasion profile • Passive electrical properties of earth minerals • Self-potential log; • Resistivity measuring tools • Reservoir and non-reservoir discrimination • Matrix sensitive logs • Depth measurements. Pore hole callipers • Porosity mineralogy logs, density, neutron, sonic, EPT • Nuclear magnetic resonance • Porosity determination in clean formation • Formation resistivity factor • Gamma ray log • Conductivity of shales • Mineralogy identification • Saturation and Archie equation • Linear movable oil plot • Porosity – resistivity cross plots and cross plot techniques • Permeability relationship • Use of pressure measurements • Computerized log evaluation and use all log measurements to estimate various rock 			

<ul style="list-style-type: none"> • Properties and initial hydrocarbon in place • Sidewall coring • Logging programs • Cased hole logs • Well correlation • Logging interpretation using actual logs • 1 hour lab every other week using industrial well logging software 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
10%	30%	0%	60%

PET452	Transportation and Storage of Petroleum and Gas		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Cold pipeline • Hot pipelines • Gas transportation • Multiphase problems • Centrifugal pumps • Storage of oil and its products • Storage capacities • Optimum proportions and design of tanks • Transportation and storage of natural gas • Equipment of loading, transport and measurements. • Oil and natural gas transportation (on and off-shore);(• Pipelines design, • Building and control; • Oil and gases storage; • LNG storage; • Oil tanks; • Case studies. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			4
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET531	Petroleum Reservoir Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Review of reservoir rock and fluid properties; • Volumetric method to estimate oil and gas reserves • Primary recovery mechanisms (fluid and rock expansion, solution gas drive, water drive, gas-cap drive); volumetric (oil and gas in place); • Theory and assumptions of material balance equation (MBE); • Calculation of oil in place by material balance for under-saturated and saturated reservoirs; Production forecasting using material balance equation; • Decline curve analysis for estimating IHIP and forecasting • Aquifers and derivation of the diffusivity equation, dimensionless variables, solutions of the diffusivity equation and radius of investigation, multiple wells, line source solution, principles of superposition theory. • Water influx; water coning; • Introduction to Secondary and tertiary oil recovery. • 1 hour lab every other week using industrial reserve estimation and prediction software 				
Used in Program / Level				
Program Name or requirement				Study Level
Petroleum Discipline Requirement				5
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

PET511	Geostatistics for petroleum			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • An introduction to Petroleum geostatistics. • Applications of geostatistics in petroleum geoscience; • The framework for geostatistics & the Geostatistical concepts • Introduction to basic statistics: random variables, univariate and joint probability distributions, expectation, variance, covariance, conditional distribution. • Spatial data analysis: experimental variograms, clouds, maps • Variogram models 				

<ul style="list-style-type: none"> • The theory and properties of the Best Linear Unbiased Estimator (BLUE) • Kriging, Co-Kriging, Co-Kriging, External Drift • Uncertainties related to the Kriging • Conditional Simulation • Stochastic Simulation • Sequential Gaussian Simulation • Sequential Indicator Simulation • Application of simulation techniques in petroleum geology: simulation of facies, simulation of reservoir characteristics. • Software package data analysis • Case studies: Using geostatistical techniques in an exploration, evaluation or production. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	30%	20%	50%

PET512	Petroleum Development Geology		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to petroleum development geology, • Impact of geological factors on field development strategy, • Identification of reservoir characteristics and seals, • Importance of log correlation, cross section and subsurface maps in oil and gas fields development plans, • Depositional and diagenetic controls on reservoir rocks, barriers, and hydrocarbon distribution, Aquifer characterisation, distribution and mapping, • Geologic reservoir modelling, • Reserve estimation and evaluation, • Geological/petro-physical studies for infill drilling and recovery enhancement, • Assessment of case histories. • 1 hour lab every week learning static model creation on industrial software 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	30%	10%	60%

PET513	Well Testing			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		2	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Role of well testing in formation evaluation. • Well test design. • Pressure drawdown test - single rate test, skin factor, wellbore storage. • Pressure build-up test. • Injection and fall-off tests. • Multi-rate tests. • Repeat formation tester. • Horizontal wells testing. • Bounded reservoirs; determination of distance to no flow boundaries, reservoir limit tests and determination of average reservoir pressure. • Type curve matching (interference test). • Computer assisted well test analysis. • 2 hours lab every week using industrial well testing software 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Discipline Requirement			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

PET551	Corrosion in the Oil and Gas Industry			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Overview of corrosion in oil and gas production • Economics of corrosion damage • Corrosion mechanism: how and why metals corrode • Control methodology: inhibitors, cathodic protection, coatings and plastics, gas removal, metals (properties, cracking processes, design, and handling considerations) • Specific control procedures: drilling, casing, internal subsurface, surface equipment, water injection systems, gas processing, offshore operations; • Detecting and monitoring corrosion activity • Various corrosion-oriented software • Safety issues related corrosions of pipelines 				

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET534	Computer Applications in Petroleum Engineering.		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Review of computer programming languages. • Petroleum engineering problems. • Simulation of drilling and completion processes. • Geological/geophysical mapping and data evaluation. • Computational processing and analysis of logs. • Reservoir engineering problem. • Production engineering problems • Using Computer Programming in Petroleum and Chemical Engineering Fields 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
30%	0%	30%	40%

PET545	Safety and Environment in Petroleum Industry		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			

<ul style="list-style-type: none"> • Importance of safety and environmental issues in field practice; • Fundamentals of safety measures and actions; • Safety performance and lost time incidents; • Techniques to improve safety performance; • Commitment and safety awareness; • Hazard and operability studies (HAZOP) • The safety triangle and procedures • Safety management systems (SMS) • Environmental Impact Assessment (EIA) • The EIA process; • Gas venting and planning; • Oil-in-water emissions; • Chlorofluorohydrocarbons (CFC) gases; • Waste disposal. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET533	Reservoir Modelling and Simulation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Reservoir modelling and simulation infield practice. • Analysis of geological, geophysical and production data. • Construction of 3-D geological models. • Spatial analysis and geostatistics. • Incorporation of well log and core data into geological models. • Scaling of geological models for numerical simulation. • Reservoir simulation and management. • Basic input data and equations for reservoir dynamic model. • Model and grid selection. • Treatment of wells in simulators. • Compositional reservoir simulator equations. • Fractured reservoir models. • History matching. • Planning and executing a reservoir simulation study. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Discipline Requirement			5

Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
20%	0%	30%	50%

PET541	Oil and Gas Production 1	3
Prerequisites	N/A	
Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	1
Required SWL	125	Equivalent ECTS
		5

Course Content
<ul style="list-style-type: none"> • Inflow performance relationships, • Well completion design, • Well completion fluids, • Well completion tools • Perforation techniques, • Types of perforation guns • Underbalance perforation • Formation damage characteristics, • Well stimulation techniques, • Well deliverability, • Chock bean performance, • Work over operation and sand control, • Artificial lift system, • Wellhead equipment and flow control devices, • Production packers, • Gas lift equipment, • Pumping systems equipments, • Pumping units and prime movers for pumping, • Oil and gas separators, Gas measurement and regulation, • Automation of lease equipment and safety systems, • Safety and environment related to production equipments and facilities • 1 hour lab every other week using industrial production software

Used in Program / Level			
Program Name or requirement	Study Level		
Petroleum Program Requirement	5		
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET552	Unit Operation	3
Prerequisites	PET541	
Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	1

Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Settling • Gas Adsorption and purification • Mass transfer: mechanism • flow of Fluids through fixed solid bed • Binary distillation • Batch distillation • Crushing operation • Two components and Multicomponent distillation • Mixing • Filtration • Liquid- Liquid Extraction • Drying 			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Program Requirement		5	
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET553	Natural Gas Processing		3
Prerequisites	PET541		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction • Why we process natural Gas? • Chemical composition of natural gas • Pipe line gas specification • Calculations involving gas compositions • By product of natural gas • General processing schemes • Physical properties of light hydrocarbons and other associated compounds • Phase behavior of natural gas systems • Vapor liquid equilibrium data and computations • Water hydrocarbon systems • Flow of fluids • Mass Transfer • Heat Transfer • Chemical Kinetics 			
Used in Program / Level			
Program Name or requirement		Study Level	

Petroleum Program Requirement		5	
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET631	Enhanced Hydrocarbon Recovery	3
Prerequisites	N/A	
Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	0
Required SWL	125	Equivalent ECTS
		5

Course Content			
<ul style="list-style-type: none"> • Revision of Primary recovery • Secondary recovery; fractional flow and frontal advance equations, • Waterflood recovery calculations in homogeneous and stratified reservoir; • Factors Influencing waterflood performance, • factors affecting production performance; wettability, oil and water viscosities, formation dip and Rate, Initial Gas Saturation, Stabilized and Variable Zones, Areal Sweep Efficiencies, Vertical and volumetric sweep efficiencies, • fundamentals of enhanced oil recovery; • Enhanced Hydrocarbon Recovery Methods; • Chemical Methods (Polymer flooding, Alkaline flooding, Surfactant flooding and Alkaline Surfactant Polymer flooding approaches, design and performance and new techniques in chemical methods; • Thermal Methods (Steam injection , cyclic steam, and in-situ-combustion and new techniques in thermal methods) • Microbial Enhanced Hydrocarbon Recovery • Miscible displacement of CH₄ by CO₂ in depleted gas reservoirs; • Screening and selection of EOR methods and environmental factors associated with oil recovery. • Evaluating and monitoring of EOR projects, design a pilot project and example of case studies. 			

Used in Program / Level			
Program Name or requirement	Study Level		
Petroleum Program Requirement	6		
Assessment Criteria			
Lab Coursework	In-Class Assessment	Group Presentation	Final Exam
0%	20%	20%	60%

PET632	Gas Condensate Reservoir Engineering	3
Prerequisites	PET531	
Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	0
Required SWL	125	Equivalent ECTS
		5

Course Content			
<ul style="list-style-type: none"> • Introduction • Type of Gas Condensate Reservoirs • Basic Definitions and Concepts • Condensate Production Pattern in Gas Condensate Reservoirs • Species Distribution in Gas Condensate Reservoirs • Recovery Issues in Gas Condensate Reservoirs – Gas Recycling, Blowout, Fast Blowout, • Specific Requirements for Compositional Modelling in Gas Condensate Reservoirs • Well Deliverability in Gas Condensate Reservoirs – Liquid Bank Accumulation (both water • Blocking and hydrocarbon blocking) and Vaporization around the Wellbore • Effect on Well Deliverability • Methods for Improving Well Deliverability in Gas-Condensate Reservoir 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET633	Natural Gas Reservoir Engineering		3
Prerequisites	PET531		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Review of properties of natural gases , • Fundamentals of fluid flow through porous media. • BHP calculation of dry gas wells, effect of liquids on BHFP calculations , • Evaluation of gas well production performance, forecasting gas well performance • Coal Bed Methane reservoirs (fundamentals, measurement of coal bed gas content, sorption of gas on coals, coal permeability, coal well pressure transient tests, gas and water mass balance in coals...) • Shale gas reservoirs (challenges, depositional environment, petrophysical evaluation, rock physics analysis, gas transport processes in shale, performance analysis, resource estimation...) • Use of computer in gas reserve estimation. • Phase behavior of gas systems • Physical properties of gases • Gas liquefaction (refrigeration system- cascade liquefaction - expander cycle) • Field development plan for gas reservoirs • Reserve estimation for unconventional gas reservoir 			

