Academic Requirements and Regulations

For Bachelor Degree's

In

Chemical and Environmental Engineering

Credit Hours System Program

2021/2020

1. Program definition

Chemical and Environmental Engineering, (**CEE**), is a branch of engineering that concerns itself with protecting people from the effects of negative environmental effects, including pollution. It is also concerned with improving environmental quality. The work of a chemical and environmental engineer includes improving the quality of recycling, waste disposal, public health and water and air pollution control in the context of environmental management issues. Chemical and Environmental engineers make use of the principles of engineering specifically heat transfer, mass transfer, momentum transfer and application of engineering thermodynamics, soil science, biology and chemistry in order to create solutions to the many environmental problems facing mankind.A key responsibility of chemical and environmental engineering is to work to prevent the release of harmful chemical and biological contaminants in the air, water and soil. In order to accomplish this, chemical and environmental engineers need to be well versed in chemistry and biology. Another key function of chemical and environmental engineers is the detection of pollutants and the tracking of them back to their source.

Chemical and environmental Engineering is a key issue for sustainable engineering. The sustainability means living well within the ecological limits of a finite planet. So engineers must looking to the interactions between technical, ecological, social and economic systems to avoid shifting problems from one area to the other. More than ever, engineers need to find holistic and effective solutions to protect our vital life support systems and, at the same time, meet the needs of a growing human population.

Graduates of the dual major in Chemical & Environmental engineering are accredited chemical engineers who have additional skills to help them tackle current and future environmental challenges. In addition to core chemical engineering courses, Chemical & Environmental engineering students study specialized courses which develop knowledge and expertise in environmental systems thinking and modeling, environmental regulation and sustainable management of water, energy and waste.. Job opportunities in this field are diverse, including process engineering, industrial ecology, waste recovery, environmental modeling, impact assessment, water supply and treatment, climate policy, energy systems, environmental regulation and sustainability. Our graduates will be employed across sectors, including industry, government and consulting firms.

2. Basic Informations

2.1 Program Vision

Providing a scholarly environment that supports and fosters academic excellence.

2.2 Program Mission

Prepare graduates for professional careers in chemical and environmental engineering and/or graduate study through a program of recognized excellence in teaching and research.

2.3 Program Objectives

1. Contribute to raising the professional competence and forming a generation of distinguished engineers and qualified researchers in the field of chemical and environmental engineering.
2. Prepare graduates for professional careers and a lifetime of learning.
3. Assist the graduates ability for help in the sustainable development of the nation.
4. Develop a sense of citizenship, support team spirit, respect time and act as a way of life and progress.
5. Participate in achieving the development plan, putting science at its service to develop the society scientifically and culturally, and providing environmental services to new urban communities.
6. Developing human capabilities to meet the needs of new societies, including chemical and environmental engineers.

2.4 Program Graduate Attribute:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations;
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation;
3. Behave professionally and adhere to engineering ethics and standards;
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance;
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles;
7. Use techniques, skills and modern engineering tools necessary for engineering practice;
8. 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;
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner;
10. Demonstrate leadership qualities, business administration and entrepreneurial skills;

2.5 Graduate Competencies According to NARS 2018

According to NARS 2018, a graduate must be able to:

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

In addition to the Competencies for All Engineering Programs the BASIC CHEMICAL Engineering graduate and similar programs must be able to:

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.

3. The Ruls of Chemical and Environmental Engineering Program by Credit hours system

Article [1]: Granting Academic Degrees

Based on Faculty of Engineering Council request, Mansoura University grants a bachelor's degree in one of the following majors:

1. Biomedical Engineering
2. Communication and Computer Engineering
3. Mechatronics Engineering
4. Building and Construction Engineering
5. Chemical and Environmental Engineering
6. Renewable and Sustainable energy Engineering

7. Infrastructure and Environmental Engineering

Students are stipulated to complete the academic requirements necessary for one of these programs to obtain a B.Sc. degree in the required major. Study in these programs should take place in English within each specialization scope based on the credit hour system. Further, students should be aware of the requirements and regulations of each program and should be responsible for achieving them.

Article [2]: The Program Study System

The study system used in these programs is the American system of credit hours within the context of one semester.

Article [3]: The Credit Hour Standard According to the Reference Framework 2020

1. With regard to theoretical lectures:

One credit hour is calculated for everyone hour per week lecture during one semester.

2. For practical lessons and practical exercises:

One credit hour is calculated for each 2-3-hour workshop or exercises per semester.

Article [4]: The Academic Council

The Program Management Academic Council shall be formed by a decision from the University President based upon the Faculty Council nomination for two-year- period headed by Faculty Dean and the membership of:

1. Vice Dean of Education and Student Affairs.
2. Heads of Scientific Departments concerned with the program.
3. Program Executive Director.
4. Professor or assistant professor from the specialized scientific departments nominated by the Dean after taking the opinion of the Head of the department and it is permissible in special cases to include two lecturers at most to the membership of the council.
5. Two experienced members either internal or external.

The academic council of the program will perform all the duties of the faculty scientific departments with respect to education and students' affairs. Further, the academic council shall observe the following criteria with regard to assigning teaching duties to staff members:

1. Scientific departments nominations based on their specialty.
2. Students' surveys on the previous times the course was taught.
3. The program management opinion according to performance evaluation and follow-up.

Article [5]: The Program Executive Director

For each program, an executive director shall be appointed by the University President, after a nomination by the Faculty Dean provided that he is one of the faculty members specialized in the field(s) of the program with associate / full professorship degree, for a minimum of two calendar years, renewable under the same conditions of the first appointment.

The executive director of the program shall perform the following tasks:

1. Implementing the program's internal regulation.

2. Coordination between the scientific departments in assigning teaching duties to faculty members.
3. Supervising students' academic registration.
4. Supervising the administrative work by the program staff.
5. Supervising the regularity of academic counseling in the program.
6. Following up the educational process regularity in accordance with the approved study schedules.
7. Supervising and regulating end-of-term and mid-term exams (if any).
8. Supervising field training and forming partnerships with distinguished training authorities.
9. Carrying out the secretariat of the council in the subcommittee of the academic council.
10. Organizing and supervising the program scientific conference.
11. Preparing the forms related to the financial duties in the program and submitting them to the higher management of the college.
12. Overseeing the development of the program's infrastructure, including runways, lecture halls, exercise halls, school laboratories and equipment.
13. Supervising the fulfillment of all quality assurance requirements in accordance with the standards of the National Authority for Accreditation and Quality Assurance of Education.
14. Preparing the annual self-study for the program to be presented to the Project Management Unit in the Ministry of Higher Education and Scientific Research.

Article [6]: Programs Coordinator for Digital Transformation

A programs coordinator for digital transformation is appointed by the Dean of the faculty after a nomination by the Faculty Vice Dean of student affairs (if three or more programs are available in the faculty) from the (associate) professors at the faculty having experience working with the credit hours' system and the programs for a period of two years' renewable with the same conditions of the first appointment.

The programs coordinator for digital transformation duties are:

1. Reviewing and auditing student registrations for all programs after approval of the relevant councils.
2. Reviewing the control works and fulfilling the final control stages after approval of the relevant councils.
3. Supervising the financial page follow-up for program students.
4. Reviewing the quality assurance work in the programs.

Article [7]: Registration Requirements and Entry Requirements

The student's registration for the bachelor's degree in these programs is required in addition to the general conditions stipulated in the executive regulations (Article 75) of the Universities Organizing Law as follows:

1. The student meets the admission requirements determined by the Supreme Council of Universities.

2. The student must have a high school completion certificate or its equivalent where major is in Mathematics.
3. The student fulfills the internal rules approved by the Faculty Board regarding the admission of students to these programs.

Article [8]: Transfer Conditions (change of course) and Re-enrollment

If the transfer is within the faculty, the transfer can occur before the start of the main semesters via approved rules by the faculty council and applied by the faculty representative for education and students affairs; while if the transfer is from another faculty within the university or from another university, the transfer is only through the central remittance office. At the beginning of the academic year, a student budget is made according to Table (1).

Table (1): The Symbol and Grade Corresponding to Assessment Obtained Degree by the Student when Converting from the Semester System to the Credit Hour System.

The percentage obtained by the student	Number of points	Estimate
Less than 50% (Failed)	00.0	F
40% to less than 50% (successful by clemency rules)	1.00	D
50% to less than 55%	1.00	D
55% to less than 60%	1.30	D+
60% to less than 65%	1.70	C-
65% to less than 68%	2.00	C
68% to less than 71%	2.30	C-
71% to less than 75%	2.70	B+
75% to less than 80%	3.00	B
80% to less than 85%	3.30	B+
85% to less than 90%	3.70	A-
90% to less than 95%	4.00	A
95% to 100%	4.00	A+

1. Transferring students who wish to enroll in one of the accredited programs specializations must have completed level (000) courses with an average grade of no less than 2,00 (maximum grade 4,00), and according to the rules determined by the faculty council and approved by the university council, based on the available capacity of the program.
2. Students who are transferred from the regular stream may be admitted to the same faculty, according to conditions determined by the Faculty Council and approved by the University Council based on the program's available capacity.
3. Students who have already spent two years in five years studying colleges outside of Faculty of Engineering, Mansoura University, and wish to join the program should submit a case statement from the faculty in which they were enrolled stating the degrees they have obtained and whether they have obtained credit hours or not.
4. It is permissible to accept international students who have obtained a high school diploma or its equivalent in every academic year according to the order of their degrees according to the nominations received by the Faculty from the General Administration of

International Students. Then, the faculty council undertakes a proposal in exchange for the cost of educational services other than the university fees prescribed for these students.

5. Students, who have previously left studying in the program for a period of up to four semesters at a maximum and who have already received high estimates in the period they spent, may re-register for the program if they wish to do so, after the approval of the relevant academic council and in accordance with the rules for regular study [11].

Article [9]: Obtaining the Degree Requirements

In order for the student to obtain a bachelor's degree in the aforementioned programs, Article [1]:

1. The student must successfully pass at least (160 credit hours).
2. The student must pass the graduation project.
3. The student must pass courses where the evaluation is Pass / Fail and does not count towards the student GPA such as summer training.
4. The distribution of subjects that are included in the study program for graduation requirements should be as follows:

Table (2) Distribution of the program hours to graduation requirements

Specialized Groups	Min %	Max%
University Requirements	8%	-
Faculty Requirements	20%	-
General Major Requirements	35%	-
Accurate Specialization Requirements	-	28%

Taking into account that the academic plans for each program achieve the courses and the indicative proportions set by the National Authority for Quality Assurance of Education, which includes the following curricula:

1. Social and Human Sciences
2. Business Administration
3. Mathematics and Basic Sciences
4. Engineering culture
5. Basic Engineering Sciences
6. Engineering and design applications
7. Project and field training

Article [10] Participating Scientific Departments

The academic council supervises, for each program, teaching of all the courses of the subprograms that follow it, including humanities, Arabic language and technical reports. The scientific departments assign teaching duties of the various courses after being approved by the faculty council. Teaching should be conducted through the following scientific departments, each in the scope of its major:

1. Electronics and Communications Engineering Department.
2. Computer Engineering and Control Systems Department.
3. Production Engineering and Mechanical Design Department.

