Disclaimer

The Catalog is an official Khalifa University document describing academic programs, course offerings, faculty listings, policies, procedures, regulations and requirements of the University. Every effort has been made to ensure the accuracy of the information presented in this catalog. However, no responsibility is assumed for editorial, clerical or printing errors, or errors occasioned by mistakes. The University reserves the right to make changes without prior notice to the information contained in this publication, including the alteration of various fees, schedules, conditions of admission and credit requirements, and the revision or cancellation of particular courses or programs.

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PRESIDENT'S MESSAGE

Welcome to Khalifa University of Science, Technology and Research, to start on one of the most important and beneficial times of your life - your university education. In tomorrow's world, high quality education in engineering and science will be at a premium to address many pressing societal concerns, relating to energy, environment, healthcare, security, communications, transportation, civil infrastructure, and many others.

The co-educational and multicultural community of scholars we are assembling at Khalifa University will prepare you to face these challenges, and to enter society prepared to make your unique contribution to the solutions demanded by them.In addition to a high quality grounding in technical fundamentals, technological leaders find that they need a variety of other attributes to succeed in the world, including the ability to communicate, the ability to work in teams, competence in carrying out technological work within economic and societal constraints, a sense of professional and personal ethics, managerial and business acumen, and the interest and capacity to serve others. We are dedicated to helping you develop and refine these skills.

Khalifa University is a dynamic institution that has a proven track record of providing high quality education and practical experience. The University strives to create a learning culture that exemplifies excellence in teaching and scholarship that emphasizes faculty-student interaction, that promotes lifelong learning, and that prepares individuals for leadership and service in the global society. A university has the responsibility to help each student develop as a complete and well-rounded person, and to aid him or her in maximizing potential and finding a career to pursue with passion and purpose. We are here to help you in this process.

We offer a diverse portfolio of degree programs that are designed to meet the criteria set by the appropriate national and international accreditation bodies. The faculty and staff are highly qualified, experienced, and dedicated professionals, who are always willing to impart their knowledge and experience to their students. The University campuses in Abu Dhabi and Sharjah have first class facilities, both inside and outside the classroom, which will make your learning experience productive and enjoyable.

This guide is designed to give you information and advice to make your academic planning easier. Decisions about what major to study, specializations, and course selection require careful consideration. Whatever study program you wish to pursue, this guide will help you plan your degree from your first year through to your final year.

If you need more information or advice, please take advantage of the experience and professional expertise of our faculty and administrative staff. Your academic advisor will be happy to give you the appropriate advice. In my seventh year of leading Khalifa University, I look forward to meeting you on our campuses in Abu Dhabi and Sharjah, and to sharing the great adventure of university life with you and the rest of our community. I believe you'll find KUSTAR to be an exciting, stimulating and supportive environment in which to shape your future.

Dr. Tod A. Laursen
President, Khalifa University

ACADEMIC CALENDAR 2016-2017

	SUN	MON	TUE	WED	THU	FRI	SAT	
AUG	14 Faculty Reporting	15	16 New Std Orientation	17	18	19	20	
	21 Classes Begin - Fall	22	23	24	25 End of add/drop period	26	27	1
SEPT	28	29	30	31	1 "I" make Up for Spr 16	2	3	2
	4	5	6	7	8	9	10 Arafat Day*	3
	11 Eid-al-Adha*	12 Eid-al-Adha*	13 Eid-al-Adha*	14	15	16	17	4
	18	19	20	21	22	23	24	5
	25	26	27	28	29	30	1	6
OCT	2 Hijri New Year's Day*	3	4	5	6	7	8	7
	9	10	11	12	13	14	15	8
	16	17	18	19	20	21	22	9
	23	24	25	26	27 Last Day to Drop w/"W"	28	29	10
NOV	30	31	1	2	3	4	5	11
	6	7	8	9	10	11	12	12
	13	14	15	16	17	18	19	13
	20	21	22	23	24	25	26	14
DEC	27	28	29	30 Martyrs' Day	1	2	3 National Day	15
	4	5	6	7	8 Last Day of Classes	9	10 Final exams Begin	16
	11 Prophet's Birthday*	12	13	14	15	16	17 Final Thesis Submission	
	18	19	20 Winter Break	21	22	23	24	
	25	26	27	28	29	30	31	
JAN	1 New Year's Holiday	2	3 Faculty Reporting	4	5 BSc Degree Cutoff	6	7	
	8 Classes begin-Spring	9	10	11	12 End of add/drop Period	13	14	1
	15	16	17	18	19 "I" Make-up for Fall 16	20	21	2
	22	23	24	25	26	27	28	3
FEB	29	30	31	1	2	3	4	4
	5	6	7	8	9	10	11	5
	12	13	14	15	16	17	18	6
	19	20	21	22	23	24	25	7
MAR	26	27	28	1	2	3	4	8
	5	6	7	8	9	10	11	9
	12	13	14	15	16 Last Day to Drop w/"W	17	18	10
	19	20	21	22	23	24	25	11
	26 Spring Break	27	28	29	30	31	1	12
APR	2	3	4	5	6	7	8	13
	9	10	11	12	13	14	15	14
	16	17	18	19	20	21	22	15
	23	24 Israa & Miaraj*	25	26	27 Last Day of Classes	28	29	16
MAY	30 Final Exams begin	1	2	3	4	5	6	
	7	8 Final Thesis Submission	9	10	11	12	13	
	14	15	16	17	18	19	20	
	21 Classes Begin-Summer	22	23 End of add/drop Period	24 BSc Degree Cutoff	25	26	27	1
JUN	28	29	30	31	1	2	3	2
	4	5	6	7	8	9	10	3
	11	12	13	14	15	16	17	4
	18 Last Day to Drop w/"W"	19	20	21	22	23	24	5
	25	26 Eid Al Fitr*	27 Eid Al Fitr*	28 Eid Al Fitr*	29	30	1	6
JUL	2	3	4	5	6 Last Day of Classes	7	8	7
	9 Final Exams Begin	10	11	12	13	14	15	

*** Islamic holidays are subject to change**

THE UNIVERSITY

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3.1 | **History of** Khalifa University

Khalifa University of Science, Technology and Research (KUSTAR) was inaugurated on the 13th February 2007 by the President of the UAE, His Highness Sheikh Khalifa bin Zayed Al Nahyan. KUSTAR is an Abu Dhabi Government initiative and is owned solely by the Emirate of Abu Dhabi.

The University opened its Abu Dhabi campus in October 2008 to add to the campus in Sharjah (formerly Etisalat University College, EUC). A large extension to the Abu Dhabi campus is currently being developed. The Sharjah branch campus has a very proud history that stretches back (as EUC) to 1989 and on the 11th February 2008 it was merged with Khalifa University of Science, Technology and Research. KUSTAR now offers a wide range of programs that are designed to be flexible, competitive, and intellectually stimulating and support the Abu Dhabi Economic Vision 2030.

3.2 | **Board of** Trustees

Chairman

- **His Highness Sheikh Hamed Bin Zayed Al Nahyan,** Abu Dhabi Crown Prince's Court (CPC)

Members

- **H.E. Eng. Hussain I. Al Hammadi,** Minister of Education, UAE
- **H.E. Dr. Mugheer Al Khaili,** Chairman, Health Authority of Abu Dhabi
- **H.E. Ali Rashid Qanas Al Ketbi,** Chairman, Tawteen
- **H.E. Mohammed Hassan Omran,** Chancellor, Higher Colleges of Technology (HCT)
- **H.E. Professor Elias Zerhouni,** President, Global R & D, Sanofi
- **H.E. Sir John O'Reilly,** Visiting Professor, University College London

3.3 | **University** Vision and Mission

Vision

To be a leading international center of higher education and research in technology and science

Mission

Khalifa University of Science, Technology and Research is an independent, non-profit coeducational institution, dedicated to the advancement of learning through teaching and research and to the discovery and application of knowledge. It pursues international recognition as a world class research university, with a strong tradition of inter-disciplinary teaching and research and of partnering with leading universities around the world.

The University endeavours to serve the Emirate of Abu Dhabi, UAE society, the region and the world by providing an environment of creative enquiry within which critical thinking, human values, technical competence and practical and social skills, business acumen and a capability for lifetime learning are cultivated and sustained. It sets itself high standards in providing a caring, rewarding and enriching environment for all of its students and staff. It ensures that its graduates, on entering the workplace, form a superlative cadre of engineers, technologists and scientists, capable of making major contributions to the current and future sectors of UAE industry and society as leaders and innovators.

The University insists on the highest world class standards of academic excellence in all that it does. It complements other universities in the region by providing, in its chosen areas of activity, the best teaching and research available in the region. It strives to meet demands for expansion while never compromising on quality.

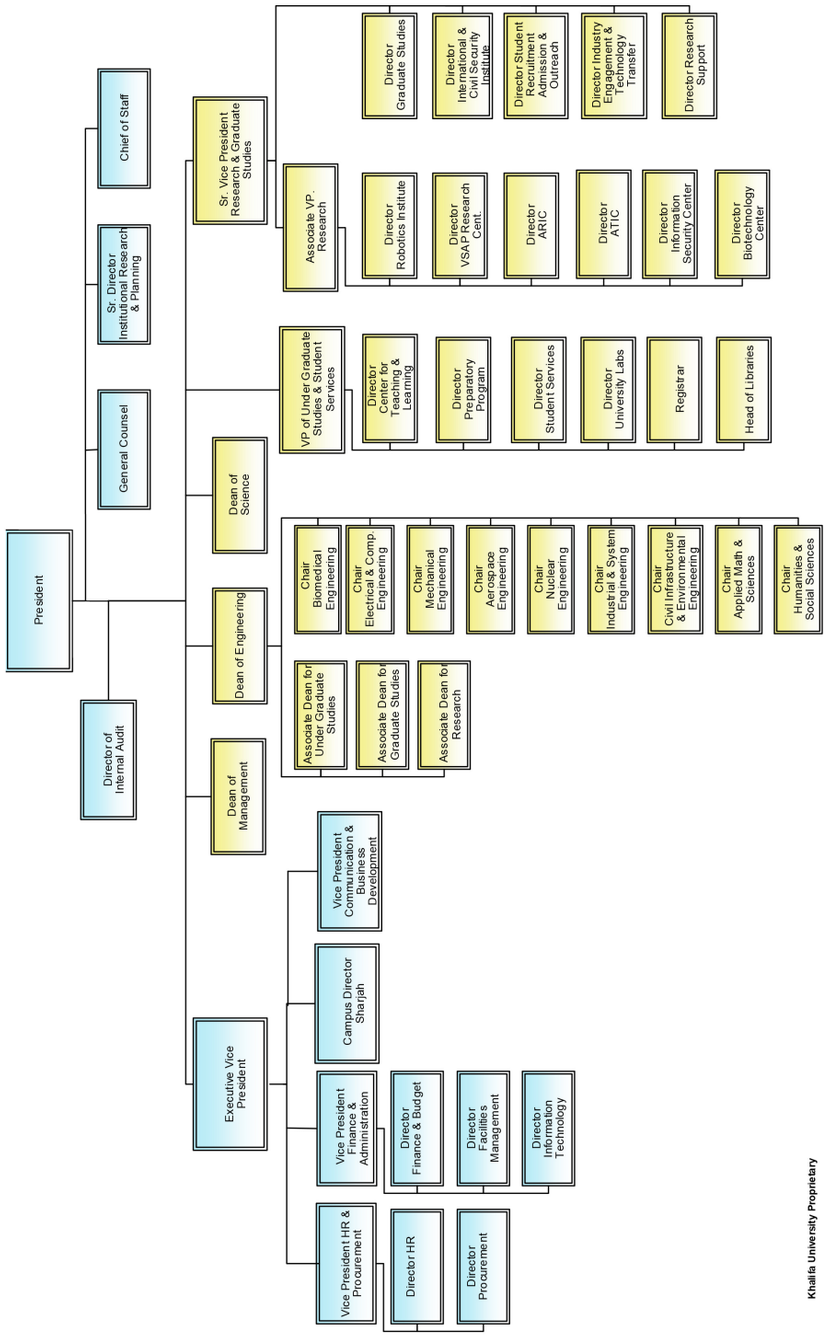
3.4 | **Licensure** and Accreditation

Khalifa University is licensed by the UAE Ministry of Higher Education and Scientific Research (MOHE). All academic programs offered by the University are recognized by MOHE and have been awarded either full or initial accreditation status.

3.5 | **University** Financial Resources

Khalifa University is a not-for-profit institution. All the financial needs of the University are supported by the Government of Abu Dhabi. The University has two purpose built campuses; one in Abu Dhabi, where the central administration for the University is located, and the second one in Sharjah.

ORGANIZATION CHART



KHALIFA UNIVERSITY

ADMISSIONS REQUIREMENTS AND FEES

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Khalifa University admits female and male students from the UAE and beyond. The admissions rules and requirements stated in this section are the basis on which a prospective student's application is assessed. Details of the admissions requirements, placement tests, recognized secondary school certificates, and the process for transfer students are set out below.

4.1 | **General** Admissions Requirements

Admission to Khalifa University is competitive. Students are admitted to the University's undergraduate programs solely on the basis of an assessment of their ability to successfully pursue University level work as evidenced by their academic record. Students seeking Admissions to the University must meet the following minimum criteria:

- Maximum age of 20 years.
- UAE Secondary School Certificate (SSC) in Science with a minimum overall achievement of 80% unless the applicant is from one of the following systems.

SCHOOL SYSTEM	KU ADMISSION CRITERIA
Advanced Science Placement from ATHS (ASP)	Minimum overall achievement of 75%
ATHS Engineering science cluster: › ESG: Engineering Science General › ESE: Engineering Science Energy	Minimum overall achievement of 75%
ATHS following clusters › AEM: Applied Engineering Mechanical › AEE: Applied Engineering Electrical › ICT: Information and Communication Technology › HST: Health Science and Technology	Minimum overall achievement of 80%
STS* (Secondary Technical School) *Conditions Apply	Minimum overall achievement of 90%
The International School of Choueifat	Minimum overall achievement of 75%

Full Admission

In addition to the minimum criteria mentioned above, to be considered for full-admission applicants must satisfy the following requirements:

- Proof of English language proficiency which may take one of the following forms :
  - A TOEFL minimum score of 79 on the Internet Based Test (IBT).
  - An IELTS minimum score of 6.0 (out of 9).
  - A composite IELTS minimum score of 6.0 (out of 9) may also be considered for admission as defined below
    - a) TOEFL and IELTS scores are valid for two calendar years only and must be sent directly by the institution to Khalifa University.
    - b) Composite IELTS Score :
      A student may use multiple IELTS test scores from the most recent six months to produce a "composite" IELTS score of 6.0 to enter Khalifa University's undergraduate program. Composite means that they can take their highest scores from each of the four bands tested (reading, writing, speaking and listening) from any of the tests they have taken in order to meet the 6.0 IELTS requirement in English. There may be no score lower than 5.0 in any of the four areas (bands).

- Pass a placement test in Mathematics (Math 1-Basic Algebra and Math 2-pre-Calculus) and physics.
- Pass a personal interview conducted in English.

Conditional Admission

Candidates who do not meet the requirements for full admission as Freshmen, but are judged to have the potential to reach these standards may be offered conditional admission. Conditionally admitted students participate in the University's Preparatory Program.

The Preparatory Program is an intensive full-time program of developmental study in academic and technical English, Mathematics, Physics, Chemistry, and Information Technology required for success in a KUSTAR degree program. Students who successfully complete the program are offered full admission into the degree programs.

Students who have the required proof of English proficiency for full admission but are asked to take preparatory technical courses may be approved to take a limited number of credit courses that will count toward the degree (a maximum of 15 credits). Students who are not able to achieve the standard for successful completion of the Preparatory Program will have their conditional admission withdrawn and they will be asked to leave the University.

4.2 | **Entry** Assessment

Students who do not have proof of English proficiency for full admission are required to take a University administered test of English. In addition, students in all engineering programs must sit for required placement tests in mathematics (Basic Algebra and Pre-Calculus) and physics.

In addition, all students must participate in a personal interview conducted in English by a KUSTAR Admission Committee. Students will be assessed on: a minimum standard of ability to communicate in English, their familiarity with the relevant profession, their commitment to pursue a professional degree program, their reasons for wanting to attend Khalifa University, and their potential for assuming a leadership role in the UAE evolving knowledge-based economy.

4.3 | **Recognized Secondary** School Certificates

Secondary school certificates are awarded either by ministries of education or by private schools and institutions. Khalifa University **only** recognizes UAE Secondary School Certificates or their equivalent, as approved by the UAE Ministry of Education. It is the responsibility of all applicants to have their school certificates fully attested by the UAE Ministry of Education.