<ul style="list-style-type: none"> Reserve estimation using software 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET641	Oil and Gas Production 2		3
Prerequisites	PET541		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Techniques of oil and natural gas processing; Task and responsibilities of process and facilities engineers; Process design: description of wellhead fluids, products specification, process model, process flow schemes; Oil processing: separation, separation design, separator types, dehydration and water treatment, de-oiling; Upstream gas processing: pressure reduction, gas dehydration, heavy hydrocarbon removal, contaminant removal, pressure evaluation (gas compression); Downstream gas processing: contaminant removal, natural gas liquid recovery, liquid natural gas or liquid petroleum gas; Facilities and production support system. Safety and environment pollution aspects , production gathering stations; Equations of oil and gas flow in pipes and restrictions; Types of storage tanks; corrosion in tanks and preventive actions; tank grades; tank battery Offshore production platforms; floating production systems (FPSO); Impact of oil and gas transportation and storage on environment. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET621	Drilling Engineering II		3
Prerequisites	PET421		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	

Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Well planning, different well design, hole problems, Hole Cleaning, and well control. High Temperature and High-Pressure drilling wells, concept, applications. Deep water drilling: concept, jetting, deep water rig advances. Underbalanced Drilling, concepts, application and design. Directional drilling: purpose, well trajectory, directional well design, kick-off, different directional pattern and build and drop-off sections; Directional assembly: mud motors, build and drop assembly, survey, measuring and logging while drilling tools; different methods for deflection. Relief well: purpose, well control, well trajectory, relief well design, drilling relief well, BHA, casing design, cement. Side tracking, correction runs and reach extended wells: purpose, well trajectory, reach extended well design, techniques. Well survey: azimuth, inclination and survey calculations; Survey Instruments. Multilateral directional well: purpose, well trajectory, multilateral well design, drilling multilateral well, BHA, casing design, cement, hole behavior. Horizontal drilling: purpose, well trajectory, horizontal well design, drilling a horizontal well, BHA, casing design, cement, hole behavior, types of Horizontal Wells . Planning Horizontal Wells; Logging Horizontal Wells; horizontal drilling with air; Cementing Horizontal Wells; Problems of Horizontal wells. Directional software: input data, output data to predict the next build and drop off section and the different directional calculations: TVD, vertical section, horizontal displacement, dog leg, tool face, next survey station. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Petroleum Program Requirement		6	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET634	Field Development and Reservoir Management		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Reservoir management: an integrated interdisciplinary team effort; Goal setting, planning, implementing, monitoring and evaluating reservoir performance; Field development and operating plans to optimize profitability; Efficient monitoring of reservoir performance; Minimizing the drilling of unnecessary wells; 			

<ul style="list-style-type: none"> Wellbore and surface production systems; Economic impact of operating plans; Identifying and acquiring critical data, data acquisition and analysis; Monitoring economic recovery and maximizing capital and operating expenses; Timing of field implementation of reservoir management plan; Case histories and analysis; Responsibilities for team members. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	10%	40%	50%

PET691	Graduation Research Project		6
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	0	0	
Required SWL	250	Equivalent ECTS	10
Course Content			
<p>Students will carry out a substantially based industrial research project on an individual basis. The topic and content will be relevant to their degree program. The project will be supervised by an individual member of academic staff and may involve experimental test work, field work, design work and possibly work based at an industrial organisation. Each student will be responsible for the planning, execution and interpretation of their own work. Each student will present individual written reports including a project plan, an interim report at the end of the first semester and a final report at the end of the second semester together with an oral presentation.</p>			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Dissertation
0%	0%	0%	100%

PET692	Graduation Design Project		6
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	0	0	
Required SWL	250	Equivalent ECTS	10
Course Content			

Students will work together in a team, a process plant or other industrial operation. Each project will be supervised by a member of academic staff who will act as project coordinator and will be responsible for the organization and assessment of that project. Students will meet with the coordinator on a regular basis to ensure good communications within the project; they will also attend a series of lectures and seminars dealing with relevant aspects of the planning, design and evaluation of the project. Students will be responsible for the organization and delivery of relevant aspects required in the project, as prescribed. Each individual student or team will be required to produce a project plan detailing the planning and execution of the project, an interim report covering basic aspects and relevant literature in the field, and a final report covering detailed technical, financial and environmental aspects of the project. Other reports may be required by the project coordinator. Students will also be required to make a verbal presentation on their findings at the end of the project.

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Dissertation
0%	0%	0%	100%

PET622	Rock Mechanics for Drilling and Completion		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • In-situ stresses and formation pressures – the basics • Rock mechanical properties – what they are and how to find them • Wellbore stability – fundamentals of borehole collapse and lost circulation, causes and effects, practical guidelines, software examples, case histories • Bit/formation interaction – log-based methods for strength estimation • Sand production and its control – theory, sanding prediction and solutions • Cold heavy oil production with sand (CHOPS) – basic mechanics and practical examples • Reservoir monitoring: microseismics, well logging. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%
PET611	Advanced Production Logging		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Principles of Production Logging Cased hole Formation Evaluation using tools used in open hole logging: Standard Gamma Ray (GR), Natural Gamma Ray Spectrometry (NGS), Neutron, Sonic. Difference in processing and interpretation for tools when used in both open and cased-hole logging. Cased-hole Formation Evaluation; Thermal Decay Time Log (TDT), Gamma Ray Spectrometry Tool (GST), Reservoir Saturation Tool (RST) Applications of production logging in low flow rate and high flow rate wells spinner Flow meter analysis Gradiomanometer Analysis Completion Evaluation Cement Quality Logging ; Cement Bond Logging ; Ultrasonic-Pulse- Echo-Logs Noise Logging; tools and Operations ; guidelines for running and interpretation of noise logging Cased Hole Formation Resistivity Tool (CHFR) Horizontal Wells Production Logging; Flow Regime in Horizontal Wells Flo -Sac Imager (FSI) Tool; Flow – Caliper Imaging Tool; Gradiomanometer Tool Cased – Hole Formation Evaluation Logs Reservoir performance: inflow and outflow relationships Economic Analysis 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET642	Well Intervention and Stimulation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> Well intervention techniques: Coil tubing Snubbing unit Slik and E lines 			

- Formation Damage:
 - Skin: completion and production
 - Sources of formation damage
 - Formation damage during workover
 - Well inflow and stimulation
 - Candidate stimulation selection
- Matrix acidizing:
 - Selection of chemical treatment type
 - Formation damage caused by matrix stimulation fluids
 - Selection of matrix stimulation fluids
 - acidizing physics;
 - matrix acidizing of sandstones;
 - fluid placement and diversion in sandstone acidizing;
 - matrix acidizing treatment evaluation;
- Hydraulic Fracturing:
 - Fracturing stimulation treatments types
 - Brief review of rock mechanical issues related to hydraulic fracturing
 - Creation of a propped hydraulic fracture
 - Optimization of hydraulic fracture dimensions
 - Propped fracture conductivity
 - Fracturing fluids

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET651	Advanced Petroleum Refining Engineering		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Crude oil fractionation, • Details of design of Atmospheric and Vacuum distillation Columns, • Basic petroleum fractions from AD/AV complex, • Refinery Gases, • Gasoline Specifications & use in Internal Combustion Engines, ignition quality of gasoline, • Pre-ignition and Detonation, Mechanism of Detonation, • Naphtha Specification and uses, • Aviation Turbine Fuel, • Kerosene specifications (uses & production of Linear Alkyl Benzene LAB), 			

<ul style="list-style-type: none"> • Gas Oil and Diesel Fuel, • Fuel oil and Asphalt specifications & uses, • Wax distillates production, • Manufacture of lubricating oils, • Theory of friction and Lubrication, • Manufacture of grease, • Complex refinery schemes for processing of Natural Gas and crude oil, dehydration, desulphurization, • Cracking & reforming Operations. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PET623	Special Topics in Advanced Drilling		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • High Pressure / High Temperature wells Techniques and Equipment • Deepwater Techniques and considerations • Underbalanced Drilling • Through tubing rotary drilling • Managed pressure drilling • Advanced well control equipment for offshore drilling. • Casing while drilling; vertical and directional wells • Extended Reach, Multilateral and Designer Design considerations Technology • Workover, Intervention and Well Management Techniques . • QRA based well programming. • New Techniques in drilling operations. • Factors affecting rate of penetration. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%
PET635	Nanotechnology and its application oil & gas		3
Prerequisites	N/A		
Number of weekly Contact Hours			

Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction to nanotechnology and its applications • Basic concepts and definitions of Nanomaterials • nanomaterials properties based on proportion of surface/volume • scanning technology and electron probe on nanomaterials characterization • Introduction to ultraviolet spectroscopy and infrared • Nano membrane technology techniques • Stimuli Nano engineered • polymers Nano engineered • nanotubes manufacturing • nanoparticles quantum dots • Micro wire micro • Formulation of nanoparticles • Manufacturing of nanoparticles in biotechnology industries. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

PET652	Energy Conservation		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • All methods and ideas for energy saving • Energy recovery and Rationalization of Fuel • Optimized design of the steam system • Isolation • Energy saving by re-use of heat 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

PET653	Automatic Control in Chemical Operations			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to automatic control system (ACS) • Methods of analysis and synthesis of ACS • Stability and quality of ACS • Mathematical description of controlled member (plant) of ACS • Automatic control equipment (principals of automatic check • Measurement of temperature, pressure, quantity, flow and level • Transmission of instruments readings • Process control systems (methods of automatic control of petroleum refining and petrochemical equipment-process control schemes) 				
Used in Program / Level				
Program Name or requirement				Study Level
Petroleum Elective Program Requirement				6
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	10%	30%	60%	

PET643	Well Control			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Pressure control concepts and theory . • Formation pressure: Definition of normal, subnormal and abnormal pressure; Fracture pressure. • Formation integrity tests. Circulation pressure losses. Shallow gas: introduction, operational precautions. • Production well control methods and procedures . • Reasons for well interventions well control: Introduction, tubing blockage, control of excessive water or gas production, mechanical failure, stimulation, sand control. Well control in hydraulic workovers . • Well control operations, equipment, and specific containment problems: Introduction, snubbing operations, wireline operations, coiled tubing operations. • well intervention well control: pumping operations and wellhead and tree maintenance. • Risk assessment: PUWER, LOLER, HAZID. Well intervention well control management. 				

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

PET624	Horizontal Oil Well Drilling Technology		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
<ul style="list-style-type: none"> • Introduction & objectives of horizontal wells, ERD, Laterals etc . • Horizontal drilling methods and applications • Geological aspects, & development of oil & gas field using horizontal wells . • Drilling of horizontal, multilateral and ERD wells . • Completion of horizontal, multilateral and ERD wells . • Reservoir engineering concepts of horizontal wells . • Well logging methods in horizontal wells . • Well test analysis of horizontal wells . • Well performance & productivity of horizontal Wells . • Water & Gas coning in horizontal wells . • Application of horizontal wells in gas reservoirs & in recovery of heavy oils. 			