4. Electrical Engineering Department.
5. power mechanical engineering Department.
6. Mathematics and Engineering Physics Department.
7. Structural Engineering Department - Public Works Department - Irrigation and Hydraulics Department.
8. Architecture Department.
9. External departments in the field of anatomy, physiology and public health from the Faculty of Medicine.
10. External departments in the field of organic chemistry, biochemistry, Microbiology and Pharmaceutical procedures from Faculty of Pharmacy.
11. External departments in the field of languages - Faculty of Education or Faculty of Arts – English Major.
12. External departments of the Faculty of Commerce in the field of management and marketing.
13. External departments of the Faculty of Law in the field of legislation and administration laws.

The academic council of the program administration approves the faculty members nominated by the concerned departments, and these nominations are presented to the faculty council for approval such that the language of study for all courses is English.

Article [11]: Study Duration and its Dates

The duration of the study in the program is ten main semesters for all students, and the student may finish studying the program in nine semesters (when the student has successfully passed 160 credit hours). The academic year is divided into two main semesters, each ending with an exam, according to the content stated in the curriculum schedules appended to this regulation.

The academic year is divided into three semesters:

1. The first semester: Autumn semester (main semester): It starts at the beginning of the university academic year for a period of 14 teaching weeks.
2. The second semester: Spring semester (main semester): It starts after the mid-year vacation of the university for a period of 14 teaching weeks.
3. Summer semester: It starts in July for a period of 7 teaching weeks doubling the course contact hours.

Enrolment and Registration take place before the start of each semester.

Article [12]: Study Regulations

All students enrolled in the program must adhere to the following university rules:

1. **Tuition Fees**

   Registration fees and educational services are paid at the start of registration, and the faculty council determines the fees required for registration and educational services after they have been approved by the university council.

2. **Payment Rules**

   The student is not allowed to register at the next level or know his result unless all tuition fees are paid to the lower level. Upon graduation, the student does not receive his papers and certificates indicating that the degree was awarded unless all the late tuition fees have been paid in full.

3. **Attendance**

   The course professor records the attendance of students at the start of each theoretical lecture, or an exercise / practical workshop in a record prepared for that by the Student Affairs of the program, taking into account the following:

A. The absence limit allowed for the students without an acceptable excuse is 25% of the total hours of the tutorials and labs of the course, and the course professor shall notify the Student Affairs Department to warn the student twice, the first warning is after the student exceeds the absence rate of 10% of the course hours, and the second warning is after exceeding the absence rate of 20%. Then, the student's case is presented to the academic council to take measures needed to prevent him from entering the course exam.

B. If the student's absence rate exceeds 25% and the student's absence without an approved excuse is accredited from the academic council of the program, the student will score a deprived grade in the course and the result of a "deprived" grade will be included in the calculation of the student's semester grade and the overall GPA.

4. **Partial Discontinuation Condition**

   Students must notify the academic advisor assigned to them by the academic council when they have stopped their studies for more than a week, and if the discontinuation is a result of illness, a "being sick declaration" must be submitted from an accredited governmental hospital or medical center that is approved by the university's medical administration within the specified times. If the student does not take the exam as a result of the illness, a "being sick declaration" must be introduced within the stipulated timings. In addition, a "being sick declaration" approved by the medical administration of the university must be introduced by whom the student's affairs will be notified of the expected absence period for the student.

5. **Enrollment Stoppage**

   In case that the student stops his enrollment in one of the new programs, the student shall pay the related administrative fees.

6. **Address Change**

   The student must notify the faculty administration of any change in his postal address.

7. **Demurrage**

   If the student is late in paying the fees, the decisions approved by the College Board and the University Council in this regard will be applied.

Article [13]: Academic Registration and Academic Load

1. **Registration**

   The academic council of the program announces the dates of registration in the academic curricula through the approved academic agenda. Students should review their choices with the academic advisors assigned to them according to the instructions written in the

program's guide announced on the program's website on the official university website. Registration will not be allowed after the specified date, and if the defaulters are allowed to register, this will be accompanied by a delay fine after being submitted to the academic council.

2. **Advertising**

   Information on registration steps is announced in advance of each semester (Academic Agenda).

3. **Academic Load Per Semester**

   The minimum and maximum number of credit hours a student is allowed to register in one semester is determined as follows:

Table (3): The Maximum Registration

No	Student's GPA	Maximum Registration
1	**GPA<2**	Up to 14 Credit hours
2	**2≤GPA<3**	Up to 18 Credit hours
3	**3≤GPA**	Up to 21 Credit hours

A. The minimum number of hours a student is allowed to register in **Fall** and **Spring** semesters is 12 credit hours, except for graduation or stumbling cases (under academic observation) based on the approval of the Academic Council.

B. Students may register some courses in the summer semester with a maximum of two courses and up to 3 courses in case of graduating in the summer semester. In all cases, graduation projects may not be registered during the summer semester.

Article [14]: The Academic Adviser

The academic council of the program appoints an academic advisor from the teaching staff, at the rate of an academic advisor per 25 students, to guide students in their study trajectory and help them choose the academic courses. Further, he or she determines the number of credit hours they can register according to their circumstances, abilities and academic readiness, and help them solve encountered problems during the study. Besides, he or she supervises the students' study programs, monitoring their progress and monitoring their performance as part of the educational process.

1. The academic advisor meets with his/her students periodically to avoid students being exposed to academic warning.
2. No administrative procedures are taken for any student except through the academic advisor and with his written approval.
3. Each academic advisor determines a time period in his study schedule every week, and a report of this meeting is prepared and submitted to the program management.
4. Students must obtain the approval of the academic advisor assigned to them in choosing a study trajectory before registering for courses in each semester and in the summer semester.

Article [15]: Addition, Deletion and Retraction

1. After registration, the student may add or delete one of the courses in ways and steps that are approved by the academic council of the program.

2. The student may, after the approval of the academic advisor, unregister one or more courses until the end of the fourth week of study only, without violating the academic load stipulated in Article [13].
3. After the approval of the academic advisor, the student may withdraw from studying any course until the end of the tenth week of the start of registration for the autumn or spring semester (third week of the summer semester). This course is recorded in the student's academic record with a grade of W "withdrawn", provided that the student has not exceeded the percentage of absence prescribed before withdrawal, provided that the withdrawal does not violate the academic load stipulated in Article [13].
4. Re-registration

The student is allowed to re-register in the study course in which he previously obtained an estimate of **F**, and he is allowed to attend the course and repeat the exam in accordance with the financial regulations that specify that, where the maximum allowed estimate is **B +**.

5. Elective Courses

In case that the student registers an elective course and fails and registers the same course again, the student gets the maximum grade of B +, while in the case of changing the elective course, the student gets the newly obtained degree.

Article [16]: Projects

1. Students prepare 2-3 projects in specific topics related to local industries and service to the surrounding community, to be determined by the Academic Council and during the last two academic years according to what is found in the special tables of the program curricula, and under the supervision of faculty members who to prepare, supervise and discuss projects.
2. The last project, called the Graduation Project, is prepared in the last semester, culminating in what the student has studied during the university years.
3. It is permissible that the Academic Council decide to allocate an additional period for the graduation project that begins after the completion of the last semester exam for a period of one month, and at the end of the period allocated to any of the projects the student submits a scientific report on the subject of the project and discusses it.
4. The student cannot obtain a bachelor's degree unless he successfully performs all the prescribed projects.

Article [17]: Practical and Field Training

The program includes a training system during the summer vacation for students transferred to levels 200, 300 and 400 and under the supervision of faculty members, as follows:

1. **Practical Training**: students transferred to level 200 will perform a practical training within the faculty or in specialized training centers and units within the faculty for a period of two weeks with a total number of hours of not less than 60 hours. The student should get a practical training completion certificate.
2. **Field Training**: students transferred to level 300 and those to level 400 perform field training within specialized sectors outside the faculty for a period of four weeks with a total number of hours of at least 120 hours. The student must obtain a certificate from the training authority stating his attendance and obtained the required experience.

3. The faculty is responsible for obtaining training opportunities for students, and students may get training opportunities for themselves, but after faculty council approval is obtained.
4. It is permissible to train students abroad based upon the program academic council approval. The student does not obtain a bachelor's degree unless he has successfully completed both practical and field training.
5. In all training cases, the student is given a Pass/Fail estimate only and his grade is not added to the total grade, but a Pass grade is required to obtain the course degree. The student who reaches level 400 without successfully completing his training can repeat the training any number of times until he passes the training.

The college should provide training opportunities for students in each major through cooperation protocols with companies or through its industrial advisory board.

Article [18]: Optional Courses

The student is not allowed to register at any of the elective courses unless he is at the planned level and to achieve all the requirements of the pre-requisites, and in all cases the academic advisor must review the registration of the students and remove any wrong registration.

Article [19]: Courses Registration Synchronization

Fourth level students and students subject to dismissal can register a course in conjunction with the previous prerequisite for the course after obtaining the approval of the program academic council if the following conditions are met:

1. The student has previously studied this prerequisite and received an **F** grade.
2. This registration does not violate the registration rules according to the GPA.

Article [20]: The Evaluation System

1. Each course is evaluated from (100) one hundred marks.
2. The student is evaluated in theoretical and practical courses based upon the following elements:

A. In the case of decisions that include only a theoretical study, the evaluation is as follows:

Table (4) Distribution of degrees for courses that include theoretical study only

Evaluation		Degree
Semester works	Mid-term exam	20%
	Short exams	30%
	Assignments (report)	
	Presentation and discussions	
Semester Exam (Written)		50%

B. In the case of study courses that include a theoretical and practical study, the evaluation is as follows:

Table (5) Distribution **of degrees for courses that include theoretical and practical study**

Evaluation		Degree
Semester works	Mid-term exam	20%
	Short exams	20%
	Assignments (report)	
	Presentation and discussions	
Practical Exam		10%
Semester Exam (Written)		50%

C. In the case of the Project Course, 50% of the degree is allocated to periodic follow-up, 50% for oral discussion.

D. For a student to succeed in any course, he or she must obtain at least 60% of the total score and must have obtained at least 40% of the final written examination score.

Article [21]: Degrees and Grades Digital and Symbolic Significance

A. The degrees obtained by the student in each course are estimated as shown in the following table:

Table (6)Table of numerical and symbolic implications of degrees and grades

The Student's Obtained %	Equivalent Degrees Range					Points No	Grade
From 97% or more	97	98	99	100	--	4,00	A+
93% to less than 97%	**93**	**94**	**95**	**96**	**—**	**4.00**	**A**
89% to less than 93%	**89**	**90**	**91**	**92**	**—**	**3.70**	**A-**
84% to less than 89%	**84**	**85**	**86**	**87**	**88**	**3.30**	**B+**
80% to less than 84%	**80**	**81**	**82**	**83**	**—**	**3.00**	**B**
76% to less than 80%	**76**	**77**	**78**	**79**	**—**	**2.70**	**B-**
73% to less than 76%	**73**	**74**	**75**	**—**	**—**	**2.30**	**C+**
70% to less than 73%	**70**	**71**	**72**	**—**	**—**	**2.0**	**C**
67% to less than 70%	**67**	**68**	**69**	**—**	**—**	**1.7**	**C-**
64% to less than 67%	**64**	**65**	**66**	**—**	**—**	**1.3**	**D+**
60% to less than 64%	**60**	**61**	**62**	**63**	**—**	**1.0**	**D**
Less than 60%						**0.0**	**F**

B. The course grade is calculated by multiplying the number of credit hours for the course by the number of assessment points (according to Table 6) that the student obtained in this course.