The following is a list of some common secondary school certificates that are considered for admission:

- UAE National General Secondary School Certificate
- UAE Institute of Applied Technology (IAT) Certificate
- UK Board(s) Certificates: IGCSE / GCSE / GCE
- American High School Diploma
- International Baccalaureate (IB)
- US and Canadian Advanced Placement (AP)
- Lebanese Baccalaureate
- Indian Board(s) Certificates: Senior Secondary School Certificate
- Pakistani Board(s) Certificates: Higher Secondary School Certificate

The Undergraduate Admission Criteria for students holding an American Diploma, UK Board Certificates or the International Baccalaureate include the following minimum requirements :

American system

- Complete 12 years
- Minimum GPA 3.0 (or equivalent) on scale of 4
- Mathematics in 3 of last 3 years, Physics in 2 of last 3 years, and one additional science in 1 of last 3 years.
- At least 1 science in last year.

British System

- Total of 8 courses (5 O level + 3 AS/A levels) including Mathematics, Physics and one additional science.
- Mathematics at AS level or higher.
- Minimum grade of C in all courses.

International Baccalaureate - IB

- IB diploma with minimum score of 4 (out of 7) in all courses.
- Courses should include Mathematics, Physics, and one additional science, with Mathematics being at a higher level.

Advanced Standing Credit

Khalifa University may award advanced standing credit for certain academic work completed prior to enrollment at the University. This includes sufficiently high scores on some national/international secondary school examinations such as the College Board Advanced Placement (AP), International Baccalaureate (IB), and Advance "A" Level GCE (General Certificate of Education). This may make it possible for a student to complete the Bachelor's degree in less than the normal duration or take other courses.

Advanced Standing Credit may only be granted after the student has been fully admitted as a freshman to Khalifa University. All students who would like to be considered for advanced standing credit must complete the Advanced Standing Credit Evaluation form at the Registration Office and provide either the original score certificate or an official copy from the appropriate examining agency. Each student will be evaluated on a case-by-case basis. All students must submit their request for advanced standing credit evaluations within the first semester of their freshman year at Khalifa University. Credits earned through "Advanced Standing" are considered "transfer credits" for degree requirement purposes.

College Board Advanced Placement (AP)

Khalifa University grants credit for a score of 4 or 5 on certain College Board Advanced Placement (AP) exams. The University does not grant credit for secondary school courses teaching AP curricula, or partial credit for lower scores. If the AP exam is taken more than once, the higher score will be counted.

Details of credit for various exams appear below

AP EXAM	SCORE	RECEIVE CREDIT FOR
Math: Calculus AB	4/5	MATH 111
Math Calculus BC with AB sub-score	4/5	MATH 111
Math: Calculus BC	4/5	MATH 111 MATH 112 via credit-by-examination
Physics A or B	Any	No Credit
Physics C Mechanics	4/5	PHYS 121
Physics C Electricity, Magnetism	4/5	PHYS 122
Chemistry	4/5	CHEM 115
Psychology	4/5	HUMA 140
Computer Science A	4/5	ENGR 112

International Baccalaureate

Khalifa University grants credit for a score of 5 or higher on certain Higher Level (HL) International Baccalaureate (IB) exams. The University does not grant credit for secondary school courses teaching IB curricula, or partial credit for lower scores. If the IB exam is taken more than once, the higher score will be counted.

Details of credit for various exams appear below

HL EXAM	SCORE	RECEIVE CREDIT FOR
Mathematics	5/6/7	MATH 111, MATH 112 via credit-by-examination
Physics with Magnetism	5/6/7	PHYS 121 via credit by examinations PHYS 122 via credit by examinations
Chemistry	5/6/7	CHEM 115
Psychology	5/6/7	HUMA 140
Computer Science	5/6/7	ENGR 112

Advance "A" Level GCE (General Certificate of Education)

Khalifa University grants credit for a grade of B or higher on certain A-level exams. The University does not grant partial credit for lower grades. If the A-level exam is taken more than once, the higher grade will be counted.

Details of credit for various exams appear below

A-LEVEL EXAM	GRADE	RECEIVE CREDIT FOR
Mathematics	B/A	MATH 111, MATH 112 via credit-by-examination
Physics	B/A	PHYS 121 via credit by examinations PHYS 122 via credit by examinations
Chemistry	B/A	CHEM 115
Psychology	B/A	HUMA 140
Sociology	B/A	HUMA 141
Computer Science	B/A	ENGR 112

4.4 | **Application** Documentation Required

Documents required for UAE nationals admissions:

1. A completed NAPO online application form (priority will be given to those who have KU as their first choice).
2. When the candidates are invited to sit for the admission tests, they must provide the following documents:
   - Copy of High School certificate. Private Schools Students have to submit copies of grade 10 and 11 certificates.
   - British System Students have to submit certificates of their all O level, AS and A levels if any. In case the final certificates are not issued yet, a letter of predicted grades from school is required.
3. Copy of TOEFL IBT or Academic IELTS if any.

   Documents required for non-UAE national admissions:

   a) A completed KU online application form
   b) A Copy of High School certificate.
      - Private Schools Students have to submit copies of grade 10 and 11 certificates
      - British System Students have to submit certificates of their all O level, AS and A levels if any. In case the final certificates are not issued yet, a letter of predicted grades from school is required.
   c) Copy of TOEFL IBT or Academic IELTS if any.
   d) Good Conduct Certificate
   e) Valid passport (2 copies) with visa permit for UAE residents
   f) Passport size photograph (5 photos)
   g) Copy of Emirates ID card

Important notes :

- Only copies on A4 paper are to be submitted while original documents maybe requested for verification.
- Provide school's grading scale equivalency where required.
- All foreign and private school certificates must be equated and attested by the Ministry of Education in UAE.
- Application with any missing documents will not be accepted.
- All accepted candidates must provide original documents at the time of admission.

4.5 | **Selection** Procedure

The Khalifa University Admissions Committee recommends academically able applicants to the University management who make the final admissions decision. Successful applicants are notified of their admission and asked to confirm their intent to enroll.

4.6 | **Transfer** Students

A student who has completed twelve or more credits at an accredited or recognized institution following graduation from high school may be considered for admission as a transfer student. Admission as a transfer student is highly competitive and is based on the number of students that can be accommodated in a particular program or level of study. The decision to admit a transfer student is based on the student's record of achievement in both secondary and university studies.

The following rules apply :

- Only students transferring from a federal or licensed institution in the UAE or a recognized foreign institution of higher learning (as identified by the UAE Ministry of Higher Education and Scientific Research) are eligible for admission.
- Transfer applicants must meet the English language proficiency requirements in effect for the term in which they intend to enroll.
- Official transcripts must be submitted from all previous institutions attended. The applicant must have a minimum cumulative GPA of 2.0 for all courses completed at the institution from which he/she is transferring.

If a transfer student is admitted, the student may request to transfer courses and credits (not grades) from the student's previous institution to Khalifa University. This request and all supporting documents must be submitted at least one week before the start date of the first semester of enrollment at Khalifa University. A decision to accept a courses in transfer will be provided before the end of the add/drop period of that semester. The decision to accept a course in transfer is discretionary and will be based on two factors: a review of the content and level of the course under consideration (as described below) and an assessment of a student's overall academic performance at - the student's previous institution.

Current Students

Currently enrolled Khalifa University students may request pre-approval to take course(s) for credit at another federal or licensed institution in the UAE or a recognized foreign institution of higher learning (as identified by the UAE Ministry of Higher Education and Scientific Research). This request and all supporting documents must be submitted at least one month prior to the student taking the course(s) at the other institution. A decision will be provided no later than two week from receiving the request. The decision to approve a course is discretionary and will be based on two factors: a review of the content and level of the course under consideration (as described below) and an assessment of the student's overall academic performance at Khalifa University. Taking a course for credit at another institution may not be used to avoid the University's progression rules or the consequences of poor performance in other Khalifa University courses. Once the student completes the approved course(s) at the other institution then he/she should apply for credit transfer evaluation as described below.

Credit Transfer Evaluation

Transfer evaluations are done on a course by course basis. Students who request a transfer course evaluation must provide information about the course from the official catalog, including course descriptions and course syllabi. In order to consider a course for transfer, the student must have earned a grade of C (2.0) or better.

Any decision to approve a course transfer will include an assessment of the student's overall academic performance at Khalifa University. High marks in transfer coursework should be matched by high performance - at the student's previous institution (for transfer students) or at Khalifa University (for currently enrolled students). Transfer courses may not be used to avoid the University's progression rules or the consequences of poor performance in other Khalifa University courses. For example, a student who fails a Khalifa University course may not complete the course by taking it in transfer at another university.

- Courses are evaluated on the basis of their content and level. In order for a course to transfer to Khalifa University, it must be equivalent to an existing Khalifa University course in terms of content and level of difficulty. These evaluations are conducted by knowledgeable faculty whose decisions are final.
- The maximum number of approved transfer credits allowed must be less than 50% of the total credits required by the student's degree program at Khalifa University.
- Only credits transfer, not grades. Credits accepted in transfer are not used in calculating a student's grade point average at Khalifa University. Credit will not be granted twice for substantially the same course taken at two different institutions.
- Transfer credits will not be given for work experience, vocational or training courses or coursework that is considered pre-collegiate.
- The above criteria also apply to transfer credit evaluations involving articulation agreements between Khalifa University and other institutions of higher education.
- Transfer students must also meet all graduation requirements as specified in the University Degree Requirements (Section 5.3) and Graduation Residence Requirements (Section 5.17) of this Catalog.

4.7 | **Selection** Procedure

Application

Prospective students can and obtain information about the University by visiting the Website: http://www.kustar.ac.ae and apply by completing a NAPO online application form (for UAE Nationals).

The academic year at Khalifa University is made up of two semesters, (Fall and Spring) and a Summer session. In general, the Fall Semester runs from September through early January; the Spring Semester from February through early June; and the Summer session in June and July.

The majority of the students enter in Fall. The availability of admission to Khalifa University in Spring is limited. Consult the Website or the Office of Admission to confirm which programs will accept applications for Spring.

The Office of Admission handles admissions to all the University colleges and the study programs they offer.

Application Form for International Students

Khalifa University on-line application form is available on the Web at http://www.kustar.ac.ae

On-line application can be made to any program at Khalifa University. The application can be used by International applicants, as well as special, visiting or exchange students.

All admission decisions by the University are taken in good faith on the basis of the statements on the application form. If the University discovers that the applicant has made a false statement or has omitted significant information on the application form, it may withdraw its offer of admission or terminate the applicant's registration.

Application Deadlines

- Applications must be submitted via the Web, or postmarked, on or before the date listed.
- Supporting documents should be sent as soon as they are available.

Deferred Admissions

Admission is valid only for the academic semester specified in the admission letter. If an applicant is given admission and for some reason does not register but intends to join the University in the following semester, then he/she should submit a written request to the Admission Office not later than one month before the beginning of the semester. Admission consideration for the following semester will depend on availability of places.

4.8 | **Scholarships**, Incentives and fees

Details of student scholarships and incentives at Khalifa University of Science, Technology and Research are outlined below. The University reserves the right to change its fees, scholarships and incentives at any time.

Full scholarships covering all direct academic costs (tuition, books, lab equipment and supplies, etc.) are provided to all enrolled UAE-national students and some highly-qualified non-UAE nationals. To retain their full scholarship, non-national students must be registered full time and maintain a Cumulative Grade Point Average (CGPA) of 3.0.

Non-national students admitted prior to Fall 2012 who do not maintain a CGPA of 3.0 in a semester will be charged 20% of the fees for the subsequent semester (currently AED 10,000) until they raise their CGPA to 3.0.

Beginning with students admitted for Fall 2012, highly qualified non-UAE nationals will be offered full University scholarships. These scholarships are renewable for as long as the recipient maintains a minimum 3.0 cumulative grade point average each semester. If a recipient's grade point average falls below 3.0, the student's scholarship will be reduced as follows:

2.99 – 2.50	The scholarship will be reduced to 60% of the tuition fee per semester until the student's grade point average increases to 3.0 and the full scholarship is restored.
2.49 – 1.00	The scholarship will be reduced to 20% of the tuition fee per semester until the student's grade point average increases to either 2.5 or 3.0, with the corresponding increase in the value of the scholarship.

Partial scholarships : Additional qualified non-UAE nationals may be considered for a partial scholarship equal to 50% of the tuition fee. These partial scholarships are renewable for as long as the recipient maintains a minimum 3.0 cumulative grade point average each semester. If a recipient's grade point average falls below 3.0, the student's scholarship will be reduced as follows:

2.99 – 2.50	The scholarship will be reduced to 30% of the tuition fee per semester until the student's grade point average increases to 3.0 and the 50% scholarship is restored.
2.49 – 1.00	The scholarship is suspended and the student must pay the full tuition fee per semester until the student's grade point average increases to either 2.5 or 3.0 with the corresponding increase in the value of the scholarship.

Monthly incentive payments are provided to eligible students based on their Cumulative Grade Point Average (CGPA). UAE national students are awarded a monthly incentive ranging from AED2000-8000. Presently, a minimum CGPA of 2.0 is required to receive an incentive. Non-national students may receive an incentive if they have a minimum CPGA of 3.8 and are among the top twenty of all undergraduate students in the University (based on CGPA).

Fees

The undergraduate tuition fee is AED 3,333 per credit. On average, students register for 15-16 credits per semester. Additional fees may be charged for non-academic costs such as accommodation, meals, transportation, personal computer repairs, etc.

DEGREE REQUIREMENTS, REGISTRATION, AND ACADEMIC RULES AND REGULATIONS

05

5.1 | **Degree** Programs Offered

Khalifa University offers curricula, through its College of Engineering, leading to the following undergraduate degrees:

College of Engineering

- Bachelor of Science in Aerospace Engineering
- Bachelor of Science in Applied Mathematics and Statistics
- Bachelor of Science in Applied Mathematics and Statistics – Financial Mathematics
- Bachelor of Science in Applied Mathematics and Statistics – Mathematical Biology
- Bachelor of Science in Biomedical Engineering
- Bachelor of Science in Chemical Engineering
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Communication Engineering
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Engineering – Software Systems
- Bachelor of Science in Electrical and Electronic Engineering
- Bachelor of Science in Electrical and Electronic Engineering – Power Systems
- Bachelor of Science in Industrial and Systems Engineering
- Bachelor of Science in Mechanical Engineering

The requirements for each degree are listed in this Catalog under the particular department within the college responsible for the program. Students should select a degree program, or indicate their preferences, with their application for admission. Enrolled students receive academic advisement from the appropriate department.

All Khalifa University undergraduate degree programs consist of general education requirements and a major field of study. Additional options, such as academic minors, double majors and concentrations may be available to academically able students.

5.2 | **Preparatory** Program

As English is the medium of instruction in all Khalifa University degree programs, students must have a working knowledge of academic and scientific English. In addition, students must be able to use mathematics to solve abstract problems and describe observable phenomena, and possess necessary computing skills for the study of professional engineering. Students who lack these skills but show promise of success in Khalifa's professional engineering degree programs may be conditionally admitted to the Preparatory Program.

The Preparatory Program consists of a full-time program of intensive study in English, mathematics, physics, chemistry, computer technology, and necessary study skills. Based on the results of placement testing, students are enrolled in coursework appropriate to the level of their academic achievement. Students are regularly assessed to determine if they meet program requirements for continued study in the Preparatory Program or for full admission to the degree program.

Based on an assessment of a student's overall achievement in the Preparatory Program, a student with required English proficiency may be allowed to take appropriate degree courses to a limit of 15 credits.
To be fully admitted to the degree program, a Preparatory student must achieve a minimum composite score of 6.0 on the IELTS examination (or equivalent IBT TOEFL score of 79) and demonstrate sufficient progress in mathematics, physics, chemistry and computing.

5.3 | **University** Degree Requirements

A student is required to adhere to the graduation requirements stated in the Catalog in effect for the year in which the student was admitted to a degree program, or for the year in which the student declared their academic major, or in the Catalog that was effective for the academic year when the student graduates. Degree and major requirements change from time to time and there are established procedures for making such changes that protect the University's integrity and the individual student's welfare. In case of major changes in course offerings, the Dean determines the equivalent graduation requirements to be applied. Khalifa University will confer the bachelor's degree when the following requirements have been met:

- Successful completion of the University General Education Requirements described in this Catalog.
- Satisfactory completion of the requirements of the chosen College and degree program as described in the appropriate sections of this catalog.
- A minimum cumulative grade point average (CGPA) of 2.00.
- Completion of the last two (2) years in residence at the University. Transfer and exchange students must also meet the additional conditions specified in the Graduation Residence Requirements section of this Catalog.
- Students completing programs with major and minor components must satisfy the requirements specified by the College/Department offering the major/minor.
- Students registered for a double major must satisfy the requirements of each major as specified by the College/Department offering the major.
- Candidates for degrees must apply on-line to graduate during the first week of classes for the semester in which the student is expected to graduate. The Registration Office initiates the process for graduation only after the application has been submitted by the student. Students must complete all degree requirements by the end of the semester for which they apply to graduate. If a student fails to meet all degree requirements, he/she must reapply to graduate later.