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	10%	30%	60%

PET612	Petroleum Geoscience		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
Geology, geophysics & exploration tools			
<ul style="list-style-type: none"> • Introduction to petroleum geosciences • Seismic methods for geologists • Seismic methods for geophysicists • Multi-scale geological analysis 			

- Structural analysis
- Drilling and well-site geology
- Well logging – Evaluation of formations for geologists
- Well logging – Evaluation of formations for geophysicists
- Reservoir engineering and fluid production

Seismic interpretation and basin evaluation

- Seismic interpretation
- Basin analysis and evaluation
- Advanced basin analysis and evaluation
- Advanced seismic interpretation

Reservoir characterization

- Clastics deposits
- Advanced seismic methods
- Carbonate deposits
- Reservoir geophysics
- Reservoir characterization and modeling
- Advanced reservoir characterization and modeling
- Advanced reservoir geophysics
- Fractured reservoirs
- Unconventional hydrocarbons

Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Elective Program Requirement			6
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

Minor Course Description of Modules Delivered by the Petroleum Engineering and Gas Technology Department to the Petroleum Engineering and Gas Technology Program

PETM31	Reservoir Rock and Fluid Properties			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Rock porosity (primary, secondary, total, effective); • Fluid saturation; the fluid content of reservoir rocks; • Rock permeability (absolute, effective, relative and average permeability's for both • Flow system (linear flow system and radial flow system in parallel and series bed Connection); application of relative permeability-saturation curve in hydrocarbon recovery • Capillary pressure ;(factors affecting of capillary pressure, capillary pressure in reservoir condition and application of capillary pressure) • Rock wettability; methods will be used to determine rock wettability • Pretrophysics for clean rock, Relation between porosity, permeability, tortuosity and pore radius, Kozeny equation • Electrical resistivity of subsurface reservoirs; Archie's Law water saturation calculation from electrical rock properties, and tortuosity determination for fully and partially saturated rocks. • Experimental work for rock properties • Behaviour of gases; • Phase behaviour of liquids; • Qualitative phase behaviour of hydrocarbon systems; • Quantitative phase behaviour; • Reservoir fluid characteristics; • Applications of reservoir fluid characteristics; • Five different reservoir fluids • PVT analysis and reservoir fluid study. • Experimental work for fluid properties 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Minor Program Requirement			Minor	
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
20%	20%	0%	60%	

PETM61	Petroleum Geology			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Fundamentals of sedimentology, and structural geology as applied to petroleum related concepts • The earth structure • The geologic time • Origin of oil and gas • Hydrocarbon generation and migration • Oil and gas traps • Reservoir rocks • Oil and gas exploration techniques • Cross sections and contour maps • Integrated data analysis and interpretation • Essentials of petroleum geology; • Tools and techniques for effective petroleum exploration; • Surface and subsurface geological methods; • Prospective geophysical methods: seismic, gravity and magnetic; • Data acquisition and processing; • Geophysical interpretation techniques; • Stratigraphic and structural interpretation using integrated geological/geophysical data; • Examples and case history interpretation from around the world; • Geochemical techniques in petroleum prospecting; • Geological controls of oil and gas occurrence: their impact on exploration risk and success; • Safety and environmental geophysical aspects 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Minor Program Requirement			Minor	
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

PETM62	Formation Evaluation			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125	Equivalent ECTS	5	
Course Content				

- Well logging objectives;
- Invasion profile
- Passive electrical properties of earth minerals
- Self-potential log;
- Resistivity measuring tools
- Reservoir and non-reservoir discrimination
- Matrix sensitive logs
- Depth measurements. Pore hole callipers
- Porosity mineralogy logs, density, neutron, sonic, EPT
- Nuclear magnetic resonance
- Porosity determination in clean formation
- Formation resistivity factor
- Gamma ray log
- Conductivity of shales
- Mineralogy identification
- Saturation and Archie equation
- Linear movable oil plot
- Porosity – resistivity cross plots and cross plot techniques
- Permeability relationship
- Use of pressure measurements
- Computerized log evaluation and use all log measurements to estimate various rock
- Properties and initial hydrocarbon in place
- Sidewall coring
- Logging programs
- Cased hole logs
- Well correlation
- Logging interpretation using actual logs
- Role of well testing in formation evaluation.
- Well test design.
- Pressure drawdown test - single rate test, skin factor, wellbore storage.
- Pressure build-up test.
- Injection and fall-off tests.
- Multi-rate tests.
- Repeat formation tester.
- Horizontal wells testing.
- Bounded reservoirs; determination of distance to no flow boundaries, reservoir limit tests and determination of average reservoir pressure.
- Type curve matching (interference test).
- Computer assisted well test analysis.
- 2 hour lab every other week using industrial software

Used in Program / Level

Program Name or requirement

Study Level

Petroleum Minor Program Requirement

Minor

Assessment Criteria

Lab Coursework	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

PETM32	Reservoir Engineering			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Review of reservoir rock and fluid properties; • Volumetric method to estimate oil and gas reserves • Primary recovery mechanisms (fluid and rock expansion, solution gas drive, water drive, gas-cap drive); volumetric (oil and gas in place); • Theory and assumptions of material balance equation (MBE); • Calculation of oil in place by material balance for under-saturated and saturated reservoirs; Production forecasting using material balance equation; • Decline curve analysis for estimating IHIP and forecasting • Aquifers and derivation of the diffusivity equation, dimensionless variables, solutions of the diffusivity equation and radius of investigation, multiple wells, line source solution, principles of superposition theory. • Water influx; water coning; • Introduction to Secondary and tertiary oil recovery. • 1 hour lab every other week using industrial reserve estimation and prediction software 				
Used in Program / Level				
Program Name or requirement			Study Level	
Petroleum Minor Program Requirement			Minor	
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

PETM41	Production Engineering			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		2	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Inflow performance relationships, • Well completion design, • Well completion fluids, 				

- Well completion tools
- Perforation techniques,
- Types of perforation guns
- Underbalance perforation
- Formation damage characteristics,
- Well stimulation techniques,
- Well deliverability,
- Chock bean performance,
- Work over operation and sand control,
- Artificial lift system,
- Wellhead equipment and flow control devices,
- Production packers,
- Gas lift equipment,
- Pumping systems equipments,
- Pumping units and prime movers for pumping,
- Oil and gas separators, Gas measurement and regulation,
- Automation of lease equipment and safety systems,
- Safety and environment related to production equipments and facilities
- 1 hour lab every other week using industrial production software

Used in Program / Level

Program Name or requirement		Study Level	
Petroleum Minor Program Requirement		Minor	
Petroleum Minor Program Requirement			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PETM21	Drilling Engineering		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to drilling Engineering, Well types, Rig types, Basic Rig components. • Rig Systems & Design; Hoisting system, Circulation system, Power System. • Engineering pressures; Formation pressure, fracture pressure, overburden pressure. • Prediction of abnormal pressure before, while and after drilling. • Drill String Design; Drill pipe design, Drill collar design, BHA accessories, BHA design for Vertical well. • Casing Design; Selection of Casing setting depth, Selection of Casing sizes and selection of casing grades. • Casing design loads; Collapse, burst, tension, Bending and Shock loads, Graphical methods of casing design. 			

<ul style="list-style-type: none"> • Cementing; Classification, Process, Types of cementing, Equipment of cementing. • Cementing Program Design; Slurry Density, Slurry yield, Thickening time, Displacement time and Job time. • Well Control: BOP Equipment, Kick indications, Kick detections, well control Methods, Calculation and design of killing operation (Kill sheet.) • Drill Bits; Types, Design factors; IADC Classification & Dual Grading and selection of Bit Performance. • Introduction of directional drilling; Reasons of directional drilling, types of well profile, Directional drilling terminologies 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Minor Program Requirement			Minor
Assessment Criteria			
Lab coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

PETM71	Petroleum Refinery Engineering		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Characteristics, composition and classification of crude oils. • Pretreatment and desalting CDU, VDU, visbreaking, coking, fluidized catalytic cracking, catalytic reforming, hydrocracking, alkylation, somerization and polymerization processes. • Finishing processes including H₂S removal, sweetening, solvent extraction and hydrotreating processes. • Petrochemicals: History of petrochemical industry and alternative sources, techniques involved to produce petrochemicals and their applications. • Feed stock source, process technology, reaction mechanisms, process economics, vulnerabilities and opportunities for innovation. • Derivatives of C₄ hydrocarbons: Iso and n-butanol; Methyl-tert-butyl ether (MTBE); Butylene oxide; Butyl acetate Derivatives of aromatics: BTX, Aniline; Phenol; Benzaldehyde; Terephthalic acid Polymers of Olefins. • Brief description of manufacture, properties and applications of addition polymers Polystyrene; polytetrafluoroethylene. • Copolymers of Ethylene-Propylene and Natural rubber. • Introduction to HYSYS and CHEMCAD software. 			
Used in Program / Level			
Program Name or requirement			Study Level
Petroleum Minor Program Requirement			Minor
Assessment Criteria			



Lab coursework	In-Class Assessment	Project	Final Exam
0%	40%	0%	60%

6-Modules Delivered by the Sustainable Architecture Department

	Code	Course Title	Cr & SWL			Contact Hours				Classification			
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR
ESB	SAE523	Energy and human development	2	3	75	2			2	X			
	SAE611	Sustainable Project Management & Costing	2	3	75	2	1		3	X			
	SAE431	Geotechnics	3	5	125	2	2		4		X		
	SAE412	Building Regulations & Rating Systems	3	5	125	2	2		4		X		
	SAES11	Introduction to architectural design and graphics	5	8	200	3	--	5	8			X	
	SAES21	Introduction to Environmental Sustainable Design	3	4	100	2		3	5			X	
	SAES12	Architecture Surveying	2	4	100	1	1	2	4			X	
	SAES31	Sustainable Tectonics (1)	3	5	125	2		3	5			X	
	SAE432	Sustainable Tectonics (2)	3	4	100	2		3	5			X	
	SAES13	Sustainable Architecture style, time, & place (1)	2	3	75	2			2			X	
	SAE421	Eco Design (1)	4	7	175	2		6	8			X	
	SAE433	Architectural design of Elements	3	5	125	2	2		4			X	
	SAE411	Digital Representation tools in Architecture	2	3	75	1		3	4			X	
	SAE441	Environmental Control Systems (1)	2	3	75	2	1		3			X	
	SAE422	Eco Design for occupant wellbeing (2)	4	7	175	2		6	8			X	
	SAE413	Sustainable Architecture style, time, & place (2)	2	3	75	2			2			X	
	SAE423	Urban Sustainability and Climate Change	3	4	100	2		3	5			X	
	SAE434	Sustainable Tectonics (3)	3	4	100	2		3	5			X	
	SAE531	Sustainable Tectonics (4)	3	4	100	2		3	5			X	
	SAE521	Eco Design for Zero Energy & Passive Building (3)	4	7	175	2		6	8			X	
	SAE543	Environmental Control Systems (2)	2	3	75	2	1		3			X	
	SAE532	Sustainable Tectonics (5)	3	4	100	2		3	5			X	
	SAE522	Eco Design Parametric and High-tech (4)	4	7	175	2		6	8			X	
	SAE621	Eco Design Detailing Adaptive Reuse (5)	4	7	175	2		6	8			X	
	SAE551	New technologies and Sustainable Architecture Future	2	3	75	2			2				X
	SAE542	Daylighting	3	5	125	2	1	1	4				X
	SAE552	Building Information Modelling	2	3	75	1	2		3				X
	SAE553	Integrated Building Design	3	5	125	2	2		4				X
	SAE544	Modelling & Simulation for Sustainable Architecture	3	5	125	2		3	5				X
	SAE691	Graduation Research Project	4	6	150				0				X
	SAE692	Graduation Design Project	10	18	450	2		8	10				X
	SAE622	Environmental Interior Design & Refurbishment	3	4	100	2	2		4				X
	SAE623	Life Cycle and Supply Chain Environmental Assessment	3	4	100	2	2		4				X
SAE641	Introduction to Renewable Energy Systems	3	4	100	2	2		4				X	
SAE642	Complex Building Energy Modelling	3	4	100	2	2		4				X	
SAE643	Energy Systems	3	5	125	2	2	1	5				X	
SAE644	Energy management and controls	3	5	125	2	2		4				X	
SAE645	Solar Energy	3	5	125	2	2	1	5				X	
SAE646	Building Services and Operations	3	5	125	2	2		4				X	
SAE624	Sustainable Landscapes	3	4	100	2	2		4				X	
SAE625	Environmental Sustainability	3	4	100	2	2		4				X	
SAE626	Partnerships for Sustainable Futures	3	4	100	2	2		4				X	
SAE627	Water and Waste Sustainable Management	3	4	100	2	2		4				X	
ESBD Minor	SAEM11	Introduction to architectural design and graphics	5	9	225	3	--	5	8				X
	SAEM12	Digital Representation tools in Architecture	2	3	75	1		3	4				X
	SAEM13	Architecture Surveying	2	4	100	1	1	2	4				X
	SAEM31	Sustainable Tectonics (1)	3	5	125	2		3	5				X
	SAEM14	Sustainable Architecture style, time, & place (2)	2	3	75	2			2				X
	SAEM21	Eco Design (1)	4	7	175	2		6	8				X