C. The following grades do not fall within the calculation of the average estimate, Table No. (7).

Table (7): Grades Completion

W	Formal Drop out
AU	listener
I	Incomplete
F	Unsuccessful
P	successful

a. Semester GPA:

For each course, the total score of the course is equal to the multiplication of both the number of credit hours of the course and the number of course points.

The semester average = the total points for the courses in which the student scored in the semester divided by the number of credit hours for these courses.

$$Semester\ GPA = \frac{Number of Points}{Number of Graded\ Hours} = \frac{\sum_{i=1}^{N} Grade_i \times Hours_i}{\sum_{i=1}^{N} Hours_i}$$

b. Cumulative GPA

The GPA is calculated as follows:

GPA = the sum of the points for the courses divided by the total number of hours for the courses

$$Comulative\ GPA = \frac{Number\ of\ Points}{Number\ of\ Graded\ Hours} = \frac{\sum_{i=1}^{N} Grade_i \times Hours_i}{\sum_{i=1}^{N} Hours_i}$$

c. Total Cumulative Calculation

The total cumulative is calculated as follows for the number of N courses:

For each course the total equivalent of the course scores is calculated equal to the number of credit hours for the course multiplied by the course score.

Cumulative total percentage is equal to the equivalent of the course grades divided by the total number of hours for the courses:

$$Cumulated\ Marks\ \% = \frac{Equivelent\ Accumulated\ Marks}{Number\ of\ Graded\ Hours}$$

$$= \frac{\sum_{i=1}^{N} Mark_i \times Hours_i}{\sum_{i=1}^{N} Hours_i} \times 100$$

d. Requirements Condition are met

For enrollment in courses requiring other courses as pre-requisites, the student's grade in the pre-requisites should not be less than D.

Article [22]: Graduation Students Grades

The grades obtained by the student upon graduation are granted according to the following schedule:

Table (8)Estimates Granted upon Graduation fromthe Program with Credit Hours System

The student's obtained percentage	Equivalent Degrees Range	Estimate	Equivalent grade
97% or more	**4.00**	**A+**	Excellent
93% to less than 97%	**4.00**	**A**	
89% to less than 93%	**3.70**	**A$^-$**	
84% to less than 89%	**3.30**	**B$^+$**	Very good
80% to less than 84%	**3.00**	**B**	
76% to less than 80%	**2.70**	**B$^-$**	
73% to less than 76%	**2.30**	**C$^+$**	Good
70% to less than 73%	**2.0**	**C**	

Article [23]: Honors Grade

1. Mansoura University grants a certificate of excellence to students who have obtained an average rating of 3.6 or more in previous semesters, provided that they have not failed any course during the study, and this distinction is recorded in the student's academic record.
2. Upon graduation, the student is awarded the honor degree if he obtains an average grade of 3.3 or more in all major semesters without failing any course.

Article [24]: Grades Statement

Students who obtain a degree or who drop out from the program have the right to obtain a statement of grades for their academic record, and this statement cannot be obtained during the period of exams, registration, or the date of graduation, and grades data are not given when tuition fees are not paid.

Article [25]: Academic Warning, Transferring and Dismissals

1. The student is warned academically if he obtains a GPA of less than 2 at the end of the second semester of his enrollment in the study or any other semester after that.
2. The student who is academically warned is placed under academic supervision and is not allowed to register more than 12 credit hours, and the monitoring is stopped if the GPA improves and exceeds the GPA 2.
3. A student who is academically dismissed shall be dismissed from credit hour programs if his cumulative GPA falls below 2.00 for six consecutive main semesters.
4. If the student does not meet the requirements for graduation during the maximum period of study, which is ten years, he will be dismissed.
5. The Faculty Council may consider the possibility of granting a student, subject to dismissal due to his inability to raise his cumulative GPA to at least 2.00 at least, one and last chance of two main semesters to raise his cumulative GPA to 2.00 and fulfil graduation requirements, if he has at least successfully completed 80% of the credit hours required for graduation.
6. A student who registers for 17 or more credit hours is considered a regular student, and the student's position in the study is defined according to Table No. (9).

Table (9):The Student's Position Based upon the Number of Credit Hours Passed

Academic level	Defining the student's Place in the study system	The number of credit hours the student has successfully passed	
		<	>=
1	**Freshman**	**32**	**0**
2	**Sophomore**	**64**	**32**
3	**Junior**	**112**	**64**
4	**Senior**	**160**	**112**

Article [26]: Graduation and Obtaining the Degree

For the student to obtain a bachelor's degree:

1. The student must have completed at least 160 credit hours in all programs and 163 credit hours in the Building and Construction Engineering Programs in studying the courses with a grade of no less than **D**.
2. His average grade should not be less than C or more in the cumulative average, and this means that he will obtain at least a cumulative average of 2.00 / 4.00.
3. The student fulfills all program requirements.
4. Immediately after these conditions are fulfilled, the student's condition will be transferred to a graduate and he may not register any other courses under any of the above items.

Article [27]: Transferring Students -to and from- the Program System

After approval of the academic council for the program and the Mansoura University Council, it is permissible to transfer students to and from the program with the accredited engineering faculties provided that a clearing is made between the courses studied by the student and the courses that he must study and succeed in, and to complete the clearing process the degrees equivalent to the grades specified in the credit hour system are used as shown in Table (1). Table (10) is used to calculate grades when converting from the credit hour system to faculties that do not use the credit hour system.

Table (10):Equivalence of Estimates when Convertingfrom the Credit Hour System to the Two-SemesterSystem

Credit Hour System		The Semester System	
Number of points	Estimate	Equivalent Estimate	Equivalent Percentage
4.00	**A +**	**Excellent**	**99%**
4.00	**A**		**95%**
3.70	**A-**		**91%**
3.30	**B+**	**Very Good**	**86%**
3.00	**B**		**82%**
2.70	**B-**	**Good**	**78%**
2.30	**C+**		**75%**
2.0	**C**		**72%**
1.7	**C-**	**Passed**	**69%**
1.3	**D+**		**66%**
1.0	**D**		**62%**
0.0	**F**	**Failed**	**Less than 60%**

Article [28]: Appointing Graduates of the Program as a Demonstrators (Teaching Assistants)

1. Teaching assistants from the graduates of the program are appointed via a decision from the University President upon the request of the Faculty Council in accordance with

Article (**133**) of Law No. **49** of **1972** regarding the organization of universities and without violating the application of Articles **135** and **136** of the same law.

2. The Faculty Council distributes teaching assistants newly graduated from the programs to the faculty scientific departments corresponding to their majors and based upon the previously presented annual plan of scientific departments

Article [29]: The Listening System

It is permissible to accept listening students in any of the courses if there are vacant places provided that the listening student cannot perform the exam, or obtain credit hours for joining this course, or can he obtain an attendance statement for the course from the faculty. They may register late after completing the registration for regular students.

Article [30]: The Improvement System

1. The student is allowed to improve in (5) subjects to raise the GPA during the study period, provided that the student gets the last grade, and it is not permissible to drop out from the course after the end of the official period in which withdrawal is permitted without an academic impact (the fourth week of the main semesters). As the expiration of this period entails the removal of the first estimate.
2. If the student has completed his studies in the program and his GPA is less than 2, he may improve any of the previously studied subjects until he reaches the required minimum of the GPA.
3. The student may not improve a failed course.

Article [31]: Disciplinary Rules

Students who are enrolled in the program are subject to the disciplinary system outlined in the University Regulatory Law and its executive regulations.

Article [32]: Electronic Administration

The university designs or contracts with an information administration system for the program to automate the work of the program with a credit hour system. The following conditions are required in this program:

1. Course registration.
2. Adding and removing courses.
3. Academic Advising.
4. program administration work in achieving the rules governing the program.
5. Grades control work.
6. Study work and exams.
7. Financial benefits.
8. Student affairs work.
9. Statement of the situation.
10. Student performance reports.
11. Record the absence of students.
12. E-exams.

13. Communication with students

Taking into account the preservation of confidentiality of data and its recall, ease of use for the student, faculty member and administrative team, and the availability of technical support.

Article [33]: Incomplete Courses

If a student request not to attend the final exam where he shows compulsive reasons why not to attend, is accepted by the academic council of the program and the faculty council, within two days at most from the final examination date, the course is considered incomplete with an estimate (I) in this course provided that he has obtained at least 60% of the coursework degree or he has been deprived of entering the final exam, in which case he will have the opportunity to take the final exam in the next semester and at the date determined by the faculty council, which is usually in the first week of the next academic semester directly. The degree of the semester work obtained by the student during the semester is added to the final theoretical exam degree which is conducted by the student.

Article [34]: Appeals for the Results of the Courses

The student can appeal to review the grades of the course within a week of announcing the result, after paying the fees determined in accordance with the overall regulations associated with this matter.

Article [35]: Implementing the Provisions of the Law Regulating Universities

The provisions of these regulations apply from the academic year following the date of their issuance to new students admitted to the faculty at the level (000) of those programs, and these regulations do not apply retroactively to any student in the faculty.

Article [36]: General Rules

1. The rules of the Universities Regulatory Law, its executive regulations, the internal regulations of the college, and other university regulations are applied in the absence of a text in these regulations.
2. The student is subject to the general system of the university and the college, and the rules of dismissal from the university, opportunities for re-enrollment, acceptable excuses for not taking the exam, stopping the academic registration, and all the rules, laws and regulations regarding student discipline as stipulated in the Universities Organization Law and its implementing regulations are applied to him/her.
3. The faculty is permitted to add to the list of elective courses with the approval of the Faculty Board and without the need to return to the Engineering Sector Committee.
4. The Faculty Council agrees to change the scientific content of the course in a manner that does not conflict with the course name and objectives.

Article [37]: Transitional Rules

1. The provisions of these regulations shall be applied to new preparatory year students and those covered by the decisions of the University Council that regulate the enrollment of students in the credit hour programs, starting from the academic year following the issuance

of the ministerial decision related to this regulation, and then applied sequentially to the remaining academic years.

2. When the provisions of these regulations are applied to any academic year, work shall apply to the remaining students for repetition, re-enrollment and applicants for the examination from abroad, and the College Board shall adjust the status of these students in the light of this regulation and the previous one.