Total Degree Credits

To receive a bachelor's degree from Khalifa University, a student must complete a minimum of 140 semester credit hours. Students should consult with their college or department advisor for information on specific credit requirements. Consultation with the academic advisor is essential, as it will also enable the student to complete the required degree credits within four years.

Graduation Residence Requirements

Candidates for an undergraduate degree program must comply with the following residence requirements:

- Unless otherwise approved by the Dean of the student's college, students must complete their last two academic years at Khalifa University;
- Students registered on a University recognized semester exchange program must complete their final academic year in residence at Khalifa University;
- Transfer students must complete more than 50% of the intended degree program credit hours in residence at Khalifa University. These credits must include a minimum of 36 credit hours from the intended degree program courses at the 300-level or above.

Community Service

Students admitted in Fall 2014 and thereafter, are required to complete 20 hours of community service per year to a maximum total of 80 hours during the duration of their degree program. No credits are awarded for community service but completion of the requirement is noted on the student's transcript.

Enrollment at Other Universities While a Khalifa University Student

All enrolled students are expected to focus exclusively on their courses and degree program at Khalifa University. As all students are on scholarship, the objective of their study is to complete the degree they have chosen and to attain the grade point average required by their scholarship. Except as noted below, students are not permitted to pursue courses or degrees offered at another college or university even if it is at the student's own expense and during the student's own time.

Students who will be away from the campus in the summer and wish to take coursework at another college or university must have prior approval from the Dean of their college. Pre-approved coursework, taken at colleges and universities that are accredited or recognized by the UAE Ministry of Higher Education and Scientific Research, equivalent to courses offered at Khalifa University may be accepted in transfer. Students who apply for permission to take a course at another university must be in good academic standing (not on probation), not have transferred more than 50% of the total number of credits required for the degree, and not be in senior standing. Students who have failed a Khalifa University course may not complete the course by taking it in transfer at another university.

Students may earn credit while enrolled in officially sponsored exchange or study abroad programs. All students must complete their final academic year in residence at Khalifa University.

5.4 | **General** Education Requirements

Purpose

The purpose of the General Education Requirements (GER) at Khalifa University is:

- to provide all undergraduate students, regardless of their majors, with the foundation they will need to be informed members of society;
- to help students develop intellectual skills, practical skills, and emotional and aesthetic sensitivities;
- to prepare them to think critically, to feel, and to act thoughtfully and competently in a complex and diverse world;

- to help students understand the values inherent in their culture and to be aware of other cultural traditions, values, and beliefs;
- to enable the students to enjoy a life dedicated to learning and creativity in a continually changing world

Basic University General Education Courses

All students entering Khalifa University as freshmen or undergraduate transfer students must satisfy the General Education Requirements (GER). Students should check with their academic advisors to see if their College has any additional requirements that go beyond the basic GERs, or whether certain programs will require them to undertake specific courses or to follow a particular order.

The following General Education Requirements are required for all students admitted to the starting Fall 2012

English Communication (8 credits)	
ENGL111 English Communication I	(4 credits)
ENGL112 English Communication II	(4 credits)

Math and Science (24 credits)	
MATH 111 Calculus I	(4 credits)
MATH 112 Calculus II	(4 credits)
MATH 211 Differential Equations and Linear Algebra	(4 credits)
CHEM 115 Introduction to General Chemistry for Engineers	(4 credits)
University Physics I	(4 credits)
University Physics II	(4 credits)

Business Studies (6 Credits)	
BUSS 201 Fundamentals of Accounting and Finance	(3 credits)
BUSS 301 Inside Organizations	(3 credits)

Humanities Electives (12 Credits)

A total of 4 courses (3 credits each) in the Humanities and Social Sciences are required. At least one course must be from the area of Islamic Culture and Studies. These courses include: Islamic Culture, Islamic History, Sciences in Islam, Introduction to Islamic Law, and Islam and Modernity. Other courses in this category may be offered. Students should check with the Registration Office for an updated list.

5.5 | Majors, Minors and Double Majors

Academic Majors: Rules and Regulations

General Information

- A major is a structured program of study in an academic or professional discipline which leads to a Bachelor's degree. In order to fulfill the requirements of a major, students are required to select subjects as specified by the department offering the major. A major comprises at least 30% of the total credits required by the Bachelor's degree program.
- Every degree awarded by Khalifa University requires students to complete a major field of study. All majors include a specific number of credits and a particular sequence of courses. Students must meet the minimum course and grade requirements to be awarded their bachelor's degree with a desired major.
- Academic majors and their requirements are published in the University Catalog.
- Students are required to follow the major requirements that are current at the time, the student's choice of major is effective.

Internship

All students are required to complete an internship experience. The Internship is a period of work placement conducted with an appropriately selected organization. This requires a carefully planned work experience that will match the content covered in the student's program of study. Engineering students at Khalifa University must successfully complete 8 continuous weeks of full-time internship placement in order to graduate. Students earn one credit for internship, which is assessed on a pass-fail basis. The Career and Internship Coordinator is responsible for managing the internship program; this includes sourcing appropriate internship opportunities. However, students can submit names and contact information of organizations they would like to intern with.

Complete information about internship requirements can be found in the Internship Handbook.

Declaring a Major/Change of Major

- Students should make their initial choice of major after completing 15 degree credits. However, they must make their final choice of a major before reaching Junior standing (60 credits).
- To initially request a major, a student must file an application with the Registration Office. The application form must be approved by the student's advisor, and the head of the academic department that offers the major.
- To change an existing major, a student must file a new application with the Registration Office. This application must be approved by the student's advisor and by the head of the academic department of both the student's current major and the student's requested major.
- Changes of major are subject to space being available in the sought major.

Concentration

Concentrations are best thought of as a grouping of courses which represent a sub specialization taken within the major field of study. A concentration at Khalifa University leads to a specialized award or degree and will be specified on the diploma and the student's academic record (transcript).

Track

A track is a narrow area within the major field of study which the student may choose to follow but does not lead to a specialized award or degree and is not listed on the diploma. Tracks are normally used to help students focus their selection of advanced elective courses within their selected major. The track will only be noted on the student transcript once the requirements are completed and the bachelor's degree is awarded.

Academic Minors

Academic minors afford students the opportunity to pursue a limited but structured field of study outside their major. The minor may be a truncated version of a major or a distinctive subset of a discipline. Minors are not available in every field of study. In general, a minor requires no fewer than 15 and no more than 21 credits, with at least 12 credits in upper level coursework (300-400 level). No more than 6 credits or two courses may be used to satisfy the student's minor and major fields of study. All courses taken to fulfill minor requirements must be passed with a minimum grade of C. Students must follow requirements for the minor that were in effect when the student's application to pursue a minor was approved.

- Minors are optional. A minor must be created by an academic department and approved by University management.
- An undergraduate student may not complete a major and a minor in the same program.
- Students must apply to pursue a minor before reaching senior standing (90 credits). An application to pursue a minor must be approved by the student's advisor, by the head of the student's major department and the head of the department which offers the minor.
- A student may have a major in one College and a minor in another. In this case the student must complete the general education requirements of the College of his/her major. The student is not required to meet the general education requirements of the College of his/her minor.
- A student earns a minor only when concurrently completing all major and degree requirements. A student may not be enrolled solely to complete requirements for a minor.
- When students apply to graduate, their final degree audit will determine if they have satisfied the requirements for the minor. If they have failed to do so, they will graduate without the minor.

Double Major

A student who wishes to complete a second major concurrently with his or her primary major must obtain advanced written permission from the appropriate department heads and Dean. So as not to delay graduation, students seeking a second major must be academically well qualified and have a minimum cumulative grade point average of 3.0. In addition, students must apply for a second major by the time they reach junior standing or 60 credits.

- A student wishing to graduate with a double major must apply for a second major field of study by the time the student has earned 60 degree credits. A student must also have a cumulative grade point average of 3.0. The student's application must include a proposed study plan for both majors, with no more than 18 credits applied to both majors.
- The student's application for a double major must be approved by the chairs of both departments concerned and the Dean(s) of the college(s).
- Students approved for a double major will have an advisor in each of the two approved major programs.
- To graduate with a double major, the student must meet departmental requirements for each major.

Applying to Graduate

One year prior to their expected graduation date, each student shall run an on-line degree audit and review it with their academic advisor. This audit will confirm all remaining unfulfilled degree requirements and guide student registration for their remaining terms of enrollment. Students are required to submit an on-line application to graduate, prior to the end of the first week of instruction, in their final semester of enrollment. A final graduation audit, conducted after grades are submitted for the student's final semester of study, will determine if the student has satisfied all requirements for the degree including: major, minor, double major or concentration as applicable, cumulative grade point average, and required community service hours.

5.6 | **Variation to** Academic Program

In exceptional circumstances, a student may petition the Department Chair of the major/minor program of study for approval of changes to the prescribed plan of study. Small changes may be approved by the Department Chair. Significant changes require approval of the Department Chair and the College Curriculum Committee.

Students seeking an exception to their official plan of study must submit a signed Variation to Academic Program Form to the Registration Office. When it becomes necessary to request a deviation from the prescribed plan of study, students shall consult their academic advisor prior to submitting the Variation to Academic Program Form to the Registration Office.

In preparing the form, students should be mindful of the following

- The course to be substituted must be in the same area as the required course or in a closely related area.
- Substitution of a course for a previously failed required course is seldom granted.
- A required course that is not scheduled during a given semester is not acceptable for a course substitution.

Any approved course substitutions and associated pre-requisite requirements affected by the approved Variation to Academic Program must be satisfied.

5.7 | **Time Limit** on Duration of Study and Re-admission

All degree requirements must be completed within seven years of admission to Khalifa University as an undergraduate degree student, inclusive of any leave. A student in good academic standing is allowed no more than two consecutive semesters leave. A student who is out of the University, for any reason, for more than two consecutive semesters must submit a new application for re-admission, to the Admissions Office, prior to the semester or summer term for which registration is sought. Students who are re-admitted are required to comply with the Catalog requirements in effect at the time of re-admission.

5.8 | **Academic** Advising and Registration

Academic advising is integral to effective learning and academic progress throughout the student's undergraduate program. Khalifa University is composed of colleges that serve as "academic homes" for each student. The student is assigned to one of the colleges based on his/her intended major/program. Full-time faculty members from the assigned college act as the academic advisor and work with the student from the beginning of his/her academic career.

Academic advisors provide information about selecting courses and areas of specialization and are knowledgeable about regulations and requirements. They also provide resources, guidance, and support to enable students to explore, define, and realize their aspirations throughout their academic careers. Well-advised students acquire the knowledge needed to create and fulfill educational plans, and meet their goals for the future in a timely manner.

Academic Advising Guiding Principles

Both students and advisors have advising responsibilities. Advising is guided by the following principles:

- Effective academic advising can play an integral role in student development.
- Mutual respect and shared responsibility should govern the personal interactions between advisors and students.
- Students and advisors must prepare for, actively participate in, and take appropriate action following advising sessions.
- Advising information provided to students must be accurate, accessible, and timely.
- Academic advising should encourage students to explore many possibilities and broaden their educational experience.

- Academic advising should encourage a positive attitude toward lifelong learning.
- Academic advising should use all available resources and means to provide advising tailored to the individual needs of students.
- Academic advisors should keep records of the advising sessions held with a student.

Guidelines for Graduating in Expected Time

Khalifa University has a strong commitment to ensuring that students graduate with a degree in the expected time. Students are encouraged to follow these guidelines to earn their degrees in the minimum time required.

- Consulting an advisor should be the first priority. Students should confirm with the advisor that their academic preparation is appropriate for the courses they plan to undertake. Transfer students should make sure that they know which credits will be transferable and plan accordingly. Students should seek help in planning course work to meet academic and career goals.
- Students should be certain they understand the requirements of their intended major as well as the options it will provide for future studies and employment.
- Students should be aware of the number of credits the degree program requires, and should make sure they fulfill one quarter of these each year. Credits may be taken in the fall, spring, and summer, but the annual total should equal at least 25 percent of the total credits needed to graduate. In addition, students should recognize that a degree requiring more than 120 credits will be difficult to complete in four years without undertaking substantial loads and/or summer sessions.
- Students should make sure that the courses they select will count toward the fulfillment of the University general education, major, and degree requirements. They should limit elective credits to the number the program allows.
- When students consider changing their major, or do not get admitted to the major program of their choice, they should consult an advisor, explore options, and find out how a change of major might affect their graduation plans.
- Students should make the most of course schedules and the plan of study for their degree program. They should plan to take required courses as soon as possible (as not all courses are offered every semester) and be flexible about course times. If a required course is not available, advisors can help determine an alternative.

Orientation Program

Newly admitted students participate in an orientation program that introduces them to various aspects of the Khalifa University community. During these programs the students plan an academic program, register for classes, learn about University resources and campus life, and meet with Khalifa University students, faculty, staff and new classmates. The orientation sessions are held before the fall semester and the spring semester.

Advising and Registration

In order to register each semester, students are required to meet with their faculty academic advisors to discuss their academic progress and obtain the faculty advisors' approval for course selections. This process ensures that the student is on course to meet the graduation requirements of his or her particular degree program.

Change of Academic Advisor

Students may request a change of an assigned academic advisor when they are unable to resolve communication problems with their current advisor. Students must make an effort to resolve any differences before requesting a change. A request to change advisors should be made to the student's Department Chair.

Faculty Office Hours

Faculty office hours are allocated for student's consultation and advising. Faculty are required to show their office hours on their office doors. Students are encouraged to make use of these times for advising or for consulting with faculty on the courses they are teaching.

Plan of Study

The plan of study for a major or minor outlines the minimum approved courses, internships, projects, and academic requirements that must be completed to be eligible to graduate. Plans of study change over time, consequently students are required to follow the requirements of the approved plan of study that were in effect at the time of their admission to the academic major program or minor.

Students may petition the Department Chair for approval of changes to the prescribed plan of study. Small changes may be approved by the Department Chair. Significant changes require approval of the Department Chair and applicable University standing committee(s). Please refer to the University's policy on Variation to Academic Program for additional information.

5.9 | Registration

Registration Process

The Registration Office is responsible for the management of the registration process by which students enroll in classes. Registration information is provided to students before the registration period begins. New students are automatically registered for required courses. Continuing students register for classes on-line via the web.

Drop and add a course: Students are allowed to drop and/or add courses during the first week of the fall and spring semesters or during the first three days of a summer session. Such changes in course registration are not recorded on the students' transcripts. Students interested in dropping or adding courses should consult with their respective academic advisors.

Through the registration process, students assume academic and financial responsibilities for the classes in which they enroll. They are relieved of these responsibilities only after formally terminating enrollment by dropping or withdrawing from classes in accordance with procedures and deadlines specified in the Academic Calendar each semester.

Course Restrictions, Prerequisites and Co-requisites

Enrollment in some courses may be restricted. For example, a course may be restricted to students with a specific major or require that a student have junior or senior level standing. An instructor's approval may be required in some cases. These are referred to as "course restrictions".

A program of study may also require that courses be taken in a certain order or taken together. A course that is required to be taken before another course is called a "prerequisite". Students are not allowed to register for any course with a prerequisite unless the prerequisite course has been completed with a passing grade.

A "co-requisite" is a course that is designed to be taken together with another course

- A co-requisite course may be satisfied if the student has previously completed it with a passing grade.
- Students may not drop a course if it is a co-requisite of another course in their schedule. In this case both courses would have to be dropped.
- If a student repeats a co-requisite course in which the student earned a grade of C- or lower, the companion course (if passed) does not have to be repeated.

Registration Deadlines

Khalifa University policies determine when students may enroll or adjust their enrollment in classes. The Registration Office has the most up to date information regarding these policies. The registration period and other important dates are published in the Academic Calendar section of this Catalog.

Registration Holds

Students will not be permitted to register if there is a "hold" on their registration record. Holds may be related to academic standing (probation or dismissal), non-academic offense violations (disciplinary), incomplete admission files (missing transcripts), or financial issues. Holds may also be placed on students who are not UAE citizens or residents and have not submitted required immigration documentation. To clear a hold, the student must contact the office that has issued the hold to find out what must be done to fulfill the obligation(s).

Auditing Courses

Subject to availability, admitted degree students may, with the approval of the Department Chair and the permission of the instructor, audit undergraduate courses without credit. The permission of the Department Chair and instructor must be obtained prior to registration, and the student must register as an auditor. Registration priority will be given to matriculated degree-seeking students.