Course Description of Modules Delivered by the Sustainable Architecture Engineering Department to the Architecture Engineering - Sustainable Building Design Program

SAE523	Energy and human development			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Engineering and technology in society; • The engineering profession; • Energy engineering; • The engineer as a problem solver presented through consideration of specific topics such as: safety requirements, energy and the environment, service failure of systems and components, low cost automation, development of industry and energy in Europe and the Middle East with Special reference to Egypt and UK and power generation. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture University Requirement Elective			5	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Project	Final Exam	
0%	20%	20%	60%	

SAE611	Sustainable Project Management and Costing			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Preparing project bids and proposals • Negotiating contracts • Project planning and initiation • Scheduling construction • Estimating, budgeting and cost control • Project organization and control • Construction project execution • BIM and electronic information exchange • Green building and sustainable construction • Life cycle and supply chain sustainability assessment • Managing human factors 				
Used in Program / Level				

Program Name or requirement		Study Level	
Architecture University Requirement Elective		5	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Project	Final Exam
0%	20%	20%	60%

SAE431	Geotechnics			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to the geology and geomaterials of Egypt and the UK; • Nature of soils and their variability; and the state and behaviour of a soil. • Basic engineering properties of soils and rock masses and their classifications; • Vertical stress and shear strength of soils, • Flow of water through soils; • Introduction to consolidation theory; • Common ground engineering problems, techniques and technologies for soil improvement. 				
Used in Program / Level				
Program Name or requirement		Study Level		
Architecture Faculty Requirement Elective		4		
Assessment Criteria				
Lab coursework	In-Class Assessment	Project	Final Exam	
0%	40%	0%	60%	

SAE412	Building Regulations & Rating Systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Urban strategies, policies, programs, and planning approaches. • Land management, types, and infrastructure facilities . • Introduction to standard forms of contract and ownership key challenges. • Strategic urban plans for small and large cities in Egypt. • Strategic development plans for greater Cairo region, etc. • Achieving sustainable urban development priorities . • Central institutions relevant to urban planning and affiliates in Egypt and UK . • Institutions and regional and local administrative involved in land management in Egypt and UK. 				

<ul style="list-style-type: none"> • Egyptian building law. • High-Performance Green Building (green technology, processes and principles) • Green Pyramid Rating System and International Green Construction Code. • Sustainable Design Certificate Program (LEED) • Ecological design practices and rating systems worldwide and locally. • Sustainable building materials and practices, Low carbon buildings . • Economy of resources and life cycle design . • Water and waste management and engineering. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Faculty Requirement Elective			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
40%	20%	0%	40%

SAES11	Introduction to Architectural Design and Graphics		5
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
3	0	5	
Required SWL	200	Equivalent ECTS	8
Course Content			
<ul style="list-style-type: none"> • Architectural drawing tools and materials ; • Principle methods of architectural drawing and representation: orthographic (plan, elevation, section, layout), isometrics and axonometric ; • Human scale, architectural standards and zoning codes ; • Integrated design and representation of a simple architectural design. The language inherent in the four disciplines of: art production, art history, art criticism, and aesthetics ; • Colour theory and movement, and their application in Architectural Design ; • Observations and drawing of architectural elements and landscapes: line and shape, contour, positive and negative shapes and projections ; • Tone, texture and colour: colour, tone, scale, form, light and texture ; • Form and architecture: layering, volume, proportion and area ; • Space and depth: pictorial space, composition and multi-view drawing ; 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			S
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
40%	20%	0%	40%

SAES21	Introduction to Environmental Sustainable Design		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	3	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> Inspire critical awareness of environmental and sustainable architecture, smart city, its concepts, language and representation. Introduction to climate, units of heat and energy; temperature, sensible and latent heat capacity. Introduction to the principles of sustainability. Economy of Resources Principle: Energy Conservation; Water Conservation; Materials Conservation. Life Cycle Design Principle: Pre-Building Phase; Building Phase; Post-Building Phase. Humane Design Principle: Preservation for Natural Conditions; Urban Design and Site Planning; Design for Human Comfort (thermal, visual and acoustics comfort). 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		S	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
20%	20%	20%	40%

SAES12	Architecture Surveying		2
Prerequisites	SAES11		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	1	2	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> Maps and plans Linear, area, and volume measurements and calculation. Levels, levelling and adjustment of level loops . Detailed survey. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		S	
Assessment Criteria			
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam
0%	20%	40%	40%

SAES31	Sustainable Tectonics (1)			3
Prerequisites	ENGS31			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Introduction to the technology, materials and techniques used in constructing buildings • Historical overview of traditional Sustainable construction methods and sequences ; • Basic building elements: foundations, walls, columns, girders, slabs, openings, floors, roofs, stairs and lifts, finishing work, and building services; • Interior & exterior enclosure systems ; • Basic understanding of the qualitative behavior of structures and the interaction between structural form and the loads that they have to carry. • Types of structural systems of low-rise buildings ; • Construction types, procedures, and techniques of low-rise buildings ; • Construction procedures and elements of masonry and timber structures ; • Health and safety procedures in construction sites. 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Discipline Requirement				S
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam	
40%	10%	10%	40%	

SAE432	Sustainable Tectonics (2)			3
Prerequisites	SAES31			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Green buildings materials and finishing materials properties and economics . • Types of structural and roofing systems of medium-scale buildings ; • Construction types and techniques of medium-scale buildings ; • Construction procedure & elements of reinforced concrete and green buildings ; • Working drawings of concrete structures and building services ; • Health and safety procedures in construction sites. • Doors, windows and finishing: types, construction techniques and schedules ; • Plumbing, HVAC, firefighting, and electrical systems ; • Water effect on materials, insulation and water proofing; 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Discipline Requirement				4

Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	10%	10%	40%

SAES13	Sustainable Architecture style, time, & place (1)		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	0	
Required SWL	75	Equivalent ECTS	3

Course Content			
<ul style="list-style-type: none"> • This module offers you an A two-hour weekly lecture aims to familiarize you with major architectural. • Introduction to the history of architecture from ancient times to the present day. • Surveying the history of architecture and urbanism from the architecture and design traditions of early civilizations to the medieval periods . • Middle East, Europe, South Asia, East Asia, South America and the Pacific • Emphasis on significant developments in the ancient Egyptian, classical, byzantine, medieval periods. typologies and the social and technological changes that brought them into being • In the context of social, technical and environmental settings : • Form (functional and aesthetic elements), spatial grammar, structural approaches, function and social role. • Analyze the values reflected in vernacular buildings (housing), religious institutions (churches, temples), and the power of ruling institutions (state, city, palace and empire). 			

Used in Program / Level			
Program Name or requirement	Study Level		
Architecture Discipline Requirement	S		
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Project	Final Exam
40%	20%	0%	40%

SAE421	Eco Design (1)		4
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	6	
Required SWL	175	Equivalent ECTS	7
Course Content			
<ul style="list-style-type: none"> • This studio-based module focuses on developing student practical architectural design skills and exploring the relevance of related subjects, such as structure and construction. 			

<ul style="list-style-type: none"> • The emphasis is given to the ‘craftsmanship of architecture’, improving the spatial, aesthetic, and sensual, as well as practical, structural and dimensional qualities of design. • Theory of architecture: design methodology and strategic thinking ; • How to develop design concepts and to select a suitable approach in solving design problems and overcoming constrains. • How to translate an abstract idea into a form with a positive physical presence. The units are organized into five thematic blocks: <ul style="list-style-type: none"> ○ Urban Settings ○ Making Processes ○ Context ○ Poetic Narratives ○ Sustainable Communities 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			4
Assessment Criteria			
Assignments & Projects	One-week Project	Practical Exam	Final Exam
60%	20%	20%	0%

SAE433	Architectural design of Elements		3
Prerequisites	ENGS13		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Design principles of the design of concrete and steel structures; • Design loads and load distribution, and statistically determined structures; • Reinforced Concrete: fundamentals of reinforced concrete structures, analysis and design of sections subjected to bending, reinforcement details of beams, solid slabs, columns, stairs, ribbed and hollow slabs, paneled beam slabs, connections of precast concrete structural elements; • Steel Structure: design of members subjected to axial forces, flexural or shear, design bolted and welded connections, details of connections. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Project	Final Exam
20%	20%	0%	60%

SAE411	Digital Representation tools in Architecture		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	

1	0	3	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to AutoCAD Software: Theory of CAD; 2D construction and editing commands; Drawing 2D shapes, modifying 2D objects; Transformation concepts; CAD Layers; Rendering 2D drawings; Creating reference objects; Multiple linked drawings management; CAD and the Internet; model space and paper space plotting using templates. • 3D CAD Modelling theory ; Digital Architecture; three-dimensional coordinates; wire frame; user coordinate system (UCS); model space view ports; 3D surface modelling techniques; solid model construction and features; editing three-dimensional objects; presentation graphics and rendering; CAD and the Internet; model space and paper space plotting. • Raster graphics editor: draw lines with simulated brushes, fill a region with colours/textures, select a colour using different colour models, remove imperfections, use layers, apply filters, and convert between various image formats. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		4	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
60%	20%	20%	0%

SAE441	Environmental Control Systems (1)		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to the environmental services systems • Climatic classifications: Examples of Egypt and UK's climate ; • Climatic control, thermal performance, energy conscious design, and their relation to architectural features (windows, doors, materials, etc) • The influence of energy source, climate, heating, cooling, lighting, acoustics, and water and waste systems on design of buildings and sites ; • Environmental indicators and thermal comfort criteria and indices ; • Natural ventilation and air flow inside and around buildings ; • Heat transfer, storage and insulation ; • Mechanical means to manipulate thermal environment; Natural lighting, luminance design, artificial lighting mechanisms, and energy ; • Computer aided design and applications. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		4	

Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
20%	20%	0%	60%

SAE422	Eco Design for occupant wellbeing (2)		4
Prerequisites	SAE421 & SAE411		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	6	
Required SWL	175	Equivalent ECTS	7
Course Content			
<ul style="list-style-type: none"> In this studio-based module will study the concepts behind the active and passive systems used to provide healthy, comfortable conditions for building occupants. Students will be developing a project employing design strategies based on the information obtainable by sensory devices. Environmental and behavioral data collection by sensory devices distributed in buildings and public spaces. How climatic conditions data influence the built environment to turn into design intelligence and tap into dynamic architectural projects. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		4	
Assessment Criteria			
Assignments & Projects	One-week project	Portfolio	Final Exam
60%	20%	20%	0%

SAE413	Sustainable Architecture style, time, & place (2)		2
Prerequisites	SAES13		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Introduction to the contribution of architectural theory to an understanding of the phenomenon and practice of sustainability and environmental design throughout history. With emphasis on significant developments in Islamic Architecture (ventilation, lighting, functionality, etc) Exploring the building traditions of Islamic architecture, Urban planning origins in Islamic urbanization on a wide Geographical scale (ex: Umayyad Arch. Spain & North Africa, Indo-Islamic architecture), exploring the environmental reflections, and highlighting the social & religion factors. Studying the vocabulary, elements of landscape, and the building types in Islamic architecture: Different functions: Islamic House, Palaces, Citadels, Fortifications, public buildings ...etc 			

<ul style="list-style-type: none"> Egypt: Coptic architecture in parallel with Islamic architecture reaching Muhammad Ali Period. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			4
Assessment Criteria			
Assignments & Projects	One-week project	Portfolio	Final Exam
20%	20%	0%	60%

SAE423	Urban Sustainability and Climate Change		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	0		3
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> In this studio-based module will be introduced to site planning and design principles, elements, and processes; Image of place; Urban Character; Urban fabric; Urban spaces ; the key factors contributing to changes to natural and built environments, and their centrality to urban planning activities. the complex interrelationship between environmental processes, climate change, urban change, sustainability goals and urban planning policies. Theories of urban and landscape design, including: walkable and new urbanism; Current urban planning issues including sustainability, climate change, resilience, and vulnerability will be critically analyzed and applied to current and future problems. Local and global examples will be drawn upon. This approach will equip students with the capability to propose urban planning solutions to address climate change and facilitate urban sustainability. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			4
Assessment Criteria			
Assignments & Projects	One-week project	Portfolio	Final Exam
40%	0%	20%	40%

SAE434	Sustainable Tectonics (3)		3
Prerequisites	SAE432		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	0		3
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> Design parameters, construction methods and management implications of environmental sustainable buildings . 			