4. The Courses of Chemical and Environmental Engineering Program by Credit hours system

4.1 Course Coding System

The following figure shows courses coding system according to reference framework NARS 2018, where the course code is composed of three letters and three digits. The letters indicate the course specialization department. The first digit indicates the year 0, 1, 2, 3, or 4. The second digit between 1 and 9 displays the discipline in the major. The third digit is the course sequence in each discipline. The following must be considered:-

1. The letters indicate the majors in which the degree is given but some of these represent university requirements, college requirements, or specialized courses.
2. Course descriptions refer to the semester in which this course is usually given, but these dates are subject to change, as not all courses are taught every year, and before the start of each semester, college affairs show students the courses tables that will be taught in this semester, their teaching times and those in charge of teaching

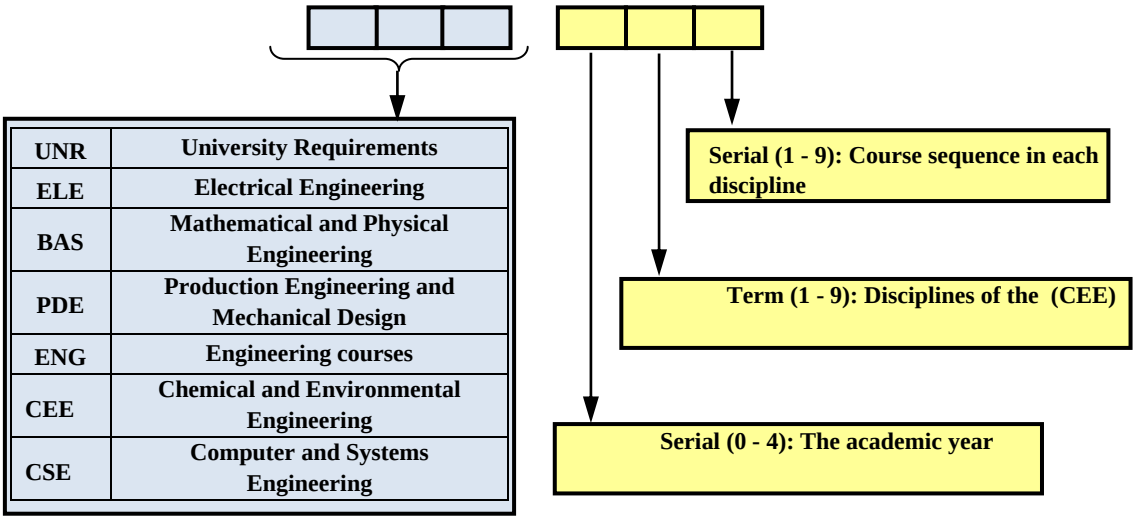

Figure (1): Courses coding system

4.2 The Program Plan Description

The study plan of the CEE Program at the College of Engineering, Mansoura University involves different requirements for the university, the college, and the department, as well as courses which satisfy these requirements. Also, the study plan includes the credit units for all courses and the distribution of these credit units on the Five studying levels (Years).

To prepare the student for the above targeted Educational Objectives, a set of program outcomes, that describes what students are expected to know and is able to do by the time of graduation, have been adopted. The student must successfully pass a number of courses totaling 160 credit hours in order to obtain a bachelor's degree in chemical and environmental engineering from the Faculty of Engineering, Mansoura University.

4.2.1. The University Requirements

The main purpose of university education is not only to prepare students for successful careers but also to provide them with the knowledge and skills necessary to develop a rational and successful personal identity. In addition, Mansoura University assists students in gaining an appreciation of the natural and cultural environments in which they live and their roles in society and community services. The university's requirements for bachelor's programs consist of 13 credit hours (8.12% of the total 160 credit hours), which are met by completing six (6) courses. Tables (1), shows the courses credit units, Total SWL and marks distribution for the university.

Table (1): The University Requirements (13 Credit)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final
UNR061	English (1)	2	5	20	30	--	50
UNR062	English (2)	2	5	20	30	--	50
UNR171	History of Engineering and Technology	1	2	20	30	--	50
UNR281	Law and Human Rights	2	4	20	30	--	50
UNR241	Communication and Presentation Skills	2	5	20	30	--	50
UNR461	Ethics and Morals of The Profession	2	4	20	30	--	50
UNR471	Marketing	2	4	20	30	--	50
Total		13	29				

4.2.2 The College Requirements

Table (2) indicate the college requirements which contain basic science courses and basic engineering science courses.

Table (2): The College Requirements (45 Credit)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final
BAS011	Mathematics (1)	3	8	20	30	--	50
BAS021	Mechanics (1)	3	8	20	30	--	50
BAS012	Mathematics (2)	3	8	20	30	--	50

BAS022	**Mechanics (2)**	**3**	**8**	**20**	**30**	**--**	**50**
BAS031	**Physics (1)**	**3**	**9**	**20**	**20**	**10**	**50**
BAS032	**Physics (2)**	**3**	**9**	**20**	**20**	**10**	**50**
BAS041	**Principles of Engineering Chemistry**	**3**	**9**	**20**	**20**	**10**	**50**
PDE051	**Principles of Manufacturing Engineering**	**3**	**8**	**20**	**20**	**10**	**50**
PDE052	**Engineering Drawing**	**3**	**10**	**20**	**30**	**--**	**50**
ENG111	**Technical Reports Writing**	**2**	**6**	**20**	**30**	**--**	**50**
BAS113	**Mathematics (3)**	**3**	**8**	**20**	**30**	**--**	**50**
BAS114	**Mathematics (4)**	**3**	**8**	**20**	**30**	**--**	**50**
BAS115	**Statistics and Probability Theory**	**2**	**6**	**20**	**30**	**--**	**50**
ELE151	**Electrical Power and Machines**	**3**	**8**	**20**	**30**	**--**	**50**
BAS215	**Mathematics (5)**	**3**	**8**	**20**	**30**	**--**	**50**
ENG412	**Project Management**	**2**	**6**	**20**	**30**	**--**	**50**
Total		**45**	**127**				

4.2.3. The Program Requirements (Core Courses)

Table (3) shows the courses distribution according to the specializations in CEE which include:

- Basic courses in chemical engineering
- Transport Phenomena and Separation processes
- Modeling and design operations courses
- Elective Courses
- Training and graduation projects

Table (3): CEE Requirements (Core Courses) Based on Disciplines

Code	Course Name	Credit	Total SWL	Marks Distribution				Groups Name
				Mid Term	semester Works	Lab	Final	
CSE042	Introduction to Computer Systems	3	9	20	20	10	50	Basic Chemical Engineering Courses (1)
CEE111	Organic Chemistry	3	10	20	30	10	50	
CEE112	Physical Chemistry	3	9	20	30	--	50	
CEE113	Introduction to Chemical	3	9	20	30	--	50	
CEE114	Material Science	3	8	20	30	--	50	
CEE115	Chemical Engineering	3	10	20	20	10	50	
CEE216	Chemical Engineering Process	3	9	20	30	--	50	
CEE317	Chemical Industries	3	8	20	30	--	50	
CEE221	Momentum Transfer	3	11	20	20	10	50	Transport Phenomena& Separation processes (2)
CEE222	Heat Transfer	3	10	20	20	10	50	
CEE223	Mass Transfer	3	10	20	20	10	50	
CEE224	Common Mechanical Operation	3	9	20	30	--	50	
CEE325	Separation Processes	3	9	20	30	--	50	
CEE331	Computer Application in Chemical	3	9	20	20	10	50	Processes Design & Modelling (3)
CEE332	Modeling and simulation in	3	10	20	50	10	50	
CEE333	Kinetics and Reactor Design	3	9	20	30	--	50	

CEE334	Corrosion Engineering	3	7	20	30	--	50	
CEE435	Process Control in Chem.	3	7	20	30	--	50	
CEE436	Petrochemical Engineering	3	7	20	30	--	50	
CEE437	Plant Design and Economics	3	7	20	30	--	50	
CEE141	Environmental Chemistry	3	8	20	30	--	50	Environmental Engineering (4&5)
CEE142	Environmental Impact Assessment	2	6	20	30	--	50	
CEE243	Water and wastewater Treatment Engineering.	3	10	20	20	10	50	
CEE244	Environmental Risk Assessment	2	7	20	30	--	50	
CEE245	Solid and Hazard Waste	3	9	20	30	--	50	
CEE346	Clean Production	2	5	20	30	--	50	
CEE347	Air Pollution Control	3	9	20	30	--	50	
CEE348	Environmental Performance	2	4	20	30	--	50	
CEE361	Elective (1)	3	9	20	30	--	50	Elective Courses (6 and 7)
CEE362	Elective (2)	3	9	20	30	--	50	
CEE463	Elective (3)	3	9	20	30	--	50	
CEE464	Elective (4)	3	9	20	30	--	50	
CEE291	Training (1)	2	25	--	50	--	50	Training & project (9)
CEE392	Training (2)	2	25	--	50	--	50	
CEE493	Senior Project (1)	3	17	--	50	--	50	
CEE494	Senior Project (2)	3	17	--	50	--	50	
Total		**102**	**355**					

4.2.4. Elective Courses

Tables (4) and (5) shows a list of elective courses that a student can choose for elective courses.

Table (4): List of Elective Courses (1 and 2)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final
CEE371	Water Desalinations	3	9	20	30	--	50
CEE372	Energy Technology	3	9	20	30	--	50
CEE373	Petroleum Engineering	3	9	20	30	--	50
CEE374	Catalysts and Catalytic Processes	3	9	20	30	--	50

Table (5): List of Elective Courses (3 and 4)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final
CEE475	Biochemical Engineering	3	9	20	20	--	50
CEE476	Natural Gas Engineering	3	9	20	30	--	50
CEE477	Design of Heat Exchanger	3	9	20	30	--	50
CEE478	Polymer Engineering	3	9	20	30	--	50

4.2.5. Mapping of Courses to Competencies

Program competencies are enlisted in the first row of the table (by their code number: a1, a2…etc.), then the course titles or codes are enlisted in first column, and an "x" mark is inserted where the respective course contributes to the achievement of the program competencies.