Auditors are required to follow the same registration procedures as persons taking the course for credit. Auditors do not receive grades or credits. Participation in class discussion and written work is permitted at the discretion of the instructor. A fee per credit hour may be charged. The status of Auditor cannot be changed after the course has begun. The University reserves the right to cancel an audit registration if the class size is excessively large.

Limitation of Courses Offered

The University reserves the right to cancel a course even though it is listed in the Catalog or scheduled to be offered. Notification of a cancelled course will be sent to any affected students at their University email address.

5.10 | **Withdrawal from** Courses and From the University

Withdrawal from Courses

Students are permitted to withdraw from courses. However, all students are expected to maintain full-time status by carrying a minimum load of 12 credits per semester. Under exceptional circumstances the Dean of the College may allow a student's credit load to drop below 12 credits. The payment of incentives or scholarships will be suspended for the remainder of any semester during which a student is approved to drop below 12 credits. Non-national students who drop below 12 credits are subject to payment of full tuition for that semester.

- Withdraw from a course with grade of (W) recorded: A student may withdraw from a course by the end of the end of the 10th week of classes in a semester or by the end of the fourth week of classes in a summer session with a grade of W. The grade of W will not affect a student's Grade Point Average (GPA).
- Withdraw from a course with grade of (WP or WF) recorded: A student who withdraws from a course after the 10th week of classes, will be assigned either a grade of WP (withdraw passing) or WF (withdraw failing). The grade of WP or WF will be assigned by the course instructor. The grade of WF is equivalent to an F (0.0 quality points), and is used in the calculation of the GPA.

Withdrawal from the University

Any student voluntarily leaving the University before the close of the term must withdraw officially and complete the withdrawal clearance process. A student initiates the withdrawal procedure and files the completed form at the Registration Office in person or by letter. A withdrawal is effective on the date when the form or letter is received by the Registration Office. A student who withdraws from the University after the first week and before the end of the 10th week of classes will receive the grade of (W) for all courses in progress. Students withdrawing after the 10th week and before the last day of classes will receive WP or WF in each course. Any student who leaves the University before the close of a semester without withdrawing officially will receive a failing grade (F) in each course for which he/she is registered.

5.11 | **Academic** Year

The academic year at Khalifa University consists of two regular semesters and a summer term. The two regular semesters which are referred to as the fall semester and the spring semester, consist of 15 weeks of teaching and final examinations period. The summer term lasts for five to six weeks of teaching. In the summer, a three credit course meets 75 -90 minutes per day, five days per week. Because of the intense nature of summer coursework, students may take no more than two courses or six credits. In exceptional circumstances the Dean may allow a student to register for seven credits.

5.12 | **Credit** System

The unit of measurement of academic work at Khalifa University is the credit hour. It ordinarily represents one lecture hour per week for one semester. A lecture hour has a nominal duration of fifty minutes. A sequence of three laboratory hours per week or two hours of problem solving sessions per week are considered to be the equivalent of one credit hour. Credit hours are also referred to as credits or semester credit hours.

5.13 | **Course Title, Code,** Credit Value and Description

Each course offered at the University has a unique code, a title and a credit value. A list of courses offered may be found in this Catalog. In addition, the Catalog contains a brief description of the course content and any required prerequisites or co-requisites. The course code consists of four letters that reflect its discipline or field of study, followed by a three-digit number that indicates its level. The title of the course gives an indication of its content. The credit value of the course has three numbers; the first one gives the number of lecture hours per week, the second shows the number of laboratory or problem solving hours per week, and the third one gives the overall credit value of the course which will contribute to the particular degree requirements. The example below further explains the course code and value information.

PHYS	**101**	**General Physics I**	**(3 – 3 – 4)**
Letter part of the code	Numerical part of the code	Course title	› Lecture hours per week › Laboratory hours Per week › Overall credit value

5.14 | **Total Degree Credits** and Semester Credit Loads

The total degree credits for engineering programs are 140semester credit hours. Students should consult with their academic advisor for information on specific credit requirements. Consultation with the academic advisor is essential, as it will also enable the student to complete the required degree credits within four years.

The appropriate course load for an undergraduate student is dependent on two factors: scholastic ability, as reflected by the student's academic history, and available study time. Successful academic achievement usually requires about two hours of outside study for each hour spent in class. For example, enrollment in 16 credit hours would require about 32 hours of outside preparation per week.

A credit load of 15-18 credit hours constitutes a normal full semester program for undergraduates. A student must complete at least 15-18 credit hours per semester to finish a bachelor's degree in four academic years.

Enrollment in more than 18 credits in a semester requires advance written approval of the Dean of the student's college. A maximum load for an undergraduate student enrolled in a summer session is six credit hours. Enrollment in more than six credit hours in a single summer session requires advance written approval of the Dean of the student's college.

5.15 | **Full** and Part-Time Status

The status of a student is determined by the number of credits for which he/she is registered at the close of add and drop period. To be considered full-time, a student must register for a minimum of 12 credit hours during each regular semester. A student enrolled for less than 12 credits will be considered a part-time student.

5.16 | **Student** Classification

Undergraduate students admitted to a bachelor's degree program are classified on the basis of earned semester credit hours:

Earned Credit Hours	Classification
0 – 29	Freshman
30 –59	Sophomore
60 – 89	Junior
90 or more	Senior

5.17 | **Graduation** Residence Requirements

Candidates for an undergraduate degree program must comply with the following residence requirements:

- Unless otherwise approved by the Dean of the Student's College, students must complete their last two academic years in residence at Khalifa University. Students registered on KUSTAR recognized semester exchange program must complete their final academic year in residence at Khalifa University.
- Transfer students must complete more than 50% of the intended degree program credit hours in residence at Khalifa University. These credits must include a minimum of 36 credit hours from the intended degree program courses at 300-level or above.

5.18 | **Grading** System

The grading system of Khalifa University is based on letter grades that are assigned according to the grading scheme adopted by the instructor in charge of a particular course. In order to assess the student's academic standing, each letter grade is assigned a grade point on a four-point scale as set out below.

Letter Grade	Classification	Description
A+	4.00	Exceptional
A	4.00	Excellent
A-	3.70	Very Good
B+	3.30	Very Good
B	3.00	Good
B-	2.70	Good
C+	2.30	Satisfactory
C	2.00	Satisfactory
C-	1.70	Less than satisfactory
D+	1.30	Poor
D	1.00	Poor
D-	0.70	Poor
F	0.00	Fail
WF	0.00	Withdrawal Fail

Other letter grades are used at Khalifa University but do not have corresponding grade points, and hence not used in the calculation of the grade point average :

Letter Grade	Description
W	Withdrawn (Between 2nd and 10th Week of Classes)
WP	Withdraw Passing (after the 10th week of classes through the last day of classes)
P	Pass (in a Pass/Fail Course)performance of D- or better
U	Fail (in a Pass/Fail Course)
I	Incomplete
IP	In Progress
AUD	Audit
EX	Exempt; no credit
TR	Transfer; credit counted
N	No Grade Submitted

5.19 | **Grade** Point Average

The grade point average (GPA) is the cumulative numerical average which measures student academic achievement at the University. It is reflective of the credit hours the student has attempted and the grades that the student has earned. Therefore, the GPA is calculated by multiplying the grade value of the letter grade by the number of credit hours of the course. The result is the quality points that the student has achieved in the particular course. The sum of the quality points of the courses taken is divided by the total credit hours completed to obtain the GPA. Grades without a corresponding grade value (W, WP, P, U, I, IP, AUD, EX, TR and N) are not included in the computation of the cumulative grade point average. A student transcript will have a semester GPA (SGPA) and a cumulative GPA (CGPA). The former only reflects the student's performance in a particular semester, while the later reflects performance in all the attempted degree credits since the student's first enrollment at the University. A sample of GPA calculations follows.

Sample GPA Calculation

Fall Semester				
Course	**Credit Hours**	**Grade**	**Grade Value**	**Quality Points**
ENGL 111	4	B	3.00	12.00
MATH 111	4	A	4.00	16.00
PHYS 121	4	B	3.00	12.00
ENGR 111	4	A	4.00	16.00
Semester Total	**16**			**56**
SGPA = 56 / 16 = 3.50				
Spring Semester				
ENGL 112	4	B	3.00	12.00
MATH 112	4	B	3.00	12.00
PHYS 122	4	A	4.00	16.0
ENGR 112	4	C	2.00	8.00
Semester Total	**16**			**48**
SGPA = 48 / 16 = 3.00				
Cumulative Total	**32**			**104**
CGPA = 104 / 32 = 3.25				

At the end of each semester, student grade point averages are used in determining academic actions (probation, dismissal, dean's list etc.) and scholarship decisions (partial tuition payments). Although a student's grade point average may subsequently change due to repeated courses, the academic action or scholarship decision taken at the end of each semester remains unchanged.

5.20 | **Incomplete** Grades

The incomplete grade (I) is an optional grade that can only be assigned when a student has satisfactorily completed a major portion of the work in a course but, for non-academic reasons beyond the student's control and deemed to be acceptable in accordance with the University regulations, was unable to meet the full requirements of the course. An incomplete grade (I) assigned in a course must be removed and the grade change submitted by the end of the second full week of classes in the next regular semester.Failing to remove the grade of I in the allotted time will result in the grade of I being changed to the grade of F.

It is the student's responsibility to meet with the faculty member and request arrangements for the completion of the required course work.

5.21 | **Repetition** of Courses

A student may repeat a course for which he/she received a letter grade of C- or lower. The repetition is subject to the following guidelines:

- Repetition of a course more than once requires the approval of the College Dean. A student who fails a required course more than twice is subject to dismissal for failure to make satisfactory academic progress toward the student's degree. Such dismissal shall be undertaken only after a holistic review of the student's overall performance at the university.
- Degree credit for a course is given only once, but the grade assigned each time the course is taken is permanently recorded on the transcript.
- Only the highest grade earned for a repeated course will be used in calculating the GPA.
- A student is not allowed to repeat more than 10 degree courses throughout his/her undergraduate studies at the University.
- For prerequisite purposes, the highest grade will be used.

5.22 | **Advanced** Standing Credit

Khalifa University may award advanced standing credit for certain academic work completed prior to enrollment at the University. This includes sufficiently high scores on some national/international secondary school examinations such as the College Board Advanced Placement (AP), International Baccalaureate (IB-Higher Level), and Advanced A-Level GCE (General Certificate of Education). Information on score requirements and equivalent course credit is available from the Admission Office or the Registration Office.

Advanced Standing Credit may only be granted after the student has been fully admitted as a freshman to Khalifa University. All students who would like to be considered for advanced standing credit must complete the Advanced Standing Credit Evaluation form at the Admissions Office and provide either the original score certificate or an official copy from the appropriate examining agency. Each student will be evaluated on a case-by-case basis. All students must submit their request for advanced standing credit evaluations within the first semester of their freshman year at Khalifa University. Credits earned through "Advanced Standing" are considered "transfer credits" (non-resident credits) for degree requirement purposes.

5.23 | **Credit by** Examination

A qualified student enrolled at Khalifa University may pass a specially prepared challenge examination and receive credit for a University course without having undertaken the normal course work. Interested students should contact the Chair of the Department in which credit is sought to request administration of an examination. Since it may not be appropriate to award credit based on Advanced Standing for some courses, the decision to offer an examination rests with the Department. If the Chair of the Department authorizes an examination, the student is instructed to complete the Credit by Examination form at the Registration Office. Hours earned through Credit by Examination will be indicated on the transcript, but no grade points will be awarded. Hours attempted will be assigned equal to the hours earned. Failure on such an examination will incur no grade point penalty or hours attempted. Credits earned through "credit by examination" are considered in residence credits for degree requirement purposes.

Credit by Examination is subject to the following conditions

- Credit by Examination testing will normally be offered during the final examinations period.
- Students may attempt Credit by Examination in a given course only once.
- No more than 12 credit hours of Credit by Examination may be included in a major program.
- No more than 6 credit hours of Credit by Examination may be included in a minor program.
- Credit by Examination test scores will be reported with a P or U grade. Neither grade will be included in the calculation of the student's GPA.
- Students requesting Credit by Examination must satisfy all pre-requisites of the course for which they are being examined.

5.24 | **Final Grade** Changes and Appeals

Final course grades, officially reported by the instructor at the end of an academic semester, are recorded by the Registration Office. Official recorded grades can only be changed with the approval of the Department Chair and the Dean. A request to change a grade may be initiated, in writing, by the student or the student's instructor. The student can initiate a grade appeal no later than two weeks from the official release of the grades as specified by the Registration Office.

5.25 | **Lateness and** Attendance Guidelines

Khalifa University is committed to providing high quality education to its students. Attendance at classes is essential to their obtaining that education, and for taking advantage of the resources that the University provides for the intellectual growth and development of its students. For these reasons, students at Khalifa University are required to punctually attend all scheduled lectures, labs, recitation or tutorial sessions, etc., in each course for which they are registered, and are responsible for completing the work from all class sessions. Absences from class may be excused for such reasons as personal illness, family emergency, religious holidays, or participating as an authorized University representative in an approved event. All absences, with or without an excuse, are calculated as part of the total absence allowance of 20%.

Khalifa University guidelines on lateness and attendance are outlined below. The complete policy may be found in the student handbook.

- Attendance is mandatory for every session of every course in which a student is registered.
- Instructors are not obliged to give substitute assignments or examinations to students who miss classes.
- If a student misses 20% of the scheduled sessions in a course for any reason (excused or unexcused), the University may initiate withdrawal of the student from the course. If approved by the Dean of the student's college, the withdrawal is implemented. A grade of W will be entered on the student's record if the withdrawal is initiated before the end of the tenth week of class. If the withdrawal is initiated after the tenth week of classes, a grade of WF will be entered on the student's record and will be calculated in the GPA. Instructors are to keep attendance records and to draw students' attention to attendance requirements noted in each course syllabus.

5.26 | **Language of** Instruction and Examination

English is the official language of Khalifa University. All courses at Khalifa University are taught and examined in English with the exception of non-English content courses such as Arabic language.

5.27 | **Leave of** Absence and Reinstatement

A leave of absence can interrupt a student's studies and delay the completion of degree requirements. Such leaves shall only be granted for good cause.

- Generally, a student must be in good academic standing. A student in good academic standing is allowed no more than two consecutive semesters leave of absence. The student must complete a Leave of Absence form at the Registration Office. The leave of absence must be approved by the Registrar who may grant exceptions in those cases when the student is not in good academic standing or conduct standing.
- A student may apply for a leave of absence once throughout the duration of his/her undergraduate study at the University.
- To resume studies after a leave of absence a student must complete a Reactivation form at the Registration Office.

5.28 | **Evaluation** and Examinations

Evaluation

A university degree certifies that its holder has attained a measurable level of achievement as established by a recognized system of evaluation. Thus, the performance of each student in each course must be evaluated by the instructor or instructors responsible for the course.

Final grades are determined by students' performance in one or more of the following :

- Assigned work, term papers, projects, etc.;
- Class participation;
- Progress tests;
- Laboratory tests and/or laboratory work;
- Mid-term and/or final examinations;
- Level of written expression.

The weight accorded to the various elements is at the discretion of the academic department responsible for the course. At the beginning of a course, the instructor will provide students with the detailed syllabus in writing. The scheme cannot be altered without appropriate notice in writing. To assist students in preparing for their final exams, no tests or significant assessments should be administered during the final week of classes.

Normally, an instructor will submit final grades no later than three days after the scheduled final examination in a course or, where there is no final examination, seven days after the last scheduled class in a course.

Examinations

The University academic calendar lists the first day of each official examination period. University policies and regulations governing the administration of examinations are available from the Registration Office.

A final examination or other form of final assessment shall be given in every course. Exceptions may be made only in accordance with the approved course syllabus.

All final examinations shall be held on the date and at the time listed in the official final examination schedule issued by the Registration Office. Approved alternative assessments shall be due on the date and time listed in the final examination schedule for the course involved.

In extraordinary situations, a student may apply for an excused absence from a semester or final examination if the absence is due to serious illness or other compelling circumstances beyond the student's control. These criteria shall be strictly applied. Students requesting an excused absence must apply in writing to the Registration Office and provide documentary support for their assertion that the absence resulted from one of these causes. Any request for an excused absence from an examination should be made within 72 hours of the exam date.

Students who are excused from a final examination will be required to sit for a make-up examination administered at a time and place set by the Registration Office. The make-up exam shall cover only the material for which the student was originally responsible and be at a comparable level of difficulty with the original examination. A make-up exam shall be scheduled as quickly as possible but shall not interfere with the student's other classes or examinations.

Students who are officially excused from a semester examination shall not be re-examined. Instead, their final examination mark(s) will be attributed to the mid-term exam.