<ul style="list-style-type: none"> • Types of structural systems of high-rise and long-span buildings. • Construction types and techniques of high-rise and long-span buildings. • Construction procedure and elements of steel and precast framed buildings. • Movement, tolerances and fit: manufacturing, positioning and tolerances. • Choice of appropriate frames, service and access cores . • Working drawings of steel and precast framed structures . • Sections & Elevations (including external and internal finishing materials) • Life cycle and supply chain environmental assessment. • Health and safety procedures in construction sites. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			4
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	10%	10%	40%

SAE531	Sustainable Tectonics (4)		3
Prerequisites	SAE434		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	3	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Advanced Construction Technology: Innovative use of manufacturing techniques in construction: e.g. offsite production; robotics in construction; freeform construction; • Advanced Envelope Technology: e.g. planar glazing; intelligent facades; fabric roofs; • Advanced Construction Techniques: e.g. working on congested sites; top-down basement construction; retained facades; air-tight buildings; tall buildings; sustainability; • Review of recent major construction projects. Advanced Construction Management: e.g. innovation; logistics; interface management, safety measures. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			5
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	10%	10%	40%

SAE521	Eco Design for Zero Energy & Passive Building (3)		4
Prerequisites	SAE422		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	

2	0	6	
Required SWL	175	Equivalent ECTS	7
Course Content			
<ul style="list-style-type: none"> In this studio-based module will be introduced to Reduce energy use and transitioning towards zero greenhouse emissions in the built environment. The concepts behind the active and passive systems for decreasing energy consumption . Analyses, quantify, visualize and improve the energy performance of buildings, neighborhoods and cities, at different scales of the built environment, towards zero greenhouse gas emissions. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		5	
Assessment Criteria			
Assignments & Projects	One-week Project	Portfolio	Final Exam
60%	20%	20%	0%

SAE543	Environmental Control Systems (2)		2
Prerequisites	SAE441		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> Introducing to large scale building services Implications of acoustics, water and waste for architectural design; Comfort and noise indices ; Nature of Acoustics, weighted pressure levels, sound analysis ; Acoustics design and noise control ; Introduction to water and waste management and engineering ; Hydraulic Services: hot and cold water services, solar heating and cooling, water desalination and pumping ; Sanitation Services: function and operation, fluid flow in waste systems, types of systems, soil pipes, discharge stacks, water treatment and reuse ; Other Services: electrical supply, acoustics and distribution; gas supply; firefighting; and solid waste sorting/disposal/recycling/reuse ; Costs, maintenance, and integrated building design. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Discipline Requirement		5	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

SAE532	Sustainable Tectonics (5)			3
Prerequisites	SAE531			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • Introduction to the latest international developments in prefabrication and its application within construction. • How prefabrication can be used to minimize or avoid many of the issues currently faced by the construction industry as well as the environmental, financial and social benefits that are possible. • The challenges and benefits of prefabrication in construction will be demonstrated through a series of case studies and site visits . • The use of prefabrication in construction at various scales and levels of complexity, including an in-depth look at a range of componentized, panelized and modular construction systems. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Discipline Requirement			5	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam	
40%	10%	10%	40%	

SAE522	Eco Design Parametric and High-tech (4)			4
Prerequisites	SAE521			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		6
Required SWL	175	Equivalent ECTS	7	
Course Content				
<ul style="list-style-type: none"> • In this studio-based module focuses on the interaction between users and the built environment. • Integrated computational design approach to architecture, stemming from both a form generation perspective and performance-based evaluation perspective. • How Digital technology changes the ways we create and use space. • Introducing computational methods, including parametric modeling, simulation and analysis – including the possibility of applying digital fabrication, physical computing and advanced kinetic mechanisms – to detailed building model elements . • The emphasis is on the correlation between architectural design, computational techniques and mechatronics . • the automated procedures of creating spatial change (using sensor/actuator technologies) 				

<ul style="list-style-type: none"> Design intelligence and dynamic architectural project. Throughout the semester, students will be developing a project employing design strategies based on the information obtainable by sensory devices. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			5
Assessment Criteria			
Assignments & Projects	One-week Project	Portfolio	Final Exam
60%	20%	20%	0%

SAE621	Eco Design Detailing Adaptive Reuse (5)		4
Prerequisites	SAE522		
Number of weekly Contact Hours			
Lecture		Tutorial	Laboratory
2		0	6
Required SWL	175	Equivalent ECTS	7
Course Content			
<ul style="list-style-type: none"> This studio-based module focuses on the technological design, performance requirements, procurement, manufacturing and construction of building envelope systems and materials. facades and roofing systems from start to finish of the building process, the subject gives insight on the specificity of the facade construction industry as a key agent of the design and delivery of contemporary projects. adaptive reuse Approach, including extensive refurbishments and facade treatments, while respecting the history and heritage of the site. The properties and behavior of materials commonly used in building envelopes (e.g. glass, metals, insulation, sealants) and the fitness for purpose of different façade and roofing configurations, systems and products. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Discipline Requirement			6
Assessment Criteria			
Assignments & Projects	One-week Project	Portfolio	Final Exam
60%	20%	20%	0%

SAE551	New technologies and Sustainable Architecture Future		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture		Tutorial	Laboratory
2		0	0
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> This Module explores contemporary architecture in relation to major social, economic, political, ecological, and technological transformations after the Second World War. 			

<ul style="list-style-type: none"> • A wide range of topics including consumerism, globalization, mass media, cultural identities and changing economic structures are discussed in terms of their role in shaping architectural theory, practice, and built environment . • Exploring the modern architecture and international schools of architecture during the late nineteenth and twentieth centuries. Including: the origins and development of modernism; changing ideas of housing, urbanism and society; functionalism and expression; materiality. • The study will reach the contemporary architectural trends, moving from: Post-modernism, Deconstruction, Digital Architecture, Green Architecture, and Environmental Sustainable Architecture. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Program Requirement			5
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

SAE542	Daylighting		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Understand the principles and practices of introducing natural light into the building interiors. • Check if the window sizes in each room for a given project conform to the minimum requirements of the National/international Building Code. • Calculate the level of natural illumination in each room for a given project using the Average DaylightFactor (ADF) Calculation Method. • Calculate the area of the skylight for sufficient daylighting. • Layout the skylight on the floor plan and the roof plan using the perpendicular and parallel configurations. • Calculate the length and height of a clerestory window for sufficient daylighting. • Using reliable software to design daylighting 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Program Requirement			5
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
0%	20%	40%	40%

SAE552	Building Information Modelling			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Evolution of architectural representation: from CAD to BIM platform ; • BIM, definition and terms ; • BIM tools in design, parametric modeling, attribute and relationships ; • Design and construction process for BIM and interoperability ; • BIM strategies: the building project execution plan ; • Team working strategies and multidisciplinary collaboration ; • application with BIM tools; software will be used for 3D models checking and detecting clashes in 3D models, following by developing a 4D model (construction sequencing) and finally developing 5D model (quantity extraction) of the project. 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Program Requirement				5
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
40%	0%	20%	40%	

SAE553	Integrated Building Design			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> • Develop a fully integrated concept design for a building, starting from the briefing and master planning stage ; • The identification of appropriate environmental strategies for integration within the context of an overall building design and practice the development of these ideas from scheme design to detailed design stage • The concept design will be developed to detailed design, including: choice of appropriate materials, buildings services, partition systems, raised floors and suspended ceiling, fittings, finishes, etc ; • The work will be carried out on project to focus on producing a full set of working and selective workshop drawings for technical building system details. 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Program Requirement				5
Assessment Criteria				

Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
40%	0%	20%	40%

SAE544	Modelling & Simulation for Sustainable Architecture		3
Prerequisites	BSC513 & ENG522		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	0		3
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction of the role of modelling and simulation to study sustainable architecture: governing equations; formulation, discretization, loads, boundary and initial conditions, limitations/capabilities, and computational errors ; • Introduction of state-of-the-art computer simulation methods for ventilation (CFD), thermal/energy/renewable energy analysis, and daylighting ; • Hands-on practical problems on real-life case studies using commercial software 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Program Requirement			5
Assessment Criteria			
Assignments & Projects	One-week Project	Portfolio	Final Exam
60%	20%	20%	0%

SAE691	Graduation Research Project		4
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
0	0		0
Required SWL	150	Equivalent ECTS	6
Course Content			
<ul style="list-style-type: none"> • As defined by an agreed Project Definition Document, and reflecting knowledge gained in the previous academic years of the BSc program. • The topic of choice for the research dissertation could be in any area that is related to Environmental Sustainable architectural studies. • The research will normally involve a mixture of experimental, theoretical, and computational work together with a relevant literature review. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Program Requirement			6
Assessment Criteria			
Individual Report	Individual Presentation	Oral Exam	Thesis
15%	10%	15%	60%

SAE692	Graduation Design Project			10
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		8
Required SWL	450	Equivalent ECTS		18
Course Content				
<ul style="list-style-type: none"> The final design project of the program, focuses on the detailed design of a significant new piece of architecture that responds to sustainable development objectives and the environmental, social and built context. The principles of architectural sustainability within the broader cultural context and theoretical discourse. This will be specified by the project supervisor. 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Program Requirement				6
Assessment Criteria				
Project Assignments		Portfolio	final Presentation	Final Project
20%		20%	10 %	50%

SAE622	Environmental Interior Design & Refurbishment			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100	Equivalent ECTS		4
Course Content				
<ul style="list-style-type: none"> This studio-based module focuses on technical skills that learners apply to their own design projects relating to design for climate; they analyse and draw re-furnished buildings and they creatively detail their own interior design project (in drawing and model) An introduction to the theories of interior design in architecture Site visits; physical prototyping with real materials; live case study analysis; modelling and drawing characterise this enjoyable and accessible module, which brings the craft of interior refurbishment to life . Principles of interior lighting design. 				
Used in Program / Level				
Program Name or requirement				Study Level
Architecture Elective Program Requirement				6
Assessment Criteria				
Assignments & Projects		In-Class Assessment	Portfolio	Final Exam
40%		0%	20%	40%

SAE623	Life Cycle and Supply Chain Environmental Assessment			3
Prerequisites	N/A			
Number of weekly Contact Hours				

Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		100		Equivalent ECTS	
				4	
Course Content					
<ul style="list-style-type: none"> • Holistic view of engineering the entire life cycle of a product or service from raw material extraction, production, usage to disposal. • Sustainable development and life cycle thinking . • Life cycle analysis tools , • Eco-design and cleaner production, and closed-loop economy . • Product life cycle management, life cycle assessment, sustainable manufacturing, circular economy. etc. Hands-on, in-depth understanding of LCA frameworks, principles, tools, and applications of life cycle assessment. • State of life cycle practice and current initiatives. Guest speakers are also invited to provide broader examples from a global perspective. 					
Used in Program / Level					
Program Name or requirement				Study Level	
Architecture Elective Program Requirement				6	
Assessment Criteria					
Assignments & Projects		In-Class Assessment		Portfolio	
40%		20%		0%	
				Final Exam	
				40%	