Level	Course Code	Course Title	Graduate Competencies According to NARS 2018													
			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4
000	UNR061	English Language (1)								√						
	BAS011	Mathematics (1)	√													
	BAS021	Mechanics (1)	√													
	BAS031	Physics (1)	√	√												
	BAS041	Basics of Chemical Engineering	√	√												
	PDE052	Engineering Drawing	√		√											
	UNR062	English Language (2)								√						
	BAS012	Mathematics (2)	√													
	BAS022	Mechanics (2)	√													
	BAS032	Physics (2)	√	√												
	CSE042	Introduction to Computer Systems	√				√									
	PDE051	Principles of Manufacturing Engineering	√	√		√										
100	UNR171	History of Engineering and Technology				√	√			√		√				
	BAS113	Mathematics (3)	√													
	BAS115	Probability Theory and Statics	√	√				√								

	CEE111	Organic Chemistry	√	√												
	CEE112	Physical Chemistry	√	√												
	CEE141	Environmental Chem.	√	√												
	CEE142	Environmental Impact Assessment	√			√										
	BAS114	Mathematics (4)	√													
	ENG111	Technical Report Writing					√			√						
	ELE151	Electric Power and Machines	√	√												
	CEE113	Introduction to Chemical Eng.	√	√	√											
	CEE114	Material Science	√													
	CEE115	Chemical Eng. Thermodynamics	√	√			√									
200	UNR241	Communication and Presentation Skills						√	√	√	√	√				
	UNR281	Law and Human Rights	√				√		√	√		√				
	BAS215	Mathematics (5)	√	√												
	CEE221	Momentum Transfer	√	√			√									
	CEE243	Water and wastewater Treatment Engineering	√	√	√	√										
	CEE244	Environmental Risk Assessment	√			√	√									
	CEE216	Chemical Eng. Process Safety	√			√	√									
	CEE222	Heat Transfer	√	√			√									
	CEE223	Mass Transfer	√	√			√									
	CEE224	Common Mechanical Operation	√								√	√		√		
	CEE245	Solid and Hazard Waste Management	√			√						√				
	CEE291	Training (1)	√	√		√	√	√	√	√	√	√		√		
300	CEE325	Separation Processes	√								√			√		
	CEE331	Computer Application in Chemical Eng.	√								√	√		√	√	
	CEE346	Clean Production	√				√							√		
	CEE347	Air Pollution Control	√			√	√							√		
	CEE348	Environmental Performance Evaluation	√			√	√									
	CEE361	Elective (1)	√		√								√			
	CEE317	Chemical Industries	√		√						√			√		
	CEE332	Modeling and simulation in Chemical Eng.	√		√						√	√			√	
	CEE333	Kinetics and Reactor Design	√		√								√			

	CEE334	**Corrosion Engineering**	√		√								√			√
	CEE362	**Elective (2)**	√		√								√			
	CEE392	**Training (2)**	√	√		√	√	√	√	√	√	√		√		
400	**UNR461**	**Ethics and Morals of the Profession**	√			√	√		√	√	√	√				
	UNR471	**Marketing**	√	√		√	√	√	√	√	√	√				
	CEE435	**Process Control in Chemical Engineering**	√		√						√	√	√			
	CEE463	**Elective (3)**	√		√		√				√	√	√	√		
	CEE493	**Senior Project (1)**	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	ENG412	**Project Management**	√	√	√	√	√	√	√	√	√					
	CEE436	**Petrochemical Engineering**	√		√	√							√			√
	CEE437	**Plant Design and Economics**	√		√								√			√
	CEE464	**Elective (4)**	√		√		√				√	√	√	√		
	CEE494	**Senior Project (2)**	√	√	√	√	√	√	√	√	√	√	√	√	√	√

4.3. Courses distributions

LEVEL 000

First Semester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
UNR061	English (1)	2	1	2	--	2	-------	20	30	--	50
BAS011	Mathematics (1)	3	2	2	--	4	-------	20	30	--	50
BAS021	Mechanics (1)	3	2	2	--	4	-------	20	30	--	50
BAS031	Physics (1)	3	2	1	1.5	4.5	-------	20	20	10	50
BAS041	Principles of Engineering Chemistry	3	2	1	1.5	4.5	-------	20	20	10	50
PDE052	Engineering Drawing	3	2	2	--	6	-------	20	30	--	50
Total		17	11	10	3	25					
Total Contact hours = 24 hrs/weekTotal SWL = 49 hrs/week											

SecondSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
UNR062	English (2)	2	1	2	--	2	UNR061	20	30	--	50
BAS012	Mathematics (2)	3	2	2	--	4	BAS011	20	30	--	50
BAS022	Mechanics (2)	3	2	2	--	4	BAS021	20	30	--	50
BAS032	Physics (1)	3	2	1	1.5	4.5	---------	20	20	10	50
CSE042	Intro. to Comp. Systems	3	2	1	1.5	4.5		20	20	10	50
PDE051	Principles of Manufacturing Eng.	3	2	--	3	3	----------	20	30	--	50
Total		17	11	8	6	22					
Total Contact hours = 25 hrs/weekTotal SWL = 47 hrs/week											

LEVEL 100

ThirdSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
UNR171	History of Eng. and Technology	1	1	--	--	1	----------	20	30	--	50
BAS113	Mathematics (3)	3	2	2	--	5	BAS012	20	30	--	50
BAS115	Statistics and Probability Theory	2	1	2	--	3	BAS012	20	30	--	50
CEE111	Organic Chemistry	3	2	--	3	4		20	30	--	50
CEE112	Physical Chemistry	3	2	2	--	5	BAS041	20	30	--	50
CEE141	Environmental Chem.	3	2	2	--	4	---	20	30	--	50
CEE142	Environmental Impact Assessment	2	2	--	--	2	--	20	30	--	50
Total		**17**	**12**	**8**	**3**	**24**					
Total Contact hours = 23 hrs/weekTotal SWL = 47 hrs/week											

FourthSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
BAS114	Mathematics (4)	3	2	2	--	5	BAS113	20	30	--	50
ENG111	Technical Reports Writing	2	1	2	--	4	UNR062	20	30	--	50
ELE151	Electrical Power and Machines	3	2	2	--	4	-------	20	30	--	50
CEE113	Introduction to Chemical Eng.	3	2	2	--	5	-------	20	30	--	50
CEE114	Material Science	3	2	2	--	4	CEE 111	20	30	--	50
CEE115	Chemical Eng. Thermodynamics	3	2	--	3	4	CEE 112	20	20	10	50
Total		**17**	**12**	**8**	**3**	**26**					
Total Contact hours = 23 hrs/weekTotal SWL = 49 hrs/week											

LEVEL 200

FifthSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
UNR241	Communication and Presentation Skills	2	1	2	--	3	----------	20	30	--	50
UNR281	Law and Human Rights	2	2	--	--	2	------	20	30	--	50
BAS215	Mathematics (5)	3	2	2	--	5	BAS113	20	30	--	50
CEE221	Momentum Transfer	3	2	--	3	3	----	20	20	10	50
CEE243	Water and wastewater Treatment Engineering	3	2	--	3	4	CEE141	20	20	10	50
CEE244	Environmental Risk Assessment	2	2	--	--	4	-----	20	30	--	50
Total		**15**	**11**	**4**	**6**	**21**					
Total Contact hours = 21 hrs/weekTotal SWL = 42 hrs/week											

SixthSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
CEE216	Chemical Eng. Process Safety	3	2	2	--	4	----	20	30	--	50
CEE222	Heat Transfer	3	2	--	3	4	CEE115	20	20	10	50
CEE223	Mass Transfer	3	2	--	3	4	CEE221	20	20	10	50
CEE224	Common Mechanical Operation	3	2	2	--	5	----	20	30	--	50
CEE245	Solid and Hazard Waste Management	3	2	2	--	4	CEE141	20	30	--	50
CEE291	Training (1)	2	--	--	--	--	In summer		50		50
Total		**17**	**10**	**6**	**6**	**21**					
Total Contact hours = 22 hrs/weekTotal SWL = 43 hrs/week											

LEVEL 300

SeventhSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
CEE325	Separation Processes	3	2	2	--	5	CEE221	20	30	--	50
CEE331	Computer Application in Chemical Eng.	2	2	--	3	4	---	20	30	10	50
CEE346	Clean Production	2	2	--	--	4	----	20	30	--	50
CEE347	Air Pollution Control	3	2	2	--	5	----	20	20	--	50
CEE348	Environmental Performance Evaluation	2	2	--	--	4	----	20	30	--	50
CEE361	Elective (1)	3	2	2	--	5	CEE223	20	30	--	50
Total		**15**	**12**	**6**	**3**	**27**					
Total Contact hours = 21 hrs/weekTotal SWL = 48 hrs/week											

EighthSemester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
CEE317	Chemical Industries	3	3	--	--	5	----	20	30	--	50
CEE332	Modeling and simulation in Chemical Eng.	3	2	--	3	4	CEE331	20	20	10	50
CEE333	Kinetics and Reactor Design	3	2	2	--	5	CEE223	20	30	--	50
CEE334	Corrosion Engineering	3	2	2	--	5	----	20	30	--	50
CEE362	Elective (2)	3	2	2	--	5	CEE223	20	30	--	50
CEE392	Training (2)	2	--	--	--	--	In summer		50		50
Total		**17**	**11**	**6**	**3**	**24**					
Total Contact hours = 20 hrs/weekTotal SWL = 44 hrs/week											

LEVEL 400

Ninth Semester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
UNR461	Ethics and Morals of The Profession	2	2	--	--	4	----	20	30	--	50
UNR471	Marketing	2	2	--	--	4	-------	20	30	--	50
CEE435	Process Control in Chemical Engineering	3	3	--	--	5	CEE332	20	30	--	50
CEE463	Elective (3)	3	2	2	--	5	CEE361	20	30	--	50
CEE493	Senior Project (1)	3	1	--	6	3	CEE331, CEE332 CEE333	--	50	--	50
Total		**13**	**10**	**2**	**6**	**21**					
Total Contact hours = 18 hrs/weekTotal SWL = 39 hrs/week											

Tenth Semester

Code	Course Name	Hours/Week					Prerequisites	Marks Distribution			
		Credit	Lecture	Tutorial	Lab.	Free work		Mid Term	Semester Work	Lab	Final
ENG412	Project Management	2	2	--	--	4	Pass 90 Cr.	20	30	--	50
CEE436	Petrochemical Engineering	3	3	--	--	5	--------	20	30	--	50
CEE437	Plant Design and Economics	3	2	2	--	5	CEE333	20	30	--	50
CEE464	Elective (4)	3	2	2	--	5	CEE362	20	30	--	50
CEE494	Senior Project (2)	3	1	--	6	3	CEE493	--	50	--	50
Total		**14**	**10**	**4**	**6**	**22**					
Total Contact hours = 20 hrs/weekTotal SWL = 42 hrs/week											

4.5 CEE Program Courses Syllabi

4.5.1. University Requirements:

UNR061	English (1)								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	---
Main skills of the English language - listening to short and long conversations - reading scientific passages - writing reports, summaries, and scientific articles - speaking and presenting new ideas									
References: Mark Ibbotson, Cambridge English for Engineering Student's book free, Cambridge press 2011									

UNR062	English (2)								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	UNR061
Analysis and interpretation of engineering issues - summarizing engineering issues - preparation for language tests.									
References: Mark Ibbotson, Cambridge English for Engineering Student's book free, Cambridge press 2011									

UNR171	History of Engineering and Technology								Prerequisites
1 Cr	Lecture	1	Tutorial	--	Lab.	--	Semester	2nd	---
Engineering history: Art, Science, Engineering and technology - Role of engineering and technology in development and establishment of civilizations -Technology and environment - Examples on development of engineering activity.									
References: Roger S. Kirby, Engineering in History, Dover Publications Inc. New York, United States, 1990, ISBN10 0486264122									

UNR281	Law and Human Rights								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	2ed	---
Systems and laws of institutions - Introduction to Accounting - Labor legislation and laws governing engineering professions - Industrial security legislation and environment - Historical philosophical origins of human rights - international sources of human rights - national sources of human rights - global bodies based on the protection of human rights.									