5.29 | **Records** and Transcripts

A permanent academic record for each student enrolled in the University is maintained in the Registration Office. The written consent of the student is officially required to disclose his/her academic record. Exceptions are made for parents, sponsors, and authorized Khalifa University officials and in compliance with a judicial order.

Students may obtain official transcripts of their academic records from the Registration Office. A transcript will only be released with a signed request from the student concerned.

5.30 | **Academic** Honors

Khalifa University encourages excellence in scholarship and gives official recognition to undergraduate students whose work is superior in any given semester.

President's List : The President's List includes all degree-seeking undergraduates who, during the preceding semester, earned a semester grade point average of 3.80 or higher, completed a minimum of 12 credits and are not on academic probation or subject to any disciplinary action. (All grades must be reported.) An eligible student must have no incomplete grades, repeated grades replacing lower grades earned in prior terms, nor any grade below C. The President's List acknowledgement will be posted on the student's transcript.

Dean's List : The Dean's List includes all degree-seeking undergraduates who, during the preceding semester, earned a semester grade point average of 3.50 – 3.79, completed a minimum of 12 credits and are not on academic probation or subject to any disciplinary action. (All grades must be reported.) An eligible student must have no incomplete grades, repeated grades replacing lower grades earned in prior terms, nor any grade below C. The Dean's List acknowledgement will be posted on the student's transcript.

Graduation Honors : An undergraduate student graduating from Khalifa University will be awarded graduation honors based on the student's final cumulative grade point average as follows:
4.00-3.80 Excellent With Highest Honor; 3.79-3.65 Excellent with High Honor; 3.64-3.50 Excellent with Honor.

5.31 | **Academic** Probation

Fully admitted degree students are placed on probation if their overall or cumulative GPA (CGPA) falls below 2.00. This is noted on the student's academic record and grade report. While on probation, a student may not take any course on a Pass/Fail basis. Probation ends at the close of a regular semester if a student has attained a CGPA of 2.00 or above. Unless otherwise approved by the Dean, a full-time student on probation is only allowed to register for a maximum of 13 credit hours per semester. A student who is placed on academic probation must enroll for a special one-credit course (SDAS100) dealing with academic goal setting, study skills and time management.

Conditionally admitted students, who are enrolled in the Preparatory Program, are not subject to academic probation. Conditionally admitted students must successfully complete the Preparatory Program or their conditional admission will be rescinded and they will be separated from the University.

5.32 | **Academic** Dismissal

An undergraduate student who fails to remove his/her probation status by the end of the second regular semester on probation is academically dismissed from the University.

A student's transcript will indicate if they are subject to dismissal. A student in jeopardy of dismissal should make an appointment with their academic advisor and the Dean of the appropriate College at the earliest opportunity.

A student who is subject to academic dismissal may be continued on probation for an additional semester upon application by the student and a determination by the University that the student is making substantial and timely improvement in raising his cumulative grade point average to 2.0.

At the discretion of the University, an academic dismissal action may be delayed pending a final appeal to the Provost.

5.33 | **Student** Rights and Responsibilities

Student Academic Rights

University life is about learning, growing, and discovering. This section describes your academic rights. These rights include:

- Your instructor's obligations to you to inform you as to what you will learn and how you will be assessed on your accomplishments.
- The right to a fair and impartial assessment of your performance as a student.
- The obligation of the University to uphold and preserve its students' rights to exercise principles of academic freedom. This obligation reflects the University's mission, which is dedicated to the advancement of learning through teaching and research and to the discovery and application of knowledge. The principles of academic freedom protect the freedom of inquiry and research and freedom of expression and publication within the bounds of professional, ethical, cultural, contractual and legal behavior. In order to preserve the rights and

freedoms of its students, the University has a formal process for adjudication of academic related student grievances.

- The right of every student to a quality education.
- Provision by the University of sufficient course information to permit students to make informed course selections.
- Availability in each course of a course outline including (but not limited to):
  a) A description of the topics to be considered in the course;
  b) Objectives and outcomes; and
  c) A list of all required readings and other materials, a description of the means of evaluation to be used in the course, the instructor's office hours, and locations for office appointments.
- Fair and reasonable evaluation of a student's performance in a course, with evaluation measure reflecting the content of the course. The method of evaluation shall be made known to the student as soon as practicable.
- Subject to reasonable administrative arrangements, and provided the request is made by a student within a reasonable time after the notification of a grade:
  a) The right to consult any written submission for which he or she has received a grade and a right to discuss this submission with the faculty member.
  b) The right to impartial and competent review of any grade.
- Provision by the University of Information and transparent delivery mechanisms for students in need of financial aid.

Student Responsibilities

An educated person realizes that rights are not to be taken for granted. Rights require responsibility.The University policy on Student Responsibilities to the University, the Faculty and fellow students include:

Honor Code of Conduct: Modeled after the "Fundamental Standard" established at Stanford University in 1896, Khalifa University espouses a simple statement of student conduct which is expected of all students in the University community. This statement is as follows:

"Whether engaging in university activities or engaging in their lives outside the university, students at Khalifa University are expected to show respect for order, morality, personal honor and the rights of others as is demanded of good citizens. This includes conforming to applicable laws and respect at all times for the cultural norms and expectations of the society we live in. Failure to do this will be sufficient cause for removal from the University."

Students will be asked to commit to this standard upon matriculation. It is emphasized that this commitment implies adherence to both academic and non-academic regulations in this catalog, and also governs the standard of behavior they live by in other facets of their lives as well. This commitment is embodied in the Honor Code Academic Pledge:

"As a Khalifa University student, I will not lie, cheat, steal, or use any unfair means in academic work and will behave according to university rules and UAE societal norms and expectations."

- Every student is responsible for the proper completion of his/her academic program. This includes knowledge of the University Catalog, maintaining the grades required, and meeting all other degree requirements.
- Every student is responsible for maintaining communication with the University and keeping on file with the Registration Office, his/her current address, home address and telephone number.
- Every student is expected to participate in campus and community life in a manner that will reflect credit upon the student and the University.
- Every student has the responsibility to pay the fees of the University when due.
- Every student is expected to be an active learner by attending classes, completing assignments, seeking help when needed, responding to administrative requests, and participating in all course activities including course feedback.
- Students share with faculty the responsibility for maintaining the academic integrity of the teaching and learning process.

5.34 | **Student Academic** Regulations and Policies

Academic Integrity Code

The academic community, like all communities, functions best when all its members treat one another with honesty, fairness, respect, and trust. Khalifa University expects high standards of scholarship and integrity from all members of its community. To accomplish its mission of providing an optimal educational environment and developing leaders of society, the University promotes the assumption of personal responsibility and integrity and prohibits all forms of academic dishonesty. The purpose of education is to develop a student's ability to think logically and to express himself/ herself accurately.

Members of the University community are expected to carry out their work with intellectual honesty and professional integrity, adhering to the highest standards of ethical behavior consistent with the codes of conduct set down by relevant professional societies. Unethical behavior is not worthy of members of the University community and will be dealt with severely.

Academic dishonesty in any form undermines the very foundations of higher education and will not be tolerated by the University. The most common form of academic dishonesty is plagiarism. Other forms of academic dishonesty are described in the sections below.

Plagiarism

Plagiarism is the act of stealing the ideas and/or the expression of another person and representing them as one's own. It is a form of cheating and a kind of academic misconduct that should result in some form of academic penalty. It is important that one understands what it consists of, so that a student does not jeopardize his academic career. A student has come to the University to learn, and this means acquiring ideas and exchanging opinions with others. But no idea is ever genuinely learned by copying it down from someone else's work.

A student commits plagiarism if he/she submits work that is not truly the product of his or her own mind and skills.

Forms of Plagiarism

- A word-by-word copying of someone else's work, in whole or in part, without acknowledgment, whether that work be a magazine article, a portion of a book, a newspaper piece, another student's paper, or any other composition not your own. Any such use of another's work must be acknowledged by:
  a) Enclosing all such copied portions in quotation grades.
  b) Giving the original source either in the body of the paper or in a note. As a general rule, one should make very little use of quoted matter in papers, project reports and assignments.
- An unacknowledged paraphrasing of the structure and language of another person's work. Changing a few words of another's composition, omitting a few sentences, or changing their order does not constitute original composition and therefore can be given no credit. If such borrowing or paraphrasing is ever necessary, the source must be indicated by appropriate reference.
- Writing a paper based solely on the ideas of another person. Even though the language is not the same, if the thinking is clearly not one's own, then the person has committed plagiarism. If, for example, in writing a paper a student reproduces the structure and progression of ideas in an essay one has read, or a speech one has heard, the student in this case is not engaging his/her own mind and experience enough to claim credit for writing his/her own composition.

In summary plagiarism includes, but is not limited to:

- Using published work without referencing (the most common);
- Copying coursework;
- Collaborating with any other person when the work is supposed to be individual;
- Taking another person's computer file/program;
- Submitting another person's work as one's own;
- The use of unacknowledged material published on the web;
- Purchase of model assignments from whatever source;
- Copying another student's results.

Avoiding Plagiarism

To avoid plagiarism, a student must give credit whenever he or she uses:

- Another person's idea, opinion, or theory;
- Any facts, statistics, graphs, drawings, any pieces of information that are not common knowledge;
- Quotations of another person's actual spoken or written words; or
- Paraphrase of another person's spoken or written words.

Direct quotations should be put in "inverted commas", and referenced. Paraphrased or edited versions should be acknowledged and referenced.

Identification and Analysis of Plagiarism Guidelines

It is University policy that electronically-submitted coursework produced by students be regularly submitted to suitable plagiarism-detection software for the identification and analysis of possible plagiarism. The University holds a site license for reputable plagiarism-detection software and makes available to all teaching staff relevant access to the software. It is mandatory that all teaching staff use such software for all major student assignments and final project reports.

Plagiarism is deemed to have occurred if the plagiarism score is equal to or greater than 15%, after all individual instances of scores of 2% or less are discounted.
All coursework items that achieve a plagiarism score equal to or greater than 15% (after all individual instances of scores of 2% or less are discounted) will be awarded zero grades, subject to the following rider: For senior students only, where a piece of coursework or the final project report attains a plagiarism score between 15% and 17% (after all individual instances of scores of 2% or less are discounted), the report must be reviewed by the relevant instructor and a decision made jointly by the relevant instructor and the Department Chair as to the final score that will be recorded.

The only faculty member who may submit a coursework item for a particular course to a plagiarism-detection software program is the assigned instructor for that course. No other academic course member should submit any coursework item that relates to another faculty member's assigned course.

Other Forms of Academic Dishonesty

Cheating

Cheating is defined as using or attempting to use in any academic exercise, materials, information, study aids, or electronic data that the student knows or should know is unauthorized.

Collusion

Collusion includes cooperation of student(s) with faculty or staff personnel in securing confidential information/material (tests, examinations, etc.); bribery by student(s) to change examination grades and/or grade point average(s); cooperative efforts by student(s) and student assistant(s) to gain access to examinations or answers to examinations for distribution; seeking, obtaining, possessing, or giving to another person an examination or portions of an examination (not yet given), without permission of the instructor.

Fabrication of Data

This means the invention of results that have not been achieved by any scientific processes, either through logical argument or empirical investigation.

Falsification of Results

This means the alteration, modification, or misrepresentation of results (including selective inclusion or exclusion of results).

Recycling

Recycling is the submission of one's previous work to count as new work. For example, submission of a student's work that has previously counted in another unit of study is not allowed, unless explicitly authorized by the faculty members of both study units. In such case, students must reference their previous work.

Sabotage

Destruction of or deliberate inhibition of progress of another student's work related to a course is considered academically dishonest. This includes the destruction or hiding of shared resources such as library materials and computer software and hardware to tampering with another person's laboratory experiments.

Procedures and Penalties for Academic Integrity Code Offenses

- When an instructor suspects that a student has violated the University's Academic Integrity Code, he or she shall collect whatever evidence may be available and relevant and shall immediately address the matter with the student via an interview. During the interview, the instructor has the right to ask the student to provide additional evidence (such as sources used) to establish the facts of the case.
- If, after the interview, the instructor believes that the charges are unfounded or the evidence is not sound, he/she shall dismiss the case.
- If, however, at the conclusion of the interview, the instructor discovers that the student did act in violation of the Academic Integrity Code, the instructor shall consult with the Chair/Dean of the student's department/college to determine whether the student has had a previous offense. In the event the student has had a previous offense, the instructor shall forward the case directly to the Department Chair. The instructor shall accompany the case with a brief report detailing the offense committed and the interview with the student.
- If the case represents a student's first offense and the student admits guilt during the interview, the instructor may take one of the following actions:
  a) Counsel the student and issue him/her a formal written warning;
  b) Require the student to resubmit the work or undertake another form of assessment in lieu of the work in question, with a capped pass grade;
  c) Give a grade of zero for the work (in cases involving plagiarism, the issuance of a grade of zero is mandatory if the student's plagiarism score is equal to or greater than 15% after all individual instances of scores of 2% or less are discounted);
  d) Refer the case immediately to the Department Chair, if the offense is serious and warrants a greater sanction.The instructor shall then write a brief report detailing the offense committed, the interview with the students, and the penalty imposed. This report shall be provided to the student within five (5) business days of the interview and submitted, through the relevant Department Chair, to the Dean for inclusion in the student's file.
- If the student wants to initiate an appeal, the student must submit a written request through the Department Chair to the Dean within five (5) business days of receiving notification of the instructor's sanction.

Investigation and Penalties by the Hearing Committee

1. The offence is referred to a Hearing Committee in the following cases:
   a) If the case represents a student's first offense and the student either did not admit guilt or wishes to appeal the sanction imposed by the instructor;
   b) If the case represents a student's first offense and the student admitted guilt but the instructor decided that the offence is serious and warrants a greater sanction than the list of penalties that he/she has the authority to impose;
   c) If the student has had a previous offence.

2. The Hearing Committee is an ad-hoc University committee appointed by the Provost (or Designee) and is comprised of senior faculty and staff members who are independent of the student and the case. The Provost (or designee) shall designate a Chair for the hearing.

3. The committee shall meet as directed by the chair to review all statements and supporting materials and to determine whether an act of academic dishonesty occurred. The committee may also request additional information and/or interview individuals who may have information relevant to the incident, including the instructor(s) who made the referral and the student involved.

4. The hearing should be conducted in such a manner as to do substantial justice and not be restricted unduly by rules of procedure. The focus of inquiry shall be the validity or invalidity of the accusations against those accused of violating the Academic Integrity Code.

5. The meeting shall be private, in order to protect the confidentiality of the proceeding.

6. The accused student may challenge any member of the committee on grounds of prejudice. The committee shall deliberate in private and determine, by majority vote (excluding the member being challenged), whether the member should be replaced by an alternate committee member who will be designated by the Chair.

7. The student shall have the right to be assisted by an adviser of the student's choice, who must be a full-time staff member or a full-time faculty member. Attorneys are not permitted to attend the hearing. The adviser, upon request of the student may:
   a) Advise the student in the preparation of the student's case;
   b) Accompany the student to the hearing;
   c) Assist the student in questioning witnesses.
   d) Advise the student in the preparation of an appeal;

8. At the onset of the hearing, the Chair confirms that the referred student(s) understands his/her rights.

9. If the student fails, without reasonable excuse, to attend the hearing, the committee may proceed with the hearing in the student's absence or, at the Chair's discretion, postpone the start of the hearing.

10. The Instructor shall, at the outset of the hearing, and in the presence of the student, apprise the committee of the facts and allegations of the case and the names of the witnesses who are to be presented to establish said factors and allegations. The student may make a summary statement in response.

11. All witnesses shall be heard by the committee in the presence of the student. The student and the student's advisor may put questions to the witnesses, and shall have access to any documents considered by the committee as evidence in the case.

12. The student shall be afforded an opportunity to speak on his/her own behalf and to present witnesses. Should the student decide to speak, he/she will be subject to questions from the committee. The committee may consult legal assessors for advice regarding any evidentiary or procedural issue that arises during the hearing.

13. Following the hearing, the Committee will make a determination based on the facts/circumstances of the case. Depending upon the Committee's findings, it may take one of the following actions:

   (a) Dismiss the case; or
   (b) Impose a penalty based on "case history" and clear, convincing, and reliable evidence in support of the charge.