SAE641	Introduction to Renewable Energy Systems		3		
Prerequisites	N/A				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		100		Equivalent ECTS	
				4	
Course Content					
<ul style="list-style-type: none"> • The science, technology and policy instruments of a broad range of renewable energy technologies including solar, wind and water as well as other thermal renewables. Specifically, the subject covers: • Solar: Overview of the fundamental physics of solar radiation; Technical details of photovoltaic cells and concentrating solar power systems • Wind and water: Overview of the fundamental physics of motion involved in energy in wind & water; Technical details of wind turbines and hydro-power systems, including pumped Hydro-Energy Storage • Other thermal renewables: Overview of the chemistry and technologies for biomass for heat and electricity and liquid biofuels • Renewable integration and policy: Overview of renewable energy policy considerations; Understanding challenges of integration of renewables into power systems. This includes managing variability and the opportunities provided by storage and demand-side management. 					
Used in Program / Level					
Program Name or requirement				Study Level	
Architecture Elective Program Requirement				6	
Assessment Criteria					

Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

SAE642	Complex Building Energy Modelling			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> The subject teaches how to use two modelling approaches to investigate and communicate complex and innovative environmental solutions for energy efficient building design. Led by experienced software users from industry and from software manufactures, this course will allow students to specialise in a software tool which they may already be using at their work. Based on a case study approach students will assess an existing or new building project and prepare the documentation arguing for the innovative approaches to energy efficiency that are proposed. Focus will not only be on learning how to model these complex scenarios, but also how to interpret their practicality and develop risk profiles allowing end users to be able to choose between innovation and benefit. This subject will involve Virtual Environment. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Elective Program Requirement			6	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam	
40%	0%	20%	40%	

SAE643	Energy Systems			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> In relation to sustainable engineering, you'll develop a deep understanding of the principles that govern building services thermal energy systems and renewable and Low or Zero Carbon technologies Topics such as passive solar heating, photovoltaics, solar water heating and co-generation are examined, as well as costs and economic analysis; Design of hybrid (renewable) energy systems and smart grids. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Elective Program Requirement			6	

Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
30%	20%	0%	50%

SAE644	Energy management and controls		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5

Course Content			
<ul style="list-style-type: none"> The fundamental principles that determine the efficiency with which energy can be harvested, stored, produced, transmitted or consumed . The environmental impacts of the production and consumption of energy are less fully understood and have to be balanced against the availability of key resources, the cost of managing those resources, the efficiency with which they may be utilised and the political and ethical consequences of obtaining them. A quantitative survey of the chemistry and physics behind conventional and alternative energy sources, including fossil fuels, bio-fuels, the capture of energy from solar, geothermal, hydro and wind sources and their storage, and the generation of energy from nuclear fission and fusion processes. Each energy source is assessed in terms of its environmental impacts, its dependence on critical or scarce resources and the social or political consequences of reliance on that energy source with respect to long-term sustainability. This module examines the controls and processes that are necessary for efficient and effective operation of buildings and their engineering services. It provides an understanding of control elements and building energy management systems, and the way that information from these systems can be used to manage energy. The module also presents tools for financial analysis and reporting. 			

Used in Program / Level			
Program Name or requirement	Study Level		
Architecture Elective Program Requirement	6		
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

SAE645	Solar Energy		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			

<ul style="list-style-type: none"> • Introduction to Solar Energy in the energy economy; Fundamental heat & mass transfer; Radiation properties of materials; and selective surfaces • Solar Geometry and solar angles; atmospheric effects and radiation prediction; and Solar radiation measurement • Flat plate collectors design and performance characteristic • Concentrating collectors design and performance characteristic; Evacuated tube collectors • Solar System design methods • Fundamentals of photovoltaic systems • Solar process heating • Solar drying, Solar cookers, Green houses and Solar stills • Solar water pumping; Solar refrigeration • Built environment applications passive and active systems • Solar hot water and solar heat pump systems. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Elective Program Requirement		6	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
30%	20%	0%	50%

SAE646	Building Services and Operations		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
<ul style="list-style-type: none"> • Introduction on environmental quality and energy related issues. • The integration of services and energy efficient strategies into the fabric of the building and its construction process. • The subject provides students with knowledge in the field of electrical, mechanical, air handling, hydraulic and communication services and particularly the construction issues they generate: levels of documentation and decision-making required; connections with process planning; spatial requirements for functioning, installation and access purposes; protection and quality assurance; building tolerances; systems integration; layout strategies; work sequences and temporary works; contract coordination; testing; maintenance; and upgrading-replacement. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Elective Program Requirement		6	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

SAE624	Sustainable Landscapes			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • The meaning and significance of sustainability in the context of urban, urban fringe, rural, and regional landscapes and their futures; • Rural and urban land use, and drivers of current and future landscape change, including fragmentation, social change and transformation, biodiversity loss, industrialisation, intensification, pollution, sovereignty, and security; • Assumptions around land ownership, ethics and economics that influence issues of environmental security, commons and sustainable regional futures; · the utilisation, degradation, and management of rural and urban biophysical resources for sustainable futures, including maintenance of ecosystem services and processes; • The involvement of different stakeholders in decision making for regional, service, rural, fringe and urban areas, including the role of relationships and social features such as politics, memory, and values; and • The role of governance, including institutions, deliberative democracy, empowerment; and community based natural resource management in navigating landscape change. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Elective Program Requirement			6	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam	
40%	0%	20%	40%	

SAE625	Environmental Sustainability			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> • The fundamental earth system processes that provide humanity's life-support system; • The conditions that have led to the Anthropocene, and its implications for life as we know it; • Global and local environmental challenges, including for biodiversity, water, energy, and food, in relation their natural and social environments; • Complex social-ecological systems and their role in contributing to and solving critical environmental sustainability issues; 				

<ul style="list-style-type: none"> • Different perspectives, and the influence of worldview, values and beliefs on sustainability; • The role of individuals, governments, business and innovation in building a sustainable future; and • Management, governance, and social-ecological issues for achieving environmental sustainability. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Elective Program Requirement		6	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	0%	20%	40%

SAE626	Partnerships for Sustainable Futures		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
<ul style="list-style-type: none"> • Kinds of important partnerships in integrating environmental expertise and applying it to decision-making and action for sustainable futures. • The challenges for environmental professionals in developing such partnerships and collaborating effectively across organisations, sectors, forms of expertise, and communities. • Skills and strategies can assist environmental professionals in developing, leading and maintaining effective partnerships with positive outcomes. • The evaluation and lesson learned from the collaborative processes and outcomes of partnerships. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Elective Program Requirement		6	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	0%	20%	40%

SAE627	Water and Waste Sustainable Management		3
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			

- The fundamentals of water quality and the associated standards for use as potable water, recycled water or discharge into the environment in a sustainable manner.
- Risks and measures to control those risks and various treatment processes including physical, chemical and microbiological treatment of water and wastewater.
- Introduce the physical, chemical and biological processes as a foundation to the current water and waste management practices;
- Introduce the main management processes and engineering concerns of water and waste recycling systems;
- Design basic processes Sustainable of water and waste management systems.

Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Elective Program Requirement		6	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
20%	20%	0%	60%

Minor Course Description of Modules Delivered by the Sustainable Architecture

Department to the Architecture Engineering - Sustainable Building Design Program

SAEM11	Introduction to Architectural Design and Graphics			5
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		5
Required SWL	225	Equivalent ECTS	9	
Course Content				
<ul style="list-style-type: none"> • Architectural drawing tools and materials ; • Principle methods of architectural drawing and representation: orthographic (plan, elevation, section, layout), isometrics and axonometric ; • Human scale, architectural standards and zoning codes ; • Integrated design and representation of a simple architectural design. The language inherent in the four disciplines of: art production, art history, art criticism, and aesthetics ; • Colour theory and movement, and their application in Architectural Design ; • Observations and drawing of architectural elements and landscapes: line and shape, contour, positive and negative shapes and projections ; • Tone, texture and colour: colour, tone, scale, form, light and texture ; • Form and architecture: layering, volume, proportion and area ; • Space and depth: pictorial space, composition and multi-view drawing ; 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Minor Program Requirement			Minor	
Assessment Criteria				
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam	
40%	20%	0%	40%	

SAEM12	Digital Representation tools in Architecture			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		3
Required SWL	75	Equivalent ECTS	3	
Course Content				
<ul style="list-style-type: none"> • Introduction to AutoCAD Software: Theory of CAD; 2D construction and editing commands; Drawing 2D shapes, modifying 2D objects; Transformation concepts; CAD Layers; Rendering 2D drawings; Creating reference objects; Multiple linked drawings management; CAD and the Internet; model space and paper space plotting using templates. • 3D CAD Modelling theory ; Digital Architecture; three-dimensional coordinates; wire frame; user coordinate system (UCS); model space view ports; 3D surface modelling techniques; solid model construction and features; 				

<p>editing three-dimensional objects; presentation graphics and rendering; CAD and the Internet; model space and paper space plotting.</p> <ul style="list-style-type: none"> Raster graphics editor: draw lines with simulated brushes, fill a region with colours/textures, select a colour using different colour models, remove imperfections, use layers, apply filters, and convert between various image formats. 			
Used in Program / Level			
Program Name or requirement			Study Level
Architecture Minor Program Requirement			Minor
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Practical Exam	Final Exam
60%	20%	20%	0%

SAEM13	Architecture Surveying			2
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	1		2	
Required SWL	100	Equivalent ECTS	4	
Course Content				
<ul style="list-style-type: none"> Maps and plans Linear, area, and volume measurements and calculation. Levels, levelling and adjustment of level loops . Detailed survey. 				
Used in Program / Level				
Program Name or requirement			Study Level	
Architecture Minor Program Requirement			Minor	
Assessment Criteria				
Lab Coursework	In-Class Assessment	Practical Exam	Final Exam	
0%	20%	40%	40%	

SAEM31	Sustainable Tectonics (1)			3
Prerequisites	N/A			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		3	
Required SWL	125	Equivalent ECTS	5	
Course Content				
<ul style="list-style-type: none"> Introduction to the technology, materials and techniques used in constructing buildings Historical overview of traditional Sustainable construction methods and sequences ; Basic building elements: foundations, walls, columns, girders, slabs, openings, floors, roofs, stairs and lifts, finishing work, and building services; 				

<ul style="list-style-type: none"> • Interior & exterior enclosure systems ; • Basic understanding of the qualitative behavior of structures and the interaction between structural form and the loads that they have to carry. • Types of structural systems of low-rise buildings ; • Construction types, procedures, and techniques of low-rise buildings ; • Construction procedures and elements of masonry and timber structures ; • Health and safety procedures in construction sites. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Minor Program Requirement		Minor	
Assessment Criteria			
Assignments & Projects	In-Class Assessment	Portfolio	Final Exam
40%	10%	10%	40%

SAEM14	Sustainable Architecture style, time, & place (2)		2
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
<ul style="list-style-type: none"> • Introduction to the contribution of architectural theory to an understanding of the phenomenon and practice of sustainability and environmental design throughout history. With emphasis on significant developments in Islamic Architecture (ventilation, lighting, functionality, etc) • Exploring the building traditions of Islamic architecture, Urban planning origins in Islamic urbanization on a wide Geographical scale (ex: Umayyad Arch. Spain & North Africa, Indo-Islamic architecture), exploring the environmental reflections, and highlighting the social & religion factors. • Studying the vocabulary, elements of landscape, and the building types in Islamic architecture: Different functions: Islamic House, Palaces, Citadels, Fortifications, public buildings ...etc • Egypt: Coptic architecture in parallel with Islamic architecture reaching Muhammad Ali Period. 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Minor Program Requirement		Minor	
Assessment Criteria			
Assignments & Projects	One-week project	Portfolio	Final Exam
20%	20%	0%	60%
SAEM21	Eco Design (1)		4
Prerequisites	N/A		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	6	

Required SWL	175	Equivalent ECTS	7
Course Content			
<ul style="list-style-type: none"> • This studio-based module focuses on developing student practical architectural design skills and exploring the relevance of related subjects, such as structure and construction. • The emphasis is given to the ‘craftsmanship of architecture’, improving the spatial, aesthetic, and sensual, as well as practical, structural and dimensional qualities of design. • Theory of architecture: design methodology and strategic thinking ; • How to develop design concepts and to select a suitable approach in solving design problems and overcoming constrains. • How to translate an abstract idea into a form with a positive physical presence. The units are organized into five thematic blocks: <ul style="list-style-type: none"> ○ Urban Settings ○ Making Processes ○ Context ○ Poetic Narratives ○ Sustainable Communities 			
Used in Program / Level			
Program Name or requirement		Study Level	
Architecture Minor Program Requirement		Minor	
Assessment Criteria			
Assignments & Projects	One-week Project	Practical Exam	Final Exam
60%	20%	20%	0%