UNR241	Communication and Presentation Skills								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	---
Communication skills- Presentation planning and preparation - Delivery skills such as eye contact, voice control, gestures, body language and appearance - Presenter’s characteristics - Using visuals - Presentation structure - Elevator Pitch									
References: Joan van Emden, Lucinda Becker, Presentation Skills for Students, 3rd Edition, Red Globe Press, 2016 M. Wa Mutua, S. Mwaniki, P. Kyalo, B. Sugut, Communication Skills: A University Book, Succex Publishers, 2016 Ian Tuhovsky, Wendell Wadsworth, Communication Skills Training, Ian Tuhovsky, 2015 Tabitha Wambui, Alice W. Hibui, Elizaeth Gathuthi, "Communication skills " Vol.1, Students'									

coursebook, LAP LAMBERT Academic Publishing, 2012

UNR461	Ethics and Morals of The Profession								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	1st	---
General principles of professional ethics - Commitments to society - Responsibilities of the engineer - Detection of violations - Behavior - Case studies and general issues.									
References: Lizabeth A. Stephan, David R. Bowman, William J. Park, Benjamin L. Sill, Matthew W. Ohland, "Thinking like an engineer", Published by Pearson 2018. Harris, C. E., Jr., Pritchard, M. S., & Rabins, M. J. Engineering Ethics. Second edition. Belmont, CA: Wadsworth, 2000									

UNR471	Marketing								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	1st	---
Principles of biomedical products marketing - Marketing research - Biomedical customers buying behavior - Marketing mix - Plotting marketing strategy - Building marketing plan - Pinpointing the target market - Marketing on the world wide web - Branding strategy - Developing new products - Advertising and promotions - Costing and pricing strategies - Case studies on biomedical products marketing									
References: Principles of Marketing, University of Minnesota Libraries Publishing, 2015, ISBN 13: 9781946135193									

4.5.2. Collage Requirements:

BAS011	Mathematics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Calculus: Function (definition - theorems) - Basic functions - limits - Continuity - Derivation - definition - theorems - types - higher orders - Applications on derivatives - partial derivatives - indefinite integral - theories and properties of integration. Algebra: Binomial theorem (with any exponent and applications) - Partial Fractions - Theory of Equations - Matrices - System of linear equations - Gauss elimination method.									
References: Akhtar & Ahsan, Textbook of Differential Calculus, second edition, 2009, PHI Learning Private Limited. Alan Jeffrey, Matrix operations for Engineers and Scientists, 2010, Springer Science & Business Media.									

BAS021	Mechanics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Newton's laws - Types of forces، coplanar forces، Rectangular components of vector (1D, 2D, Space), Forces in space - Equilibrium of a particle - Conditions, Free-body diagram - Moment - Couple moment - Resultant of a system of forces and couples as a force and couple system - General procedure for reducing force and couple systems - Equilibrium of a rigid body - Conditions of equilibrium of a rigid-body، free body diagrams – friction									
References: R.C. Hibbeler, "Engineering Mechanics: Statics and Dynamics, 14th Edition", Pearson Prentice Hall, New Jersey, 2016. J. L. Meriam, L. G. Kriage, and J. N. Botton, "Engineering Mechanics: Statics, 8th Edition", John Wiley & Sons, New York, 2016.									

BAS012	Mathematics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	BAS011
Integral Calculus: Definite integral - Methods of integration - Applicationson definite integral (plane area - volume of revaluation - length of a plane curve - area of surfaces of revolution) - improper integral. Analytic Geometry: Equations of second degree - Equation of pair of straight lines - Translation of axes - Conic sections - parabola - ellipse - hyperbola) Equation of plane - Equation of sphere.									
References: Jumarie, G., Fractional Differential Calculus for Non-Differentiable Functions: Mechanics, Geometry, Stochastics, Information Theory. 2013: LAP Lambert Academic Publishing. Hestenes, D. and G. Sobczyk, Clifford algebra to geometric calculus: a unified language for mathematics and physics. Vol. 5. 2012: Springer Science & Business Media. Grossman, S.I., Multivariable calculus, linear algebra, and differential equations. 2014: Academic Press.									

BAS022	Mechanics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	BAS021
Kinematics of a particle: curvilinear motion - Normal and tangential components. - Newton's laws - motion of projectiles - Work and energy of a particle - applications of friction.									
References: R.C. Hibbeler, "Engineering Mechanics: Statics, 11th Edition", Pearson Prentice Hall, 2006. F. P. Beer, and E. R. Johston, Jr., D. F. Mazurek, P. J. Cornwell, E. R. Eisenberg, "Vector Mechanics for Engineering, Statics and Dynamics, 9th Edition", McGraw-Hill, New York, 2010.									

BAS031	Physics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	1st	---
Material properties: Physical quantities - Standard units and dimensions - Mechanical properties for materials - Fluid properties - Periodic motion - Mechanical waves - Sound waves - Waves in elastic media. Heat and thermodynamics: Temperature measurements and thermometers - Thermal expansion - Specific and latent heat - Heat transfer - Gas motion theory - First law of thermodynamics - Entropy and second law of thermodynamics.									
References: Physics for Scientists and Engineers, R.A. Serway and J.W. Jewett, 6th Edition, Thomson Brooks/Cole 2014. Paul A. Tipler, " Physics for scientists and engineers" sixth edition, 2008.									

BAS032	Physics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	1st	---
Electricity and Magnetism: Electric charge - Electric force - Electric field- Column's law- Electric flux- Gauss law- Electric potential- Electric capacitance and Dielectrics - Ohm's law and simple circuits- Magnetic field - Baiot and Savart laws. Optics and Modern physics: Nature of light and laws of geometric optics - Interference - Diffraction - polarization - optical fiber - laser - photoelectric effects - principle of quantum theory - special theory of relativity.									
References: Physics for Scientists and Engineers, R.A. Serway and J.W. Jewett, 9th Edition, Thomson Brooks/Cole 2014., Paul A. Tipler, " Physics for scientists and engineers" sixth edition, 2008.									

BAS041	Principals ofEngineering Chemistry								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	1st	---
Equations of state-chemical thermodynamics - Material and energy balance in chemical processes- properties of solutions - Basic principles in electrochemistry and it's applications- selected topics in chemical industry.									
References: Brown, L. T, LeMay H. E. Jr; Bursten, B. E.; Murphy, C.J., and Woodward, P.; " Chemistry The Central Science", Pearson International Edition (11th edn), Pearson Printice Hall, (2009).									

PDE051	Principles of Manufacturing Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2ed	---
Introduction to the following processes (Casting- Forging- Metal filing - Machining- Forming- Woodworking)									
References: Hitomi, Katsundo. Manufacturing Systems Engineering: A Unified Approach to Manufacturing Technology, Production Management and Industrial Economics. Routledge, 2017.									

PDE052	Engineering Drawing								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Two-dimensional drawings - Free-hand sketching - Sectional views - Auxiliary views and conventions - Computer-aided drawing (CAD) of 2D and 3D figures.									
References: Mcgraw-hill Mint, "Mechanical Drawing Board & CAD Techniques", Student Edition,2011									

ENG111	Technical Reports Writing								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	2ed	UNR062
Technical writing defenition - audience analysis - technical writing styles - technical document characteristics - automated document organization - official and unofficial document types - structure of different types of technical documents.									
References: G. J. Alred, W. E. Oliu, The Handbook of Technical Writing, 12th Edition, Bedford/St. Martin's; 2018 K. Hyland, Teaching and researching writing. 3rd edition Routledge academic publisher, 2016 M. Markel, Technical Communication, 11th edition, MacMillan, 2015.									

BAS113	Mathematics (3)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	BAS012
Applications of partial differentiation - Maximum values of functions in more than one variable and applications - First order differential equations - Second order differential equations - Laplace transform and its applications - Analytical geometry in space.									
References: D. Backman, "Advanced Calculus Demystified", McGraw-Hill, 2007. S. A. Wirkus, and R. J. Swifi, "A Course of Ordinary Differential Equations", Taylor & Francis Group, LLC, 2015.									

BAS114	Mathematics (4)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	BAS113
Fourier series - Fourier transform - Complex numbers - Functions of a complex variable - Complex integration - Residue theorem - Direction derivatives - Double integrals - Triple integrals - Line integrals - Surface integrals.									

References: J. Brown, and R. Churchill, "Complex Variables and Applications", 9th Edition, McGraw-Hill, 2013. D. Backman, "Advanced Calculus Demystified", McGraw-Hill, 2007.

BAS115	Statistics and Probability Theory								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	BAS012
Measures of tendency and dispersion - Probability distributions - Sampling theorem - tests of hypothesis - non-parametric tests - regression and correlation - time series.									
References: Mary C. Meyer, Probability and Mathematical Statistics: Theory, Applications, and Practice in RSBN-10: 1611975778, SIAM (June 24, 2019)									

ELE151	Electrical Power and Machines								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	---
Power: Electrical power systems - three phase systems - Theory and models of transformers - Transmission line models - Voltage and frequency control - effective and ineffective power - Optimal work of power systems. Machines: The theory of operation ، The construction of the Direct Current motors. The speed، torque، and current characteristics - applications of the DC motors. The theory of operation and construction of stepper motors - Permanent-magnet DC motor and Low-inertia DC Motors. The theory of operation، construction of three phase induction motors.									
References: Nilsson, J.W. and S.A. Riedel, Electric circuits. 2015: Pearson Upper Saddle River, NJ. Slade, P.G., Electrical contacts: principles and applications. 2017: CRC press.									

BAS215	Mathematics (5)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	BAS113
Numerical solution of linear and non-linear systems of equations - Iterative methods - Curve fitting: Least square of (Straight lines, Polynomials), Linearization of nonlinear relationship. Interpolation and polynomial approximation -finite difference operators - Numerical integration and differentiation.									
References: Mazumder, Numerical Methods for Partial Differential Equations,Finite Difference and Finite Volume Methods, science direct ,2016. Sheldon Rose, A First course in probability, Eighth edition, 2010, Pearson Prentice Hall.									

ENG412	Project Management								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	---
Fundamentals of biomedical project management - Integration management - Scope management - Time management - Cost management - Quality management - Human resources management - Communication management - Risk management - Procurement management - Biomedical projects case studies									
References: Kerzner, H. and H.R. Kerzner, Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons, 2017. Kalpakjian, S., K. Vijai Sekar, and S.R. Schmid, Manufacturing Engineering and technology. Pearson, 2014. Nigel J. Smith, "Engineering Project Management", 3rd Edition, Wiley-Blackwell, 2008.									