   This may include, but is not limited to, the following :
   - Counseling the student and issuing him/her a formal written warning;
   - Requiring the student to resubmit the work or to undertake another form of assessment in lieu of the work in question, with a capped pass grade;
   - Giving a grade of zero for the work (in cases involving plagiarism, the issuance of a grade of zero is normally mandatory as detailed in the Identification and Analysis of Plagiarism Guidelines section of this Volume);
   - Failing the student in the relevant course;
   - Failing the student in all courses for the semester during which the academic misconduct has occurred
   - Suspending the student from the University for a given period of time. Suspension shall entail the withdrawal of such University privileges as are specified by the party or the hearing body imposing the suspension. If no particular privileges are specified, suspension shall entail the withdrawal of all University privileges, including the right to enter and be upon University property, in which case the student, during suspension, may only come upon University property for a specified purpose, previously authorized in writing by the Chair of the Committee that imposed the disciplinary action. Violation of the terms of the suspension shall result in the case being referred by the University Registrar to the Provost for further action if required.
   - Dismissing the student from the University. Dismissal from the University for academic misconduct reasons entails the termination of all the student's rights and privileges as a student at the University. No application for re-admission by a dismissed student will be entertained by the University for a minimum of two years from the dismissal. Dismissal will be recorded on the academic transcript of the student.
   - Expelling the student from the University. Expulsion from the University entails the termination of all the student's rights and privileges as a student at the University. The University will not entertain any application from an expelled student for re-admission. Expulsion will be recorded on the academic transcript of the student

14. In cases of penalties resulting in immediate suspension or expulsion, the student shall physically leave University-owned or controlled property within twenty-four (24) hours after being informed of the sanction by the committee. The student may return to University-owned or controlled property during the terms of the suspension, dismissal or expulsion for the express purpose of attending the appeal hearing (if applicable) or for completing total separation requirements. Suspended students shall also be permitted to take examination(s) or submit paper(s) during the suspension, but the University may make special arrangements as to time and place for the completion of such work.

15. The chair of the committee will notify the student of the committee's decision in writing within five (5) business days. The student will also be informed in writing of the right to file a final written appeal to the Provost within five (5) business days of receipt of the Committee decision. . The Committee shall write a brief report detailing the case and its decision. . A copy of the report shall be submitted to the Dean / Vice Provost for Graduate Studies and Research (for graduate students) for inclusion in the student's file.

16. In the absence of an appeal, the decision of the committee shall be implemented immediately. In the event of an appeal, implementation of the committee decision will be suspended until a decision on the appeal is rendered by the Provost. The Provost's decision is final.

17. An annual report of the disciplinary activities and actions shall be prepared by the University Registrar and presented to the Provost and the President annually. However, in any description, no mention shall be made of the names of the parties or of any information which might lead to their identification.

DIVISION OF STUDENT SERVICES

06

The Division of Student Services is dedicated to providing quality services and support for students on and off-campus. The Division advocates for students' needs, facilitates student involvement in their learning and personal development, and supports students as they accept responsibilities associated with membership in a campus community. Operating within the framework of intentional student development, the Division is committed to promoting a caring, cooperative campus environment that values diversity and appreciates the dignity of all people.

6.1 | **Student** Engagement

Students at Khalifa University are encouraged to participate in curricular as well as co-curricular activities. The university wants students to be engaged in a student-centered manner with a variety of educational, recreational, cultural and social activities enabling students to develop personal and professional talents and interests. Students are provided with facilities such as meeting rooms, student lounges, activity rooms, TV rooms, and prayer rooms. In addition, Khalifa University provides on-campus services tailored to the needs of its students such as personal and career counseling and a nurse/health educator. The aim is to promote a campus climate that enhances the educational, physical, social, and emotional well-being of students, and creates a collaborative, caring, and participative academic environment.

Housing

University hostels offer an environment in which students from different parts of the country have the chance to meet and learn from one another. Student housing is available at both the Sharjah and Abu Dhabi Campuses. All housing facilities are managed by on-site staff. Based on availability and demand, student housing is subject to priority allocation. In general, housing priority is afforded to students who are UAE Nationals residing beyond 100 km commuting distance to campus. Priorities and costs are subject to change.

The Sharjah Campus provides purpose-built student housing for men, which is located on campus. The Abu Dhabi campus provides leased off-campus accommodation for both male and female students. Transportation is provided to and from the campus.

Emergency services
Campus security and emergency services are provided by the campus security department which operates twenty-four hours daily. These services can be requested by calling or contacting the security office.

Campus Food Services
Food services are available at the Sharjah and Abu Dhabi campuses including full meals and snack items. There are a variety of food venue options at reasonable rates on the Abu Dhabi campus and a cafeteria on the Sharjah campus.

Mosque and Prayer Facilities
Khalifa University provides separate prayer rooms for men and women including separate areas for `Wudhu', washing and cleansing.

Recreational Facilities
Recreational facilities including a gymnasium, swimming pool, tennis courts, and playing field, are available at the Sharjah campus. There are no recreational facilities on the Abu Dhabi campus at this time, but venues are leased on a 'current needs' basis.

6.2 | **Career and** Counseling Services

Career Development
Career Services engage students in educationally purposeful experiences resulting in student learning and development, academic success and degree completion. Our aim is to help students identify academic majors, develop career plans and goals, become employment ready and build relationships with employers.

Career Services offers a University Success Program which includes the following topics: developing effective study habits; discovering personal learning styles; understanding the importance of managing time; exploring personal values and interests. To prepare students for internships and employment the following services are offered:

- Workshops on resume writing and cover letter development
- Workshops on interview skills and etiquette
- Career fairs providing effective opportunities to network with hiring employers
- An internship preparation symposium orienting students on the internship process

Also, Career Services offers great mentorship opportunities where students get to enroll in a mentorship experience which contributes to the enhancement of their personalities, and equips them with the needed tools to make informed decisions. Khalifa University has agreements of cooperation with a number of leading organizations and projects, including:

- Al Bait Motwahed Initiative
- Abu Dhabi Ports
- Tomouh

External Scholarships
Khalifa University, along with its partners, offers a number of selective undergraduate scholarships for its students. The goal behind allowing such scholarships is to link students to industry, support Emiratization, provide guaranteed internship opportunities, and build links with the university's research and development activities. Scholarships are the students' gate towards career guarantee and professional development.

Students are encouraged to search for their desired scholarships, taking into account that University Scholarship Office must be informed prior to any signing of another scholarship.

Community Services
Community Services is a mandatory requirement for all students in undergraduate programs who started Fall 2014 and thereafter. Students are required to carry out a minimum of 20 hours per academic year for a total of 80 hours (or 100 hours if Preparatory year is included) of Community Service/ Service Learning to graduate.

Students will not be able to graduate from Khalifa University unless they complete the required community service hours. Students who fail to achieve the required hours of community service program during the study program, will take the full responsibility for their graduation suspension.

The main purpose behind the Community Service Program is to improve the quality of life in the region through citizen's involvement, the main source of manpower "KU students" who plan, organize, participate and execute extensive services to the community.

Counseling Services
Counseling services at Khalifa University are designed to help students cope with their everyday challenges to ensure they reach their full potential and succeed. It is important that students deal with their challenges before they become overwhelming.

The counseling Team at Khalifa will help students develop the skills necessary to overcome any challenges they may face while studying at the university. They are devoted to aid in the academic, emotional, social, and intellectual development of our students. The goal is to empower students and support them in creating a lifelong change that will stay with them in order to fulfill their dreams and reach their full potential.

Counselors are available to support students with social issues, life adjustments and offer encouragements. The support is offered through one on one sessions, group counseling, campaigns, and workshops covering various topics catered to the needs of the students. Counseling services will also assist students with special needs by offering special accommodation to ensure they are not disadvantaged because of their disability.

The guiding principle of counseling is built on trust, hence all counseling sessions are held on high level of confidentiality.

Student Success office & Peer Tutoring
The success office provides academic support for students in different ways such as Academic advising, peer tutoring and soft skills workshops.
The Peer Tutoring program seeks to offer academic support as requested by students in all degree disciplines and course levels. Tutoring is provided on a one-to-one basis, however tutoring to small groups can be arranged.

Peer tutoring is viewed as a means to supplement classroom instruction, foster independent learning, build self-esteem and assist students in improving their academic skills. The program will continue to evolve to provide quality tutoring for the student body of Khalifa University.

6.3 | **Student** Activities

Career Development
Purposeful and planned student activities at Khalifa University provide a friendly atmosphere to a multicultural and co-educational student body. The aim is to create a vibrant environment around co-curricular activities which extends beyond the classroom.

Khalifa University students are encouraged to organize and arrange many events and activities. These activities and programs include: a talent day; UAE National day celebrations, Student Leadership Day and intramural competitions.

The on campus facilities to support these co-curricular activities are: student lounges and activity rooms (male and female); prayer rooms; kitchens; cafés and wireless internet access.

The university encourages the establishment of a variety of student organizations and clubs reflecting student interest and individual/group accomplishment of learning outcomes determined by the University.

Some of the current Clubs at Khalifa University

Purposeful and planned student activities at Khalifa University provide a friendly atmosphere to a multicultural and co-educational student body. The aim is to create a vibrant environment around co-curricular activities which extends beyond the classroom.

- Hope
- Programming
- Games Dev
- Han
- Literature
- Emirati
- Arabic
- Anime
- Sport
- Art
- Green crescent
- Pioneers
- Spanish
- Ku music
- Photography
- Nippon
- Gastronomy
- Theater & talent
- Debate
- Media
- Story writing

Professional Organizations

AIAA Student Section

The objectives of the American Institute of Aeronautics and Astronautics (AIAA) Khalifa University Chapter is to promote the profession of Aerospace Engineering through organized activities in the areas of academic study and research, and to offer quality engineering experiences that cannot be obtained in the classroom environment

The goal of the AIAA Khalifa University Chapter is:

- To promote Aerospace Engineering to students.
- To establish links between students and aerospace companies through a series of industrial trips.
- To encourage students to participate in AIAA competitions, such as the design build and fly competition.

Chapter membership is open to both undergraduate and graduate students from Khalifa University. Any student who is enrolled as a student in Aerospace Engineering or in any graduate-level degree program is eligible for membership of the Chapter.

ASCE Student Section

The mission of American Society of Civil Engineers Student Chapter at KU is to provide an enriching experience to its members and to build academic, social and professional relationships in addition to developing leadership, advocating lifelong learning and promoting professionalism. The student chapter conducts regular meetings with speakers from a variety of civil engineering fields on professional issues and technical topics. It organizes field trips in different related domains: Geotechnical, Structural, Construction and Environmental. Also, it participates in community service projects, ensures entries in the National and International competitions, helps students participate in the ASCE Student Conferences, and sends potential members to the Workshops for Student Chapter Leaders. ASCE student chapter offers students an excellent opportunity to learn more about the civil engineering profession and to meet with the Civil Engineering professionals and learn from them.

ASME Student Section

Khalifa University ASME (American Society of Mechanical Engineering) student section mission is to help students to be professional and open-minded to new ideas. It aims to develop partnerships with industries, government agencies and other academic institutions. In addition, one of the ASME goals is to achieve international visibility by organizing and participating in technical conferences, seminars, lectures and competitions. Participating in the Student Professional Development Conference (SPDC) in the American University of Beirut, Lebanon was our biggest achievement. We got the chance to be part of the lectures and seminars held there and to win two of the competitions we participated in. Our next year objectives are to participate in Robocop Competition and Human Powered Vehicle Competition as well as the Student Design Contest and the Old Guard Oral Presentation Competition. We are also planning to Host the next SPDC in Khalifa University. Offering students online courses and workshops that develop engineering and communication skills is also in process. Finally, we are trying to provide as many social events as we can to encourage other students to join us.

IEEE Student Section

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association for the advancing of technology. The IEEE student chapter aims to prepare Khalifa University students to face challenges of the outside world and equip them with all the sufficient knowledge of their own field as well as being distinguished by their awareness of other fields' progress and their ability to communicate with others. IEEE and its members encourage a global community through IEEE's highly cited publications, conferences, technology standards, and professional and educational activities.

The IEEE student section vision is a continuous, successful and productive student branch that holds new and innovative activities in both the scientific and social environments. Our mission is to be the definite article that merges all disciplines and activities into one big integrated multidisciplinary team of innovation and productivity.

Goals are an important part of any emerging new chapter, and therefore, here are some of the goals of Khalifa University's Abu Dhabi IEEE student chapter section:

- Explain the importance of networking and resources through technical societies.
- Invite several qualified speakers to the campus form various backgrounds to share their experience and knowledge.
- Coordinate with the other chapters of ASME and AIAA in Khalifa University Abu Dhabi Campus to conduct workshops, activities and conferences.

Registration in the chapter is open for all majors of engineering.

IIE Student Section

The objectives of the Institute of Industrial Engineers Khalifa University (IIE KU) Chapter is to promote the profession of Industrial Engineering through organized effort in study, research and discussion of the fields of Industrial Engineering and the dissemination of knowledge thereby gained.
The goals of the IIE KU Chapter in the upcoming year are to:

- Invite several professionals from Industry to campus to share their experiences and motivate the student body.
- Organize workshops, field-trips and other academic activities to help the development of student body.
- Organize and participate in events to help promote the discipline.
- Organize regional meetings and a conference with other IIE Chapters in the UAE/MENA to network with future colleagues from other universities.

Chapter membership shall consist of undergraduate and graduate students from Khalifa University, UAE. Any student who is enrolled as a full-time student in an undergraduate curriculum in Industrial & Systems engineering or in any graduate-level degree program which will enhance professional competence is eligible for membership in the Chapter.

Student Council

The purpose of the Student Council Khalifa University is to provide the student body with a common platform that aims at promoting interaction among students and the university body. The Student Council works closely with the Division of Student Services to foster a spirit of community, understanding, and harmony throughout the campus. The Council also aims to provide students with unique opportunities to develop life skills and leadership qualities by organizing activities and hosting events of interest to the students.

Student Council Objectives

- To provide a link between the student body and University Management.
- To encourage participation in extracurricular activities.
- To coordinate university events involving the campus community, such as National Day, Leadership Day, International Day etc.
- To create a collaborative, caring, and participative work environment.
- To enhance the educational, physical, social and emotional well-being of students.
- To provide students with a platform to voice their views and facilitate action from the campus administration on any issues, needs and concerns.
- To organize clubs, field trips, workshops and competitions.
- To provide opportunities for students to develop life skills.
- To develop leadership skills.

6.4 | **Student** Rights

The University is a community. A community has many different groups and individuals. The community which enhances understanding and appreciation of others is rich in diversity. As a student, you have rights which assist you in taking your place as a member of the community.

These are as follows:

- Every student enjoys within the University all rights and freedoms recognized by the Laws of the United Arab Emirates.
- Every student has a right to equal treatment by the University. A student has a right to be free from discrimination based on race, color, origin, religion, sex, or personal handicap.

  a) A distinction, exclusion, or preference based on relevant academic or physical aptitudes required and made in good faith is considered to be non-discriminatory.

- Every student has a right to the safeguard of his or her dignity. This right includes protection by the University against vindictive conduct displayed by a representative of the University acting in an official capacity.
- Every student has a right to be free from reprisal or threat of reprisal made by a person in a position to offer or deny to the student an academic advantage or opportunity relating to the status of a student.
- The University has an obligation to ensure that administrative decisions are made, or actions taken, with fair regard for the known and legitimate interests of students.
- The University has an obligation to maintain safe and suitable conditions of learning and study.
- The University has an obligation to ensure that adequate measures are taken to protect the security of students on University property.