Part F: Mapping of Modules with NARS

1- Mechanical Engineering - Renewable Energy Program

	Code	Course Title	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6
UR	LNGS11	English for Academic Purposes	X								X								
	LNGS12	English and Academic Writing	X					X			X								
	BSCS31	Selected Topics in Contemporary Issues	X			X	X		X	X	X								X
	LNG411	Technical Report Writing and Communication	X							X	X								
	ENG552	Project Management	X			X			X	X		X						X	
	ENG556	Engineering Economics	X			X			X	X		X						X	
FR	BSCS11	Mathematics 1		X									X						
	ENGS61	Electric Circuits 1											X						
	ENGS32	Engineering Drawings and CAD Design				X	X						X						
	BSCS21	Physics		X						X	X		X						
	ENGS71	Electronics		X									X	X					
	ENGS31	Material science		X			X						X						
	BSCS12	Mathematics 2		X									X						
	ENGS33	Workshop Technology and Solid Modeling				X	X	X	X	X			X						
	BSC411	Calculus		X									X						
	ENG422	Fluid Mechanics 1											X						
	BSC412	Differential equations and Numerical solutions			X	X	X	X				X	X						
	IND411	Industrial training 1			X	X				X	X	X	X	X					
IND511	Industrial training 2			X	X				X	X	X	X	X						
PR	ENGS21	Thermodynamics 1		X									X						
	ENG424	Heat and mass transfer		X									X						
	ENG442	Measurements Lab and statistics			X														
	ENGS11	Introduction to Renewable Energy					X	X					X		X	X	X		
	ENGS12	Computers and Programming for renewable energy			X														
	ENG471	Electrical Machines 1					X						X		X				
	ENG441	Automatic Control 1		X		X													
	ENG451	Energy Conversion and Storage Systems		X		X		X							X	X			X

ENG431	Materials for Renewable Energy 2				X	X						X					X		
ENG511	Solar Energy: PV systems				X	X						X	X	X			X	X	X
ENG512	Wind Energy systems		X									X	X	X	X			X	
ENG571	Power Electronics		X																
ENG551	Environmental Pollution and Management			X	X	X	X		X	X		X				X	X		X
ENG553	Power Plant Technology		X									X	X						
ENG555	Modeling and simulations of RE systems (Elect. & Thermal)		X		X							X	X				X		
ENG573	Electrical Drives		X											X					
ENG652	Safety and Environment risk analysis				X	X						X		X	X	X			X
ENG423	Fluid Mechanics 2		X									X	X						
ENG421	Thermodynamics 2		X									X							
ENG443	Mechatronics and Robotics for Renewable Energy			X			X					X							
ENG432	Structure and stress analysis		X	X	X		X				X	X							
ENG521	Combustion and Fuels													X					
ENG513	Solar thermal energy systems 1												X	X	X			X	
ENG554	Energy efficiency and management				X	X						X					X		X
ENG514	Fuel Cell and Hydrogen Technology						X				X				X			X	
ENG543	Data acquisition and sensors			X															
ENG611	Solar thermal energy systems 2												X	X	X			X	
ENG621	Refrigeration and air conditioning systems (HVAC)				X	X						X						X	X
ENG622	Fundamentals of Turbomachinery													X					
ENG623	Water desalination and treatment technologies		X		X							X							X
ENG691	Graduation Research Project		X	X	X	X	X	X	X	X	X	X	X		X			X	
ENG692	Graduation Design Project		X	X	X	X	X	X	X	X	X	X		X			X	X	
ENG616	Geothermal and bioenergy systems												X		X				X
ENG681	Hydrology and Hydropower Systems		X		X							X							X
ENG625	Heat Transfer Equipment		X								X		X					X	
ENG682	Pipeline system design and analysis		X					X				X							X
ENG683	Basics of pneumatic and hydraulic systems				X							X							
ENG654	Lifecycle assessment of renewable energy systems			X	X	X		X				X							X
ENG617	Concentrated solar power generation			X								X			X			X	X

ENG655	Compressed air system energy optimization			X		X												X
ENG626	Steam system energy optimization			X		X												X
ENG627	Pump system energy optimization			X		X												X
ENG656	Sustainable energy economics				X			X										X
ENG628	Turbomachinery Applications		X		X													X
ENG629	Advanced Air Conditioning Systems		X		X	X												X

Competencies

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
- A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
- A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
- A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
- A5. Practice research techniques and methods of investigation as an inherent part of learning.
- A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
- A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
- A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
- A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
- A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

- D1. Select and apply appropriate systematic analysis methods to critically evaluate and solve complex renewable energy engineering problems
- D2. Analyse different energy resources and conversion processes using analytical modelling, experimental techniques and numerical simulations
- D3. Critically assess the use of renewable energy systems to mitigate climate change and improve the environment and social welfare
- D4. Make and justify decisions for selecting and optimising renewable energy products and systems based on technical, environmental, economic, risk and social criteria
- D5. Develop innovative solutions to meet the current global sustainability and renewable energy challenges
- D6. Demonstrate the application of legal and ethical requirements associated with renewable energy in an industrial environment

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

D: Coventry University MSc Renewable Energy Engineering

2- Electrical Engineering - Renewable Energy Program

	Code	Course Title	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7
UR	LNGS11	English for Academic Purposes	X								X									
	LNGS12	English and Academic Writing	X					X			X									
	BSCS31	Selected Topics in Contemporary Issues	X			X	X		X	X	X									
	LNG411	Technical Report Writing and Communication	X							X	X									
	ENG552	Project Management	X			X			X	X			X							
	ENG556	Engineering Economics	X			X			X	X			X							
ER	BSCS11	Mathematics 1		X									X							
	ENGS61	Electric Circuits 1											X							
	ENGS32	Engineering Drawings and CAD Design				X	X						X							
	BSCS21	Physics		X						X	X		X							
	ENGS71	Electronics		X									X							
	ENGS31	Material science		X			X						X							
	BSCS12	Mathematics 2		X									X							
	ENGS33	Workshop Technology and Solid Modeling				X	X	X	X	X			X							
	BSC411	Calculus		X									X							
	ENG422	Fluid Mechanics 1											X	X						
	BSC412	Differential equations and Numerical solutions			X	X	X	X				X		X						
	IND411	Industrial training 1			X	X				X	X	X	X	X						
IND511	Industrial training 2			X	X				X	X	X	X	X							
PR	ENGS21	Thermodynamics 1		X									X							
	ENG424	Heat and mass transfer		X									X							
	ENG442	Measurements Lab and statistics			X															
	ENGS11	Introduction to Renewable Energy					X	X					X	X						
	ENGS12	Computers and Programming			X															
	ENG471	Electrical Machines 1					X						X	X						
	ENG441	Automatic Control 1		X		X														
	ENG451	Energy Conversion and Storage Systems		X		X		X						X						
	ENG431	Materials for Renewable Energy 2				X	X						X							
	ENGS11	Solar Energy: PV systems				X	X							X						
	ENGS12	Wind Energy systems		X										X						
	ENGS71	Power Electronics		X																

ENG551	Environmental Pollution and Management			X	X	X	X			X	X			X					
ENG553	Power Plant Technology		X										X		X	X			
ENG555	Modeling and simulations of RE systems (Elect. & Thermal)		X		X								X	X					
ENG573	Electrical Drives		X											X					
ENG652	Safety and Environment risk analysis				X	X							X			X	X	X	
ENG461	Electric Circuits 2		X											X					
ENG462	Electric Energy Installation and Systems		X			X													
ENG444	Logic Design		X																
ENG472	Electrical Machines 2		X											X					
ENG561	Electrical Power Transmission		X			X		X							X				
ENG541	Automatic Control 2		X																
ENG542	Design, Maintenance, Economics and Control of PV system		X		X	X										X			
ENG562	Power system analysis		X					X							X	X			
ENG572	Network Interfacing of Renewable Resources and smart grid		X		X										X				
ENG612	Selected Topics in Renewable energy		X								X							X	X
ENG661	Electrical Distribution systems		X					X							X	X			
ENG651	High Voltage Engineering		X					X								X			
ENG662	Power system Protection		X			X		X								X			
ENG691	Graduation Research Project		X	X	X	X	X	X	X	X	X	X		X		X		X	X
ENG692	Graduation Design Project		X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
ENG653	Energy Efficiency in Electrical Systems				X											X			
ENG657	Energy Economics				X											X	X	X	
ENG671	Power Quality		X			X													
ENG672	Wind Energy Converters		X												X				
ENG613	Advanced Photovoltaic		X												X				
ENG641	Optimization algorithms and Machine Learning in Electrical Power Engineering		X		X											X			
ENG673	FACTS and HVDC in Electric Power Systems		X											X					X
ENG674	Modulation of Power Electronic Converters		X																
ENG642	Model Predictive Control		X																X

ENG663	Computer Applications in Power Systems		X	X					X									
ENG614	Hydropower- Technology, Economy, Sustainability		X									X		X				
ENG624	Water Desalination		X		X	X									X			
ENG615	Fuel Cell Technologies		X		X	X						X						
ENG664	Smart Grid Fundamentals		X		X							X					X	X

Competencies

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
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- A5. Practice research techniques and methods of investigation as an inherent part of learning.
- A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
- A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
- A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
- A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
- A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

- D1. The scientific and engineering principles underpinning energy and sustainability in the context of electrical power engineering.
- D2. Advanced concepts in specialist areas of electric power networks, such as energy generation, transmission and distribution engineering.
- D3. Specify and design aspects of electrical power systems with attention to a wide range of outcomes, including technical, practical, efficiency/sustainability and security.
- D4. Evaluate energy and sustainability projects with regard to environmental Impact, safety and reliability.
- D5. Find, read, understand and explain literature related to advanced and specialised areas of electrical power engineering, including scientific publications, industrial documentation, standards, ethical, legal and environmental guidance.
- D6. Plan and manage a research project involving an advanced and specialised aspect of electrical power engineering, using appropriate state of the art techniques, technologies and/or tools.
- D7. Use specialist tools for the design, realisation and evaluation of electrical power systems.

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

D: University of Southampton MSc Energy and Sustainability with Electrical Power Engineering

3-Biochemical Engineering program

	Code	Course Title	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	
UR	LNGS11	English for Academic Purposes	X								x												
	LNGS12	English and Academic Writing	X					x			x												
	BSCS31	Selected Topics in Contemporary Issues	X			x	x		x	x	x										x		
	BIO452	Project Management and Engineering Economics	X						x														
	LNG411	Technical Report Writing and Communication	X								x	x											
	BIO551	Environmental Legislations and Regulations	X			x	x		x	x	x										x		
FR	BSCS11	Mathematics 1		x									x										
	ENGS31	Material Science		x			x						x	x				x					
	ENGS34	Engineering Drawing and Workshop				x	x	x	x	x			x										
	BIOS32	Organic Chemistry				x					x		x	x									
	ENG422	Fluid Mechanics 1											x		x	x							
	BSCS12	Mathematics 2		x									x										
	BSCS21	Physics		x							x	x		x									
	BSC411	Calculus		x										x									
	BSC413	Differential Equations		x										x			x						
	BSC511	Numerical Methods			x	x		x	x					x									
	BSC512	Probability and Statistics		x	x									x			x						
	IND411	Industrial training 1		x	x									x								x	
	IND511	Industrial training 2		x	x									x								x	
DR	ENGS22	Thermodynamics		x						x	x		x	x									
	BIO421	Mass and Energy Balances												x						x			
	BIOS31	Physical Chemistry			x											x							
	BIO431	Inorganic Chemistry				x					x		x	x									
	BIO432	Electrochemistry		x									x	x									
	ENG424	Heat and Mass Transfer		x													x						
	BIOS21	Introduction to Biochemical Engineering		x												x						x	
	BIOS51	Biochemistry		x	x						x		x	x									
	BIOS33	Microbiology		x	x						x		x	x									
	BIO451	Environmental Chemistry		x	x												x						
	BIO441	Biophysics		x												x			x	x		x	x
	BIO453	Analytical Chemistry		x	x	x					x			x		x			x	x		x	x
	BIO433	Principles of Process Design		x	x									x			x						

Competencies

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
 - A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
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 - A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
 - A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
 - A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
 - A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
 - A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
-
- B1. Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including: Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design.
 - B2. Engage in the recent technological changes and emerging fields relevant to chemical engineering to respond to the challenging role and responsibilities of a professional chemical engineer.
 - B3. Apply numerical modeling methods and/or computational techniques appropriate to chemical engineering.
 - B4. Adopt suitable national and international standards and codes to: design, operate, inspect and maintain chemical engineering systems.