4.5.3. CEE Program Requirements

CSE042	Introduction to Computer Systems								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2ed	---
Introduction to the design and operation of digital computers: types of data and its representation and number systems - the basic components of the computer and the organization of the computer and the ways of transfer of information- programming with Visual Basic - Introduction to information networks Introduction to Programming: Program Structure and Command Types - Presentation of key commands - simple software development Training Fundamentals: Dealing with Common Operating Systems (Windows – Linux) - Software Development and Desktop Software									
References: Peter Van Roy, Seif Haridi, "Concepts, Techniques, and Models of Computer Programming" The MIT Press (February 20, 2012)									

CEE111	Organic Chemistry								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	1st	---
Introduction to organic compounds composition . organic reactions and its mechanism - types of carbon bonds - electronic theory of valence - Aromatic hydrocarbons - resonance and electronic displacement - paraffin, Olefins aldehydes ketones, carboxylic acids, alcohols, phenols - radical isomerism methods of analysis of organic compounds using (U.V), chromatographic analysis and magnetic resonance - enzymes - catalysts biochemistry for carbohydrates , proteins , fats and oils - kinetics of biochemical reactions.									
References: Wade ، Jr. L. G, "Organic Chemistry". 6th edn. Prentice Hall, (2006).									

CEE112	Physical Chemistry								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	BAS041
Concept of equationsof state and its application in case of ideal gas and deviation from ideality - phases equilibrium and its diagram - ideal solution and its deviations from ideality - general properties of solution - fugacity - activity of ideal solution - activity coefficient - additional properties - dynamic equilibrium and its application in physical and chemical changes: equilibrium calculations of gas and liquid -Reaction Kinetics.									
References: Mortimer R.G. ، "Physical Chemistry", Elsevier ، 3rd Ed. (2008), ISBN-13: 978-0123706171									

CEE113	Introduction to Chemical Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Basics of mass balance: processes and systems variable: mass, volume, flow rates, chemical composition, pressure - Mass balance models of continuous and discontinues. Basics of energy balance: forms of energy -energy balance for non-interactive systems - changes in the temperature and pressure - energy balance for interactive systems - heat of reaction - heat of formation - heat of combustion.									
References: David M. Himmelblau James B. Riggs Basic Principles and Calculations in Chemical Engineering, Prentice Hall, 7th ed 2003, ISBN-10: 0131406345									

CEE141	Environmental Chemistry								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	CEE011
Basic concepts from colloidal chemistry: methods of formations, colloidal dispersions in liquid, colloidal dispersion in air - basic concepts from biochemistry: enzymes and cofactors, biochemistry of carbohydrates and proteins, biochemistry of fats and oils, general biochemical pathways - Volumetric analysis, gravimetric analysis, turbidimetry, colorimetry, photometry, atomic absorption, emission methods, dispersion and scattering, fluorimetry, electrochemical methods, polarography, chromatography, nuclear magnetic resonance (nmr), X-ray analysis - Study of some environmental indicator and their significance and methods of determination: turbidity, color, pH, acidity, alkalinity, hardness, chlorine, chlorides, dissolved oxygen, biological oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, solids, iron and manganese, fluorides, sulphates, phosphorus and phosphate ‒ Grease ‒ Volatile acids ‒ Gas analysis ‒ Trace inorganic.								
References: Paul L. Bishop, "Pollution prevention: Fundamentals and Practice" Waveland Pr Inc., 2004,									

CEE142	Environmental Impact Assessment								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	1st	--
Basic concept and principles - The legislative framework of EIA - Costs and benefits of EIA - The EIA process - Linking EIA to other environmental management tools.									
References: Edinburgh David Tyldesley, A handbook on environmental Impact Assessment, 2005 2nd Edition, Natural Heritage Management.									

CEE114	Material science								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	CEE111
Organic polymer : long chain molecules - types of plastic materials - mechanical properties of polymer, cross - linking- electrical properties - formation and growth of crystals - equilibrium curve of iron and carbon - Alloys - Ceramics: Crystaline structure of ceramic materials - Ion electrical conductivity of ceramic materials - Electrical insulating properties - Thermal properties - Application of composite materials - Nano-martial : Concept of nanomaterials - properties associated with the bulk partials fundamental, carbon Nano tubes.									
References: Callister ، Jr. W.D, "Materials Science & Engineering", 7th ed., (2007) John Wiley & Sons.									

CEE115	Chemical Engineering Thermodynamics								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2ed	CEE112
Concept of internal energy and the first law of thermodynamics - concept of entropy and the second law of thermodynamics - The free energy and chemical equilibrium - spontaneous chemical reaction - thermodynamics functions and the first law of thermodynamics- the thermodynamics analysis of chemical reactions- power and refrigeration cycles- steam cycles - Gas power cycles - gas turbine cycles - The Carnot Principles - The Carnot Cycle- The Reversed Carnot Cycle.									
References: J.M. Smithjavascript:void(0), Hendrick Van Ness, Michael Abbott, Introduction to Chemical Engineering Thermodynamics, Mcgraw-Hill Chemical Engineering Series, 7th Edition, 2010.									

CEE221	Momentum Transfer								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	1st	---

Static fluid - general molecular equation of transfer phenomena (momentum temperature , mass) - the viscosity of the fluid - flow patterns - Reynolds s number - the overall mass balance and continuity equation - the overall energy balance - the overall momentum balance in thin layers flow - design equation for thin layers - flow and turbulent flow in tubes -flow of compressible gases - fluid past solid body and through fluidized bed - measurement of the rate of fluid flow - pumps instruments of agitation and mixing of fluid and the power required - non-Newton liquid flow . the differentiated form for equation of momentum transfer - the dimensional analysis in momentum transfer phenomenon.

References:
F. A. Holland &Dr R. Bragg, Fluid Flow for Chemical Engineers, Second edition, 1995

CEE243	Water and Wastewater Treatment Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	1st	CEE141

Introduction for potable water supply treatment process – Physical processes: screening, mixing, sedimentation, membrane separation – Chemical process: coagulation, chemical precipitation, disinfection, ion exchange – Desalination processes: membrane separation, evaporation, reverse osmosis, ion exchange – Development of process design parameters.
Principles of biological oxidation: organics removal mechanisms, the mechanisms of organic removal by bio-oxidation, sludge-quantity considerations, nitrification and denitrification, development of process design parameters – Biological wastewater-treatment processes: lagoons and stabilization basins, aerated lagoons, activated sludge processes, trickling filtration, rotating biological contactors, anaerobic decomposition – Adsorption: theory of adsorption, properties of activated carbon, the PACT process – Ion exchange – Chemical oxidation– Sludge handling and disposal – Miscellaneous treatment processes: land treatment, deep-well disposal, membrane processes, phosphorous removal, filtration.

References:
Metcalf & Eddy Wastewater Engineering: Treatment, Disposal and Reuse., 4th Edition , 2010.

CEE244	Environmental Risk Assessment								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	2nd	---

Introduction to Risk Management and Environment - Linking Risk Analysis and Risk Management - Structuring a Decision Problem - Benefit-Cost Analysis - Technological Risk Assessment - Strategies for Dealing with Extreme Events - Decision Making for Extreme Events in Organizations - Environmental Impact Assessment - Participants in environmental management and Approaches to environmental management - Pollution Management - Waste Management - Emerging environmental issues.

References:
Vlasta Molak Fundamentals of Risk Analysis and Risk Management, CRC Press; 1st edition, 1996

CEE245	Solid and Hazard Waste Management								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	CEE141

Solid waste: type, quantities, trends, environmental stress –collection of solid waste, Sources and assembly of solid waste - soft waste treatment - Material and energy recovery- Methods of sorting solid waste components for re-use them. Pretreatment of Solid waste - Treatment of Solid Waste - Final disposal: sanitary landfills, incineration, underground disposal, deep shallow water disposal, environmental stress, pollution issues (for all the four options)– Elimination (reduction) of solid wastes: change in production lines and life style, substitution/ reduction of package material, process/ product modification - Legislation relative to solid waste.
Characterization and rules regulation hazards waste - reduction hazardous waste volume and recovery useful materials - Hazardous waste system paths - selection appropriate physics, chemical and biological treatment: installation and hardening - Thermal processes - Chemical

and thermodynamics incineration of hazardous - Operation of burial - Check of method of pollution treatment and analysis
References: LaGrega, Michael D., Phillip.L. Buckingham, and J.C. Evans. Environmental Recourse Management. Hazardous Waste Management. 2nd Edition.,.Wave Land Press, Inc. 2010.

CEE216	Chemical Engineering Process safety								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2nd	---
Introduction to processes safety and health - The safety of laboratories and inspection - Chemical, Mechanical and Electrical risks - Toxicology - Fire and explosions - Protection from risks - Emergency and Evacuation Plans - Application of hazard evaluation techniques - Personal protection equipment.									
References: Crowl. D.A, Louvar. J.F,"Chemical Process Safety: Fundamentals with applications", Prentice Hall, (2002).									

CEE222	Heat Transfer								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2nd	CEE115
Steady state heat transfer: mechanisms of heat transfer - heat transfer by conduction - heat transfer by conductivity in case of steady state - forced conviction heat transfer through tubes - forced convocation heat transfer outside bodies according to its shape - heat transfer by natural convection - boiling and condensation - heat exchangers - principle of radiation heat transfer - heat transfer in non-Newtonian fluid - special heat transfer coefficients - dimensional analysis and its application in heat transfer.Unsteady-state heat transfer: derivation of basic equation - heat transfer by conduction in case of unsteady geometrical shape.									
References: Cengel. Y. A, "Heat Transfer", 2ed. , McGraw- Hill (2003)									

CEE223	Mass Transfer								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2nd	CEE221
Fix law of molecule diffusion - Molecular diffusion in gas - Molecular dispersion in liquids - Dispersion in biological solution and gel molecular dispersion in solid materials - Unsteady state dispersion - Mass transfer coefficient - Mass transfer coefficient in different geometrical shapes - mass transfer in colloidal having small volumes - diffusion of gases through solid bodies and capillary tubes - Mass transfer between two phases and overall mass transfer coefficient - Dimension analysis in mass transfer process.									
References: Christil J Geankolpis Transport Processes and Unit Operations, 2nd ed. Printice hall international, inc.,2006, ISBN 0-13-045253-X									

CEE224	Common mechanical operation								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2nd	---
Classification of natural mechanical separation operations -Crushing and grinding - Fluid movement through a solid bed - Fluidization - settling sedimentation - centrifugation processes - Separation of suspended solids from gases - Mixing.									
References: Christil J Geankolpis Transport Processes and Unit Operations, 2nd ed. Printice hall international, inc.,2006, ISBN 0-13-045253-X									

CEE291	Training (1)							Prerequisites
2 Cr	Lecture	--	Tutorial	--	Lab.	--	Semester	Summer for six weeks

Training on industrial establishments relevant to the program.

CEE325	Separation Processes								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	CEE221
Mass transfer operation between two phases and types of the unit operations which apply the mass transfer phenomenon- Separation processes between two content phases and in equilibrium for one stage and multistage which includes: adsorption - distillation - absorption - separation by membranes for gases, liquids, reverse osmosis solutions and application in water purification - crystallization - drying - Extraction.									
References: Christien Geankopliis ، Pamela R. Toliver, "Transport processes and separation process principles", 4th Ed Pearson, (2003).									