6.5 | **Non-Academic** Student Conduct Regulations

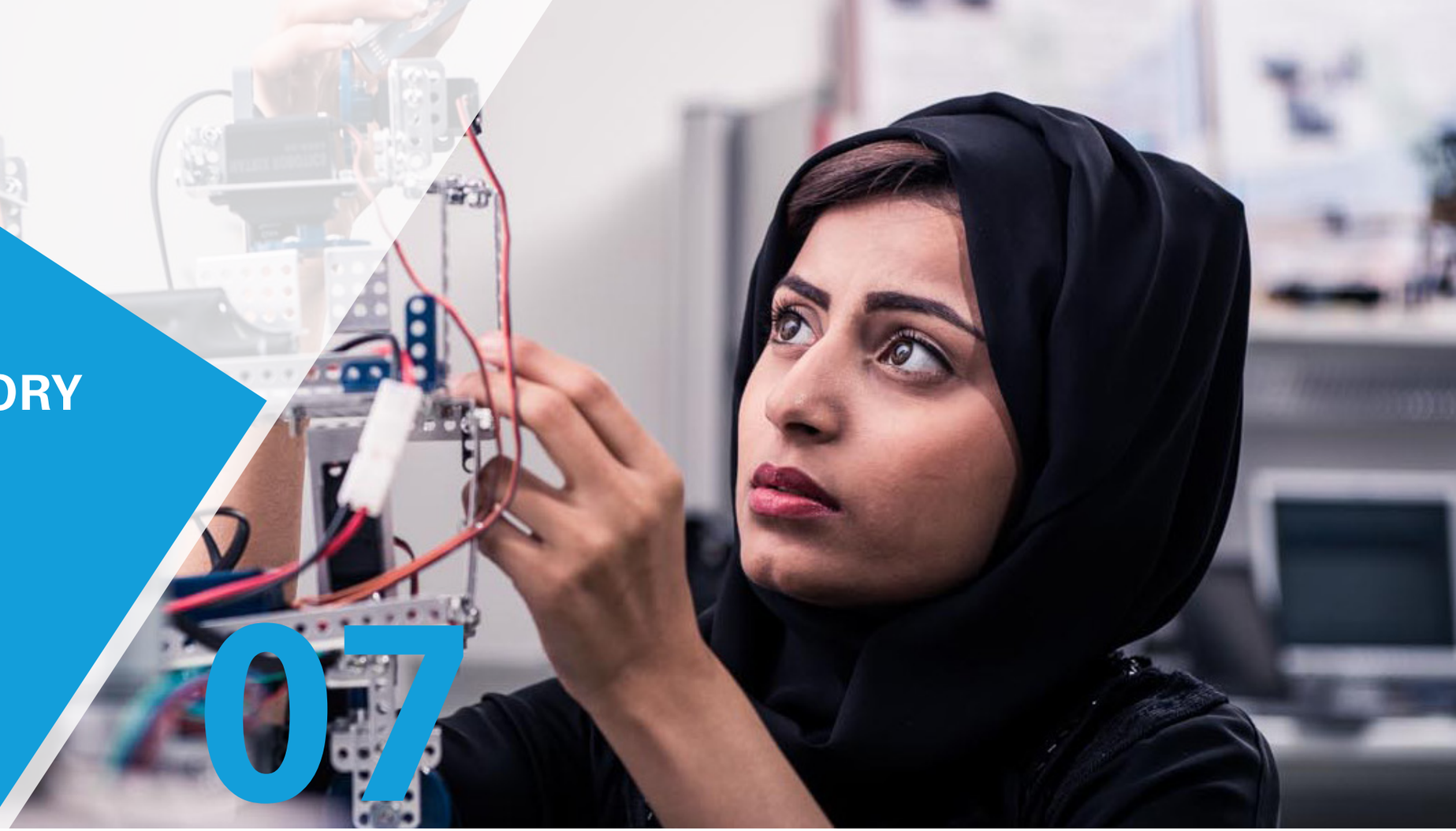
The Division of Student Services is responsible for reviewing all alleged violations of non-academic student conduct. Non-academic offenses are related to behaviors that disrupt the life of the University community. Non-academic offenses include, but are not limited to, the following categories.

- Disruption of teaching or other University activities including administrative processes.
- Unauthorized entry and/or presence on University property.
- Threat, damage and destruction of University property or the property of other members of the University community.
- Physical abuse, harassment, and dangerous activities.
- Possession of stolen property.
- Unauthorized or fraudulent use of University facilities, equipment or services.
- Misuse of library and information technology resources.
- Any behavior or appearance deemed by UAE or Khalifa University norms to be offensive to the culture.

Behaviors deemed to be unacceptable may lead to a variety of sanctions up to and including student dismissal from the University. The Khalifa University Student Handbook and website details University policies and procedures regarding student conduct regulations, hearing procedures and sanctions.

PREPARATORY PROGRAM

07



The objective of the Preparatory Program at Khalifa University is to provide a bridge for students to successfully make the transition from high school to undergraduate studies. To achieve this, the program introduces them to the rigor and discipline of academic study in a caring and supportive environment where personal development, independent study, and critical thinking are nurtured.

The aims of the Preparatory Program are to ensure that students have a sound foundation in Chemistry, Math, Physics, and IT and that their English language proficiency is sufficient to allow them to pursue undergraduate and graduate studies in an English-medium university. In addition, students are taught the academic study skills necessary for success in tertiary education and are exposed to the behavioral competencies required to become not only successful students but also effective members of society.

Depending on the level of entry, students typically spend between one to two semesters in the program. All students who gain entry to the Preparatory Program are given every opportunity to succeed and meet the criteria for full admission to undergraduate studies in Khalifa University. With this in mind, students are initially given placement tests in Math and English to place them in their appropriate proficiency level. Regular assessments are conducted to identify student progress and offer remedial support where necessary. Assessments take the form of traditional-style examinations, assignments, quizzes, as well as projects and presentations.

To further support students in the Preparatory Program, class sizes are kept small wherever possible, students are encouraged to become actively involved in the learning process, and both instructors and advisors are readily available to assist students outside of class hours.

Acceptance to the undergraduate program is based on successful completion of the Preparatory Program. This is evidenced by a student's overall academic record, successful completion of all Preparatory courses with a grade of C or higher, and achievement of a Band 6 in the external IELTS (or equivalent).

Curriculum

Students are enrolled in appropriate English, Math, Chemistry, Computer Studies and Physics courses based on their results on the Khalifa University Placement Test.

English Language Courses

ENGL 001	Preparatory English I	8 credit hours
ENGL 002	Preparatory English II	5 credit hours
ENGL 003	IELTS Exam Skills	3 credit hours

Computing Courses

CMPE 002	Introduction to Information Technology	2 credit hours

Mathematics and Sciences Courses

Mathematics and Quantitative Reasoning		
MATH 001	Preparatory Mathematics I	5 credit hours
MATH 002	Preparatory Mathematics II	5 credit hours
Natural and Physical Sciences		
PHYS 001	Preparatory Physics I	3 credit hours
PHYS 002	Preparatory Physics II	3 credit hours
CHEM 002	Preparatory Chemistry	2 credit hours

Course Descriptions

CHEM 002 **Preparatory Chemistry (1-2-2)**
Prerequisite: None

This course is an introduction to basic chemistry, measurements and calculations, matter, chemical foundations, basic chemical reactions, chemical composition, chemical quantities and chemical bonding. Laboratory experiments provide hands-on experience in visualizing, analyzing and understanding physical and chemical properties, as well as chemical reactions and equations.

CMPE 002 **Introduction to Computer Technology (1-2-2)**
Prerequisite: None

This course introduces students to the basics of computer architecture such as input, output, storage, and system unit and communications devices. It provides an overview of system software (operating system and utility programs), application software (Business, Multimedia, Communications and Educational/Personal categories), problem solving, program designing, developing algorithms, structure theorem, pseudo code and flowcharts.

ENGL 001 **Preparatory English I (16-0-8)**
Prerequisite: Placement Test

This course is designed to develop the student's academic and general English communication skills. The student will improve his or her ability to read, write, speak and listen in English. To meet the demands of undergraduate study, the course also focuses on vocabulary building and grammatical accuracy, academic study skills and basic information literacy.

ENGL 002 **Preparatory English II (10-0-5)**
Prerequisite: Grade of C or above in ENGL 001 or an adequate score on English Placement Test

This course is designed to further develop the student's academic and general English communication skills. The student will develop skills for writing in a variety of genres, reading extended academic texts on a wide range of subjects, building general and academic vocabulary, listening to extended academic lectures and social dialogues, and extending, speculating and hypothesizing in spoken communication. The student will also further develop academic study skills and information literacy.

ENGL 003 **IELTS Exam Skills (6-0-3)**
Prerequisite: None
Co-requisite: ENGL 002

Topics: Strengthening academic skills in listening, speaking, reading, and writing. This course meets 6 hours/week for a complete semester.

MATH 001 **Preparatory Mathematics I (3-2-5)**
Prerequisite: None

This course introduces the basic concepts, solving linear and radical equations, inequalities problem solving, lines, graphing linear equations, and inequalities in two variables, functions, exponents and polynomials, factoring and quadratic equations, rational expressions and related equations, and solving systems of linear equation.

MATH 002 **Preparatory Mathematics II (3-2-5)**
Prerequisite: MATH 001 with a grade of C or above or a qualifying score on math placement test

This course introduces the students to functions and their graphs, solving different types of equations, polynomials, rational functions, exponential and logarithmic functions, trigonometric functions: unit circle and right triangle approaches.

PHYS 001 **Preparatory Physics I (3-0-3)**
Prerequisite: None

This course is designed to help increase the understanding of the basics of general physics, especially Mechanics. It will cover: scientific theory, SI units, and conversion of units, uncertainty and significant figures, motion in one dimension, forces, work, energy, power, momentum, and basics of circular motion. This course also aims to improve students' scientific vocabulary, and to build up self-study, problem solving and math skills.

PHYS 002 **Preparatory Physics II (2-2-3)**
Prerequisite: MATH 001 and PHYS 001 with a grade of C or above or a qualifying score on the math placement test
Co-requisite: MATH 002

This course introduces the students to SI units, dimensional analysis of equations, uncertainty in measurement and significant figures, graphs, vector analysis, forces and Newton's laws of motion. The course also deepens the students' understanding to various physics concepts such as work, energy (kinetic, gravitational potential and elastic potential), momentum and collisions, in addition to basic concepts of electricity, and electric fields

COLLEGE OF ENGINEERING

08

Introduction

One of the main architectural pillars of the Emirate of Abu Dhabi's social, political and economic future is a sustainable knowledge-based economy that is also a central theme within the Emirate's 2030 vision. Towards this vision, the discovery of new knowledge, its dissemination and exploitation is the overarching purpose of the College of Engineering at Khalifa University. The College is distinguishing itself as a major contributor towards economic diversification within Abu Dhabi and the region, particularly through its close alignment with growing regional industries in key themes such as Energy, Aerospace, Healthcare, Transportation and Telecommunications.

The College of Engineering is a vibrant community of academic scholars, students and staff who are dedicated to engineering education and innovation for the ultimate benefit of society. To serve this admirable purpose, the College empowers students with a great sense of purposeful academic curiosity of the physical world and appreciation of the social and environmental context within a rapidly changing world.

8.1 | **College** Vision

To be a world class centre of excellence in engineering education, research, and knowledge transfer and hence be a catalyst for economic development in the Emirate of Abu Dhabi and the UAE.

8.2 | **College** Mission

The College of Engineering serves the Emirate of Abu Dhabi, the nation, and the world by providing students with holistic education underpinned by the principle of engineering with a purpose, thus empowering them to be outstanding leaders in discovering new knowledge as a catalyst for business innovation, particularly towards Abu Dhabi's 2030 vision. The College also plays an integral role towards this vision by conducting cutting edge fundamental, multidisciplinary and translational research in key strategic areas such as Information and Communication Technology, Aerospace, Transport and Logistics, Healthcare and Energy and the Environment.

College Undergraduate Degree Programs

The undergraduate degree programs offered by the College of Engineering are:

- Bachelor of Science (B.Sc.) in Aerospace Engineering
- Bachelor of Science (B.Sc.) in Applied Mathematics and Statistics
- Bachelor of Science (B.Sc.) in Applied Mathematics and Statistics – Financial Mathematics
- Bachelor of Science (B.Sc.) in Applied Mathematics and Statistics – Mathematical Biology
- Bachelor of Science (B.Sc.) in Biomedical Engineering
- Bachelor of Science (B.Sc.) in Chemical Engineering
- Bachelor of Science (B.Sc.) in Civil Engineering
- Bachelor of Science (B.Sc.) in Communication Engineering
- Bachelor of Science (B.Sc.) in Computer Engineering
- Bachelor of Science (B.Sc.) in Computer Engineering – Software Systems
- Bachelor of Science (B.Sc.) in Electrical and Electronic Engineering
- Bachelor of Science (B.Sc.) in Electrical and Electronic Engineering – Power Systems
- Bachelor of Science (B.Sc.) in Industrial and Systems Engineering
- Bachelor of Science (B.Sc.) in Mechanical Engineering

The normal length of all undergraduate engineering programs is 140 credits. These credits are divided into 76 credits of University General Education Requirements (GER, 50 credits) and College of Engineering Requirements (CER, 26 credits) and 64 credits of specific Major requirements as illustrated below.

GER and CER (76 credits)	
English Communication	(8)
Math/ Science	(32)
General Engineering	(12)
Business Studies	(6)
Humanities/ Social Sc.	(12)
Free Elective	(6)

Major (64 credits)	
Major Core	
Technical Electives	
Internship	(1)
Senior Design Project	

University General Education Requirements

1. English Communication (8 credits)

ENGL 111	English Communication I	(4 cr.)
ENGL 112	English Communication II	(4 cr.)

2. Math/Science (24 credits)

CHEM 115	Introduction to General Chemistry for Engineers	(4 cr.)
PHYS 121	University Physics I	(4 cr.)
PHYS 122	University Physics II	(4 cr.)
MATH 111	Calculus I	(4 cr.)
MATH 112	Calculus II	(4 cr.)
MATH 211	Linear Algebra and Differential Equations	(4 cr.)

3. Business Studies (6 credits)

BUSS 201	Fundamentals of Accounting and Finance	(3 cr.)
BUSS 301	Inside Organizations	(3 cr.)

4. Humanities and Social Sciences (12 credits)

Four 3-credit courses in the Humanities and Social Sciences are required for all students. Students must take at least one course but no more than two courses in the area of Islamic Studies and Culture. The current list of courses in this area includes: HUMA 102 (Islamic Culture), HUMA 111 (Islamic History), HUMA 112 (Sciences in Islam), HUMA 210 (Introduction to Islamic Law), and HUMA 211 (Islam and Modernity).

The Office of the Registration keeps an updated list of the approved courses in this category.

College of Engineering Requirements (26 credits)

1. Additional Math/Science (8 credits)

In addition to the 24 credits of Math/Science GERs, 8 credits of major-dependent Math/Science courses are required by the College of Engineering.

2. General Engineering (12 credits)

ENGR 111: Engineering Design	(4 cr.)
ENGR112: Introduction to Computing	(4 cr.)
ENGR 311: Innovation and Entrepreneurship in Engineering	(4 cr.)

3. Free Electives (6 credits)

All students must complete at least 6 credits of free electives which are intended to provide students with flexibility to develop depth or breadth to support their career paths and individual interests. They will support the development of technical expertise within the student's disciplines, undergraduate research and independent study opportunities, or a minor outside engineering. They can also be used for additional Humanities and Social Science courses or any other course offered by Khalifa University.

A Program with a Concentration may replace 3 credits of free electives with a 3-credit concentration course.

8.3 | **Department of** Aerospace Engineering

Introduction

The continued global expansion of the aviation and aerospace industries is driving a strong demand for aerospace engineers. In the UAE, as well as the Middle East, the aerospace industry has continued to expand at a rate significantly above the global average. The geographic and economic positions of the UAE are two of the drivers spurring the growth of aircraft manufacturing, maintenance repair-overhaul (MRO) facilities, and space-related industries.

Bachelor of Science (B.Sc.) in Aerospace Engineering

This program lays the foundation for the core aerospace engineering discipline while engaging students to study and understand how engineering fits within the overall global aerospace profession and industry. Principles of science and engineering are applied to design and analysis of flight vehicles and related systems in well-designed course sequences to ensure that students gain hands on experience in developing flight vehicles from concept to design, including the fabrication and testing process. Using advanced computer modeling and simulations, as well as hands-on laboratories and real life projects, students will have the tools to contribute immediately to the aerospace industry.

Program Objectives

- Graduates will meet the expectations of employers of Aerospace engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating with a B.Sc. in Aerospace Engineering degree will have the following abilities

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Aerospace Engineering, students must satisfactorily complete the courses in the specified categories. The categories cover an extended set of the General Education requirements, College of Engineering requirements, Aerospace Engineering core and Technical Electives requirements. The length of the program is 140 credits..

Aerospace Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Aerospace Engineering requires the following two Math courses:

MATH 212	Calculus III	4 cr.
MATH 313	Applied Engineering Mathematics	4 cr.

Aerospace Engineering Core Requirements (58 credits)

ENGR 200	Statics	3 cr.
ECCE 200	Fundamentals of Electronic Systems	4 cr.
AERO 201	Engineering Dynamics	3 cr.
AERO 215	Introduction to Aerospace Engineering	3 cr.
AERO 220	Aerospace Materials	3 cr.
AERO 225	Mechanics of Solids I	4 cr.
AERO 240	Thermodynamics	4 cr.
AERO 321	Aerospace Structures	3 cr.
AERO 335	Aerodynamics I	4 cr.
AERO 336	Aerodynamics II	3 cr.
AERO 350	Dynamic Systems and Control	4 cr.
ENGR 399	Engineering Internship	1 cr.
AERO 415	Aerospace Materials Manufacturing	3 cr.
AERO 440	Aerospace Propulsion	3 cr.
AERO 450	Flight Dynamics and Stability	3 cr.
AERO 465	Space Mechanics and Control	3 cr.
AERO 470	Aircraft Design Laboratory	3 cr.
AERO 497	Senior Design Project I	2 cr.
AERO 498	Senior Design Project II	2 cr.