- C1. Knowledge of the principles and practice of biochemical engineering in the industrial biotechnology and biopharmaceutical industries.
- C2. Understand strategy design and development, techniques and frameworks for crafting strategic options, competitive challenges of a global market environment, implementation of strategy and change.
- C3. Professional and ethical responsibilities including the regulatory framework and the global and social context of biochemical engineering.
- C4. Hands-on experience of facility and process design for either the industrial biotechnology and biopharmaceutical industries.
- C5. Produce solutions to problems through the application of biological and engineering knowledge and understanding.

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

B: NAQAAE 2018 basic Chemical Engineering Competencies

C: University of Sheffield MSc Biochemical Engineering

4-Petroleum Engineering and Gas Technology Program

	Code	Course Title	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7
UR	LNGS11	English for Academic Purposes	X																					
	LNGS12	English and Academic Writing	X																					
	BSCS31	Selected Topics in Contemporary Issues	X																					
	LNG411	Technical Report Writing and Communication	X					X		X														
	PET532	Engineering Project Management	X				X																	
	PET535	Petroleum Economics and Legislation	X	X													X							
ER	BSCS11	Mathematics 1		X																				
	ENGS31	Material science		X		X																		
	ENGS34	Engineering Drawing and Workshop				X																		
	BSCS21	Physics		X																				
	BSCS12	Mathematics 2		X																				
	ENG422	Fluid Mechanics 1		X											X									
	BSC411	Calculus		X																				
	ENG433	Stress Analysis		X		X	X	X	X															
	BIOS32	Organic Chemistry		X							X													
	BSC413	Differential Equations		X																				
	BSC511	Numerical Methods		X																				
	IND411	Industrial training 1									X							X		X				
	IND511	Industrial training 2									X							X		X				
DR	BIOS31	Physical Chemistry		X																				
	ENGS72	Electrical Engineering for Petroleum Engineers		X																				
	ENG424	Heat and Mass Transfer		X																				
	PETS11	Introduction to oil and gas Industry		X										X				X			X	X		
	PETS12	Geological Principles for Petroleum Engineering		X	X						X			X				X						
	PETS21	Drilling Fluids Laboratory			X	X			X	X	X				X			X			X			
	PET451	Petroleum Refinery Engineering		X	X	X												X						
	PET411	Petroleum & Natural Gas Exploration		X	X													X	X					
	PET412	Surveying & Field Courses for Petroleum Engineers		X	X	X					X													

PET431	Reservoir Fluid Properties.		X	X								X				X			X			X	
PET432	Reservoir Rock Properties.		X	X								X				X			X	X			
PET421	Drilling Engineering 1		X		X								X			X			X				X
PET413	Well Logging		X	X	X							X	X			X			X			X	
PET452	Transportation and Storage of Petroleum and Gas				X	X							X										
PET531	Petroleum Reservoir Engineering		X	X								X				X			X				
PET511	Geostatistics for petroleum		X	X	X							X					X						
PET512	Petroleum Development Geology		X									X				X							
PET513	Well Testing		X	X	X				X				X			X			X				X
PET551	Corrosion in the Oil and Gas Industry		X		X	X		X								X							
PET534	Computer Applications in Petroleum Engineering.			X				X						X									
PET533	Reservoir Modelling and Simulation.		X	X	X			X	X		X	X	X	X	X	X			X			X	
PET545	Safety & Environment in Petroleum Industry				X	X		X								X	X			X			
PET541	Oil and Gas Production 1		X	X	X			X	X				X			X			X				X
PET552	Unit Operation				X								X			X							
PET553	Natural Gas Processing		X		X											X							
PET631	Enhanced Hydrocarbon Recovery		X	X	X			X	X	X	X	X	X	X	X	X			X		X	X	X
PET632	Gas Condensate Reservoir Engineering		X	X									X			X							X
PET633	Natural Gas Reservoir Engineering		X	X									X			X							X
PET641	Oil and Gas Production 2		X	X				X					X			X			X				X
PET621	Drilling Engineering II		X	X				X	X					X		X			X				X
PET634	Field Development and Reservoir Management				X	X			X				X	X		X	X						
PET691	Graduation Research Project			X	X			X	X	X	X	X	X	X	X	X			X			X	X
PET692	Graduation Design Project			X	X			X	X	X	X	X	X	X	X	X			X				X
PET622	Rock Mechanics for Drilling and Completion		X											X									
PET611	Advanced Production Logging		X	X										X		X			X			X	
PET642	Well Intervention and Stimulation		X	X	X				X					X		X							
PET651	Advanced Petroleum Refining Engineering		X	X												X							
PET623	Special Topics in Advanced Drilling		X											X		X							
PET635	Nanotechnology and its application oil & gas			X	X			X	X	X			X			X			X				
PET652	Energy Conservation																						
PET653	Automatic Control in Chemical Operations		X	X	X																		
PET643	Well Control		X	X	X			X	X			X	X		X				X			X	
PET624	Horizontal Oil Well Drilling Technology		X		X			X	X					X		X			X			X	
PET612	Petroleum geoscience		X					X	X	X					X				X			X	X

Competencies

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
 - A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
 - A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
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 - A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
 - A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
 - A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
 - A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
 - A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
-
- B1. Analyze geological data, interpret well-logs, estimate hydrocarbon reserves and evaluate reservoir performance by applying the principles and basic concepts of: geology, geophysics and reservoir engineering.
 - B2. Plan and construct oil wells, develop oilfield production programs, design early surface facilities plants and field evacuation plans by applying the principles and basic concepts of: drilling engineering, production engineering, phase equilibrium, fluid mechanics and flow through porous media.
 - B3. Use specialist computer applications and mathematical models to maximize the performance of all petroleum engineering stages.
 - B4. Apply the concepts of project economics and resources evaluation methods for design and decision making under conditions of risk and uncertainty.

- C1. Operate effectively as petroleum engineer
- C2. Students promote the ethos of synergy within the integrated, multidisciplinary teams of petroleum engineers and petroleum geoscientists in the exploration and development of oil and gas resources
- C3. Students are trained in best current industry workflows and work practices, in order to be able to work effectively, either independently or as a member of an integrated team
- C4. The obtaining of oil from an oil reservoir - a quantitative demonstration of porosity, permeability, relative permeability, entrapment etc.
- C5. Porosity and permeability determinations - a demonstration of the processes and difficulties involved in measuring these parameters.
- C6. Rock resistivity - shows the basic principles of rock resistivity using saline solutions.
- C7. Phase Flow - a study of horizontal, vertical and inclined 2- phase flow patterns.

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

B: NAQAAE 2018 basic Petroleum Engineering Competencies

C: Imperial College London MSc Petroleum Engineering

5- Architecture Engineering - Sustainable Building Design Program

	Code	Course Title	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	
UR	LNGS11	English for Academic Purposes	X							X															
	LNGS12	English and Academic Writing	X					X		X															
	BSCS31	Selected Topics in Contemporary Issues	X			X	X		X	X	X														
	LNG411	Technical Report Writing and Communication	X							X	X														
	SAE523	Energy and human development	X			X	X	X					X	X											
	SAE611	Sustainable Project Management & Costing	X			X				X	X		X				X	X							
ER	BSCS11	Mathematics 1		X									X												
	ENGS31	Material Science		X		X				X	X		X												
	BIOS34	Chemistry		X		X				X	X		X												
	BSCS21	Physics		X		X				X	X		X												
	ENGS13	Engineering mechanics & Structural Analysis		X	X	X		X	X				X	X			X								
	SAE431	Geotechnics			X			X			X		X												
	ENG425	Fluids Mechanics and built environment		X	X	X							X												
	BSC513	Statistics, Numerical Methods		X	X	X	X		X		X	X	X												
	ENG563	Electricity and the built environment			X		X										X	X		X		X			
	ENG522	Thermo-dynamics and heat transfer		X	X	X							X												
	SAE412	Building Regulations & Rating Systems	X			X	X										X		X		X		X		
	IND411	Industrial Training 1				X	X		X	X	X	X	X												
	IND511	Industrial Training 2				X	X		X	X	X	X	X												
DR	SAES11	Introduction to architectural design and graphics				X	X						X												
	SAES21	Introduction to Environmental Sustainable Design				X		X		X	X		X	X		X									
	SAES12	Architecture Surveying		X	X						X						X								
	SAES31	Sustainable Tectonics (1)					X				X		X			X									
	SAE432	Sustainable Tectonics (2)					X				X					X							X		
	SAES13	Sustainable Architecture style, time, & place (1)						X		X	X			X					X						
	SAE421	Eco Design (1)				X	X	X		X	X		X	X	X				X			X	X	X	
	SAE433	Architectural design of Elements		X			X				X						X								
	SAE411	Digital Representation tools in Architecture						X			X			X											
	SAE441	Environmental Control Systems (1)				X	X			X					X		X			X			X		
	SAE422	Eco Design for occupant wellbeing (2)				X	X	X		X	X	X	X		X		X				X	X	X		
	SAE413	Sustainable Architecture style, time, & place (2)				X	X	X		X	X		X	X	X	X			X			X	X	X	

Competencies

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 - A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
 - A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
 - A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
 - A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
 - A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
-
- B1. Create architectural, urban and planning designs that satisfy both aesthetic and technical requirements, using adequate knowledge of: history and theory, related fine arts, local culture and heritage, technologies and human sciences.
 - B2. Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.
 - B3. Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.
 - B4. Transform design concepts into buildings and integrate plans into overall planning within the constraints of: project financing, project management, cost control and methods of project delivery; while having adequate knowledge of industries, organizations, regulations and procedures involved.
 - B5. Prepare design project briefs and documents, and understand the context of the architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.

- C1. Demonstrate a detailed knowledge of the theories, concepts and principles of architecture and environmental design with specific reference to the design process, climatic context and historical development
- C2. Demonstrate a detailed knowledge of energy systems and fluxes in the built environment and the relationship between conventional building services, low-energy practices and climatic applicability of passive design strategies for the provision of comfort in buildings.
- C3. Develop more sophisticated techniques for the conceptualization and embedding of bioclimatic, cultural and social theories and practices in the architectural design and refinement of the design process and representation.
- C4. Demonstrate fluent and systematic knowledge of the theories, concepts and principles of architecture and environmental design with specific reference to the application and integration of such principles to the architectural design process.
- C5. Demonstrate systematic and proficient knowledge of the architectural integration of environmental strategies and low-energy systems towards energy demand reduction and of methods for the quantification of building performance.
- C6. Formulate and articulate briefs and design proposals which embed principles of environmental and bioclimatic design conceptualising a variety of physical and socio- cultural contexts and being able to communicate and exemplify design through a number of representation and making skills.

References:

A: NAQAAE-NARS 2018 Engineering Graduate Competencies

B: NAQAAE 2018 basic Architectural Engineering Competencies

D: University of Westminster BSc Architecture and Environmental Design