CEE346	Clean Production								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	1st	---
Application of industrial ecology to design for environment (DFE) of processes and pollution loads – Introduction of methodology for Life Cycle Assessment (LCA) of manufactured products – Analysis of several DFE and LCA case studies – Term project required on use of DFE/LCA on a specific product/process: product design complete with materials and process selection, energy consumption, waste loadings, LCA of an existing industrial or consumer product using a commercially established method.									
References: Marc J. Rogoff, Solid Waste Recycling and Processing, ISBN: 978-1-4557-3192-3, 2nd edn, Copyright © 2014 Elsevier Inc.									

CEE347	Air Pollution Control								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Air pollution from factories of extraction nickel from its ovens - pollution of air from factories and smelters of aluminum - air pollution from copper smelters - diffusion of air pollutant and dispersion - the basic theory of diffusion and dispersion of air pollutants - assess the effect of stationary sources of pollution on air quality - the basic principles of air pollutant control - command and control devices of air pollutant - methods of removal , book dust and fine size particles.									
References: Vallero, Daniel A,"Fundamentals Of Air Pollution" 5th edition. Amsterdam ; Boston : Elsevier. 2014 ISBN:9780124046023									

CEE348	Environmental Performance Evaluation								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	1st	---
Measurement of environmental performance: basic definitions, incentives and benefits, measures and indicators - Environmental performance indicators: international standard iso 14031, other international initiatives -Eco-efficiency: concept, driving forces and benefits, eco-efficiency indicators.									
References: Philipp Weib and Jörg Bentlage, Environmental Management Systems and Certification, Printed by Nina Tryckeri, Uppsala 2006. ISBN 91-975526-3-1									

CEE331	Computer Application in Chemical Engineering								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	1st	---
Measurement of environmental performance: basic definitions, incentives and benefits, measures and indicators –Environmental performance indicators: international standard iso 14031, other international initiatives –Eco-efficiency: concept, driving forces and benefits, eco-									

efficiency indicators.
References: Arun Datta, Process Engineering and Design Using Visual Basic®, Second Edition, 2013 , CRC Press

CEE317	Chemical Industries								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	---
Industrial processes and flowchart including operation procedures and raw materials to option the final product for some organic and inorganic industries.									
References: Shreev, R.N. & Brink, J.A. : Chemical Process Industries, 5th Edition, McGraw Hill, 1987.									

CEE332	Modeling and Simulation Process								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2nd	CEE331
Important of modeling and simulation in chemical engineering systems and supported calculations by using computer - A high level of programming and ready software package tools.Introduction to water quality modeling - Reaction kinetics - Steady state solution - Response time - Feed forward systems of reactors - Modeling of the environment: Rivers and streams - BOD and oxygen saturation - Gas transfer and oxygen re-aeration.									
References: Luyben W.L, "Process Modeling Simulation & Control". 2nd Ed. McGraw-Hill, (1996).									

CEE333	Kinetics and Reactor Design								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2nd	CEE223
This course aims to establish fundamental knowledge for the students in chemical engineering through interpret and analyse chemical reaction kinetics data; apply reaction kinetics principles in chemical reaction engineering; identify and formulate problems in chemical reaction engineering and find appropriate solutions; specify size the most common industrial chemical reactors to achieve production goals for processes involving homogeneous or heterogenous reaction systems.									
References: Fogler, H.S., “Elements of Chemical Reaction Engineering”, 4th Ed., Prentice Hall, Englewood Cliffs, New Jersey, 2006.									

CEE392	Training (2)								Prerequisites
2 Cr	Lecture	--	Tutorial	--	Lab.	--	Semester	Summer for six weeks	
Training on industrial establishments relevant to the program.									

CEE334	Corrosion Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2nd	-----
Electrolyte and electrolytic transfer processes - Elyctrolytic conductivity Ostwald law of dilution - oxidation states - oxidation and reduction reactions - Equlibrium state of oxidation and reduction reactions - Voltaic cell - The eletromotive force for cells at standard conditions - The free energy and oxidation - reduction reactions - Nernest equation and its appliction for prediction the spontaneous prosesses and the electromotive force at normal conditions - Cocentration cells - Batteries and fuel celles - Electrolysis and nonspont. Oxidtion- reduction rections - The features of electrochemical corrosion: Polarization, application of thermodynamic principles on the corrrosion phenomena - Corrostion protection: Using suitable materials , change the nature of the medium , using the corrostion inhibitors, proper design, cathode protection , paints.									

References: Pierre R. Roberge Handbook of Corrosion Engineering McGraw-Hill Companies, Inc. 2000

CEE435	Process Control in Chemical Engineering								Prerequisites
3 Cr	Lecture	3	Tutorial	--	Lab.	--	Semester	1st	CEE332
Introduction to control systems - Dynamic modeling - Block diagram analysis, signal flow diagram - Transient response analysis: First and second order system - Routh stability criteria - Static error coefficients - Steady state error - Root Locus - Frequency response analysis - Nyquist stability (Polar Plots) - Stability analysis - Closed loop frequency response.									
References: E. Seborg, T.F. Edgar, D.A. Mellichamp, Process Dynamics and Control. John Wiley, second edition, 2003.									

CEE436	Petrochemical Engineering								Prerequisites
3 Cr	Lecture	3	Tutorial	--	Lab.	--	Semester	1st	---
The course cover the uses petroleum and its derivatives as raw materials to produce chemicals (e.g. ethylene, propylene, benzene, toluene), solvents, adhesives, detergents, plastics, polymers and fibers, lubricants, fertilizers, agrochemicals and *e*valuate the economical and marketing aspects of the petrochemical industry.									
References: Uttam Ray Chaudhuri," Fundamentals of Petroleum and Petrochemical, Engineering", CRC Press, 2011									

CEE493	Senior Project(1)								Prerequisites
3 Cr	Lecture	1	Tutorial	--	Lab.	6	Semester	1st	CEE331, CEE332,
Problem formulation - Assignment of solutions - Data Collection - Application of appropriate project work.									
References: To be determined by the supervisor according to the project topics									

CEE437	Plant Design and Economics								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2nd	CEE333
Fixed cost accounting - Cost estimation profits - Investment cost - taxes - Insurance - Depreciation profitability - Investment alternatives and substation - optimum design - Design strategies - Determination of volume of apparatus and equipment and its cost. Plant design process - optimum design and strategic design : proper design economically - design appropriate operationally - genial and practical considerations of design - design methodology - computer aided design.									
References: Coulson & Richardson's. Chemical Engineering, volume 6, Fourth edition, R. K. Sinnott "Chemical Engineering Design", Elsevier Butterworth-Heinemann (2005).									

CEE494	Senior Project(2)								Prerequisites
3 Cr	Lecture	1	Tutorial	--	Lab.	6	Semester	2nd	CEE494
Completing the appropriate project work - Discuss and analyze the results - Writing the final reports.									

References: To be determined by the supervisor according to the project topics

CEE371	Water Desalinations								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
Introduction to water resources & Desalination processes - Thermal Technologies: Single and Multi-Stage Flash (MSF) Technology - Process calculations and MSF performance parameters - Single and Multi-Effect Distillation (MED) Technology - Process calculations and MED performance parameters -Membrane Technologies: Osmosis and Reverse Osmosis (RO) - RO system performance parameters, Energy Recovery and pretreatment - Electro dialysis - Solar – Desalination Systems - Future desalination Technologies - Desalination problems (scaling, fouling, corrosion), and their mitigation.									
References: Cipollina A., Micale G., Rizzuti L.: "Seawater Desalination: Conventional and Renewable Energy Processes", Springer (2009)									

CEE372	Energy Technology								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
The course cover the efficiencies of both new and established energy generation and conversion methods- electricity generation by fossil fuels-nuclear, solar, wind and hydropower- Bioenergy and biogas- alternative energy technologies. The environmental consequences of energy choices on local, national and global scales, including toxic emissions, greenhouse gases and resource depletion are also discussed and integrated throughout the course.									
References: Schaeffer, John.. Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living 30th ed.). Gaiam. 2007									

CEE373	Petroleum Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
This course presents a comprehensive introduction to petroleum refining technology and economics. The focus is on transportation fuels refineries, an overview of crude oil supply and petroleum product demand, a description of refinery process technology such as crude oil distillation, heavy oil conversion options, hydrotreating, and catalytic reforming.									
References: James H. Gary, Glenn E. Handwerk, Mark J. Kaiser, Petroleum Refining: Technology and Economics, Fifth Edition 5th Edition, CRC press, 2007.									
CEE374	Catalysts and Catalytic Processes								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
This course starts with basics of catalysis and goes deeper into various aspects of catalytic preparation and characterization techniques. The course gives an introduction into catalysis and its relation to sustainable chemistry and focus on heterogeneous and homogeneous catalysis. Discusses what catalysis is and why catalytic processes are favourable over stoichiometric reactions. The basic concepts of catalysis are introduced based on examples from heterogeneous and homogeneous catalytic reactions.									
References: Fogler, H.S., "Elements of Chemical Reaction Engineering", 4th Ed., Prentice Hall, Englewood Cliffs, New Jersey, 2006.									

CEE475	Biochemical Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---

Biological processes engineering - The final treatment for biological products – removal of microbial cell and other solid materials – Disintegration of cells- Methods of extraction and concentration – purification re-solidity and drying of biological mixtures – Thermodynamics characteristics of biological processes – mass transfer phenomena and design of biological reactors -Physical properties of biological reaction- biomass as source of protein organic and amino acids – the production and purification of enzymes.
References: Michael L. Shuler and Fikret Kargi Bioprocess Engineering Basic Concepts 2ed Ed. Prentice Hall PTR. 2002. ISBN 0-13-081908-5.

CEE476	Natural Gas Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
This course is designed to cover the Properties of natural gases, hydrate formation. Estimation of gas reserves. Gas well testing. Estimation of gas deliverability. Gas flow measurement. Natural gas deliverability. Natural gas transmission, design of gathering systems. Field treating and processing of natural gas.									
References: W.C. Lyons ، G.J. Plisga ، ''Standard HandBook of Petroleum& Natural Gas Engineering''. Elsevier ، Second Edition ، (2005)									

CEE477	Design of Heat Exchanger								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	CEE477
This course cover an description and applications of different heat exchangers in process industries. Design of double pipe heat exchanger (including extended surfaces). Detailed design procedures for shell and tube heat exchanger for single phase flow. Detailed design procedures for air coolers. Selection criteria for heat exchangers. Descriptive discussion of condensers, evaporators and reboilers, novel heat exchangers and other types of heat exchangers.									
References: Kuppan Thulukkanam "Heat Exchanger Design Handbook", Dekker Mechanical Engineering, 2nd Edn Print ISBN-10: 1439842124									
CEE478	Polymer Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	--	---
This course gives an overview of engineering analysis and design techniques for synthetic polymers. Enhanced the materials properties such as chemical, electrical, physical, and mechanical. Emphasis is placed on how the various synthetic methods are used to control structural features such as molecular weight, branching, crosslinking, and crystallinity.									
References: R.J. Young & P.A. Lovell. Introduction to Polymers, 3rd Ed. CRC Press, 2011.									