Aerospace Engineering Electives (6 credits)

To satisfy the Aerospace Engineering Technical Elective requirement, the students must select 6 credits from the list of courses below. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. In addition; courses from the list below may be taken to satisfy the free elective requirement. Additional courses may be approved by the department as technical electives.

AERO 425	Design of Aerospace Structures	3 cr.
AERO 426	Designing with Composites	3 cr.
AERO 430	Intermediate Aerodynamics	3 cr.
AERO 431	Viscous Flows	3 cr.
AERO 433	Introduction to Computational Fluid Dynamics	3 cr.
AERO 435	Rotorcraft Aerodynamics and Performance	3 cr.
AERO 441	Introduction to Combustion	3 cr.
AERO 461	Aviation Management and Certification	3 cr.
AERO 485	Spacecraft Design	3 cr.
ENGR 455	Finite Element Analysis	3 cr.
ENGR 465	Methods of Engineering Analysis	3 cr.
CIVE 370	Introduction to Environmental Engineering	4 cr.
MECH 443	Heat and Mass Transfer	4 cr.
AERO 391	Independent Study I	1-3 cr.
AERO 491	Independent Study II	1-3 cr.
AERO 495	Special Topics in Aerospace Engineering	3 cr.

Typical sequence for a B.Sc. Degree in Aerospace Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	HUMA XXX Humanities and Social Sciences	3 cr	BUSS 201 Fundamentals of Accounting and Finance	3 cr
	MATH 212 Calculus III	4 cr	MATH 211 Differential Equations and Linear Algebra	4 cr
	PHYS 122 University Physics II	4 cr	AERO 201 Engineering Dynamics	3 cr
	ENGR 200 Statics	3 cr	AERO 220 Aerospace Materials	3 cr
	AERO 215 Introduction to Aero Engineering	3 cr	AERO 225 Mechanics of Solids	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	BUSS 301 Inside Organizations	3 cr	ENGR 311 Innovation & Entrepreneurship in Engineering Design	4 cr
	AERO 240 Thermodynamics	4 cr	ECCE 200 Fundamentals of Electronic Systems	4 cr
	AERO 335 Aerodynamics I	4 cr	AERO 321 Aerospace Structures	3 cr
	AERO 350 Dynamic Systems & Control	4 cr	AERO 336 Aerodynamics II	3 cr
	Free Elective	3 cr.	MATH 313 Applied Engineering Mathematics	4 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	AERO 440 Aerospace Propulsion	3 cr	Free Elective	3 cr
	AERO 450 Flight Dynamics and Stability	3 cr	Technical Elective	3 cr
	AERO 465 Space Dynamics and Control	3 cr	AERO 415 Aerospace Materials Manufacturing	3 cr
	AERO 470 Aircraft Design laboratory	3 cr	Technical Elective	3 cr
	AERO 497 Senior Design Project I	2 cr	AERO 498 Senior Design Project II	2 cr
			HUMA XXX Humanities and Social Sciences	3 cr

8.4 | **Department of Applied** Mathematics and Sciences

Introduction

The Department of Applied Mathematics & Sciences is currently an academic unit within the College of Engineering. The department offers a B.Sc. program in Applied Mathematics & Statistics with two, optional, concentrations in Financial Mathematics and Mathematical Biology. Students may choose to complete a broad program of study leading to the award of a B.Sc. degree in Applied Mathematics & Statistics, or select one of the two concentrations in order to focus their final year in the program on a particular area of application.

Bachelor of Science (B.Sc.) in Applied Mathematics & Statistics

The B.Sc. Applied Mathematics & Statistics program offers training in mathematical problem solving techniques with a reduced emphasis on abstract theory. The program is tailored to the student who will need to apply mathematical, statistical, and computational methods to practical problems.

Applied mathematics includes the theoretical portions of physics, chemistry, biomedicine, engineering, economics, finance, and a wide variety of other disciplines. Recent advances in computing technology have made the use of quantitative methods of even greater importance in these disciplines.

Prospects for employment opportunities for graduates in the mathematical and statistical sciences are excellent. There is a growing demand for professional mathematicians and statisticians in almost every sector of the job market, including the engineering and telecommunications industries; computer services and software development; actuarial and financial services; pharmaceutical industry and medical services; market research agencies; government laboratories and the military services; as well as academics and teaching.

Program Objectives

- Graduates will meet the expectations of employers of applied mathematicians and statisticians.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating with an Applied Mathematics & Statistics degree will have the following abilities

a) An ability to apply knowledge of mathematics, statistics and computing.
b) An ability to design statistical experiments, as well as to analyze and interpret data.
c) An ability to read, understand and construct mathematical and statistical proofs.
d) An ability to function on a multi-disciplinary team as a member or leader.
e) An ability to formulate, and to solve, mathematical models of real-world problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) The broad education necessary to understand the strengths and limitations of mathematical and statistical models, and their solutions, in a global and societal context.
i) A recognition of the need for, and an ability to engage in, life-long learning.
j) A knowledge of contemporary issues.
k) An ability to select, and use, appropriate software packages and/or computer programming to solve mathematical models.
l) Familiarity with, and use of, sources of current research and an understanding of how new knowledge is generated.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Applied Mathematics & Statistics, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering Requirements, as well as the Applied Mathematics & Statistics core and Technical Electives requirements. The normal length of the program is 140 credits.

Applied Mathematics & Statistics Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Applied Mathematics & Statistics requires the following two Math courses in addition to the GER

MATH 212	Calculus III	4 cr.
MATH 223	Probability and Statistical Inference	4 cr.

Applied Mathematics & Statistics Core Requirements (43 Credits)

ISYE 451	Operations Research I	4 cr.
MATH 214	Mathematical & Statistical Software	3 cr.
MATH 399	Internship	1 cr.
MATH 312	Complex Variables with Applications	4 cr.
MATH 314	Real Analysis & Probability	4 cr.
MATH 315	Advanced Linear Algebra	3 cr.
MATH 316	Partial Differential Equations	3 cr.
MATH 317	Nonparametric Statistics	3 cr.
MATH 318	Multivariate Statistics	3 cr.
MATH 319	Numerical Analysis I	3 cr.
MATH 412	Optimization	3 cr.
MATH 419	Numerical Analysis II	3 cr.
MATH 450	Senior Project I	3 cr.
MATH 451	Senior Project II	3 cr.

Program Structure and Requirements

Students can choose from the below list to satisfy their Science/ Engineering Elective requirements for Applied Mathematics & Statistics. Additional courses may be approved by the department as science/ engineering electives.

BMED 202	Biomedical Engineering Fundamentals	4 cr.
BMED 211	Physiological Systems and Modeling I	4 cr.
BMED 212	Physiological Systems and Modeling II	4 cr.
CHEM 211	Organic Chemistry	4 cr.
CHEM 311	Biochemistry	4 cr.
CMPE 211	Object-Oriented Programming	3 cr.
ECON 120	Engineering Economics	3 cr.
ENGR 200	Statics	3 cr.
ISYE 211	Probabilities with Applications	3 cr.
ISYE 331	Stochastic Processes	3 cr.
ISYE 341	Simulation Analysis and Design	4 cr.
ISYE 351	Production and Operations Management	3 cr.
ISYE 371	Supply Chain and Logistics	3 cr.
ISYE 431	Forecasting and Time Series	3 cr.
ISYE 441	Advanced Simulation	4 cr.
ISYE 480	Financial Engineering	3 cr.
MECH 201	Engineering Dynamics	3 cr.
MECH 225	Mechanics of Solids	4 cr.
MECH 240	Thermodynamics	3 cr.
MECH 335	Fluid Mechanics	4 cr.

Applied Mathematics & Statistics Technical Electives (15 credits)

To satisfy the B.Sc. Applied Mathematics & Statistics Technical Elective requirement, the students must take courses from the following list. Students may be allowed to choose technical electives from the Financial Mathematics concentration and Mathematical Biology concentration with department approval. Additional courses may be approved by the department as technical electives.

MATH 411	Modern Algebra	3 cr.
MATH 413	Game Theory	3 cr.
MATH 414	Discrete Mathematics	3 cr.
MATH 415	Design of Experiments	3 cr.
MATH 416	Sample Survey Design & Analysis	3 cr.

Applied Mathematics & Statistics - Financial Mathematics (Concentration)

Students may select a Financial Mathematics Concentration before selecting the Science/Engineering Electives. A concentration at Khalifa University leads to a specialized award or degree and will be specified on the diploma and the student's academic record (transcript).

The Financial Mathematics concentration requires the student to select ECON 120 and ISYE 480 from the list of Science/Engineering Electives and replace all technical electives with the following 5 courses.

MATH 421	Econometrics	3 cr.
MATH 422	Stochastic Differential Equations	3 cr.
MATH 423	Financial Risk Analysis	3 cr.
MATH 424	Optimal Control Theory	3 cr.
MATH 425	Financial Portfolio Management	3 cr.

Applied Mathematics & Statistics – Mathematical Biology (Concentration)

Students may select a Mathematical Biology Concentration before selecting their Science/Engineering Electives.

The Mathematical Biology concentration requires the student to select BMED 202, BMED 211 from the list of Science/Engineering Electives and replace all technical electives with the following 5 courses.

MATH 431	Computational Methods in Biology	3 cr.
MATH 432	Mathematical Models in Biology	3 cr.
MATH 433	Biostatistics	3 cr.
MATH 434	Bioinformatics	3 cr.
MATH 435	Mathematical Imaging	3 cr.

Typical sequence for a B.Sc. degree in Applied Mathematics & Statistics

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	BUSS 201 Fundamentals of Accounting & Finance	3 cr	MATH 312 Complex Variables with Applications	4 cr
	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 212 Calculus III	4 cr
	PHYS 122 University Physics II	4 cr	ISYE 251 Operations Research I	4 cr
	HUMA XXX Humanities and Social Sciences	3 cr	HUMA XXX Humanities and Social Sciences	3 cr
	MATH 223 Probability and Statistical Inference	4 cr	MATH 214 Mathematical & Statistical Software	3 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	MATH 314 Real Analysis & Probability	4 cr	MATH 319 Numerical Analysis I	3 cr
	Science/Engineering Elective	3 cr	Science/Engineering Elective	3 cr
	Science/Engineering Elective	3 cr	Science/Engineering Elective	3 cr
	MATH 315 Advanced Linear Algebra	3 cr	MATH 316 Partial Differential Equations	3 cr
	MATH 318 Multivariate Statistics	3 cr	MATH 317 Nonparametric Statistics	3 cr
SUMMER	MATH 399 Internship	1 cr		
Year 4	ENGR 311 Innovation & Entrepreneurship in Engineering	4 cr	BUSS 301 Inside Organizations	3 cr
	MATH 419 Numerical Analysis II	3 cr	Technical Elective	3 cr
	MATH 412 Optimization	3 cr	Technical Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	Technical Elective	3 cr		
	MATH 450 Senior Project I	3 cr	MATH 451 Senior Project II	3 cr

8.5 | **Department of** Biomedical Engineering

Introduction

Biomedical Engineering (BME) is a discipline in which engineering science and technology are applied to problems in biology and medicine. It covers a wide spectrum of activities including the development of advanced micro-/nano-technologies and biomaterials for improved implantable medical devices; the engineering of molecular, cellular, and tissue approaches and constructs; and the enhancement and application of medical instrumentation and imaging technologies. Ultimately, these advances have significant potential for advancing scientific understanding of the human body and disease, for the development of advanced medical devices such as artificial organs and limbs, and for the overall improvement of human health.

The demand for biomedical engineers in the UAE and the region continues to expand in alignment with the growth of the medical industry, health care, and hospital facilities. Biomedical Engineering graduates will have opportunities both for employment in established biomedical companies and for entrepreneurial endeavours. They are well prepared for advanced educational opportunities in both masters and doctoral programs as well as in professional degrees including the Medical Doctor (M.D.) and the Masters in Public Health (M.P.H.)

Bachelor of Science (B.Sc.) in Biomedical Engineering

The undergraduate biomedical engineering program at Khalifa University provides a solid foundation in both engineering and the life sciences. The curriculum integrates engineering and molecular and cellular biology into a single BME core. In addition, each student selects an area of specialization that provides more depth in a selected area of Biomedical Engineering. The instructional program is designed to impart knowledge of contemporary issues relevant to the health challenges in the UAE and at the forefront of biomedical engineering research in student- centered, collaborative learning environments. Our overall goal is to produce high quality engineers who will be leaders in their field and who are well equipped to pursue further graduate degrees, medical school, or professional careers

Program Objectives

- Graduates will meet the expectations of employers of Biomedical engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating from the Department of Biomedical Engineering degree program will have the following abilities

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Biomedical Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the General Education requirements, College of Engineering requirement, as well as the Biomedical Engineering core requirements and Area of Specialization. The program includes a total of 140 credits of required coursework.

Biomedical Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Biomedical Engineering requires the following additional Math and Science courses.

MATH 213	Probability and Statistics for Engineers	4 cr.
CHEM 211	Organic Chemistry	4 cr.

Biomedical Engineering Course Requirements (64 credits)

The BME courses have been divided into three categories: Core requirements (45 credits) provide the foundational material, capstone design and internship experience, required for all BME students. Technical electives (16 credits) provide depth in targeted technical areas, used to fulfill the area of specialization. BME students are also required to take an additional free-elective (3 credits), beyond the college requirements.

BME Core Courses (45 credits)		Credits
BMED 202	Biomedical Engineering Fundamentals	4 cr.
BMED 211	Physiological Systems and Modeling I	4 cr.
BMED 212	Physiological Systems and Modeling II	4 cr.
BMED 321	Mechanics for Biomedical Engineers	4 cr.
BMED 331	Biotransport Phenomena	4 cr.
BMED 341	Molecular and Cellular Physiology I	4 cr.
BMED 342	Molecular and Cellular Physiology II	4 cr.
BMED 351	Biomedical Circuits and Signals	4 cr.
BMED 352	Fundamentals of Biomedical Signal Processing	4 cr.
ENGR 399	Biomedical Engineering Internship	1cr.
BMED 497	Senior Design Project I	4 cr.
BMED 498	Senior Design Project II	4 cr.

Biomedical Engineering Technical Electives Requirements – 16 credits

BME students need to select 4 Technical Electives from the following list

BMED 322	Functional Biomechanics	(2-4-4)
CHEM 311*	Biochemistry	(3-3-4)
BMED 411*	Biomaterials	(3-3-4)
BMED 412*	Regenerative Medicine	(3-3-4)
BMED 413	Application of Bio-molecular Tools	(2-4-4)
BMED 430	Bioinformatics	(2-4-4)
BMED 421*	Physiological Control Systems	(2-4-4)
BMED 422*	Rehabilitation Engineering	(2-4-4)
BMED 495	Special Topics in Biomedical Engineering	

In the future, it is expected that additional areas of specialization will be offered as per faculty specialties and available workload and as per student and employer interests. Courses with * are linked and the choice of technical electives must be done in accordance with pre- and co- requites to each course.

Additional Free Electives – 3 credits

BME students have 3 additional free-elective credits beyond the College of Engineering requirements for a total of 9 Free Electives credits required for graduation.

Undergraduate Research in Biomedical Engineering

Students are provided research opportunities in the laboratories of the BME faculty members. These research experiences can receive course credit using the BME Independent Study courses. These courses can be used as Free Electives. At most 9 credits of Independent Study may be used for graduation.

BMED Independent Study Courses		Credits
BMED 291	Independent Study I	1–4
BMED 391	Independent Study II	1–4
BMED 491	Independent Study III	1–4

Typical sequence for a B.Sc. degree in Biomedical Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
	PHYS 122 University Physics II	4 cr	HUMA XXX Humanities and Social Sciences	3 cr
Year 2	BMED 202 Biomedical Engineering Fundamentals	4 cr	BMED 212 Physiological Systems and Modeling II	4 cr
	BMED 211 Physiological Systems and Modeling I	4 cr	CHEM 211 Organic Chemistry	4 cr
		4 cr	MATH 213 Probability & Statistics for Engineers	4 cr
			Free Elective	3 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	ENGR 311 Innovation & Entrepreneurship in Engineering Design	4 cr	BUSS 201 Fundamental of Accounting and Finance	3 cr
	BMED 341 Molecular and Cellular Physiology I	4 cr	BMED 331 Biotransport Phenomena	4 cr
	BMED 351 Biomedical Circuits and Signals	4 cr	BMED 342 Molecular and Cellular Physiology II	4 cr
	BMED 321 Mechanics for Biomedical Engineers	4 cr	BMED 352 Biomedical Systems and Signal Processing	4 cr
			HUMA XXX Humanities and Social Sciences	3 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	HUMA XXX Humanities and Social Sciences	3 cr	BUSS 301 Inside Organizations	3 cr
	Technical Elective	4 cr	Technical Elective	4 cr
	BMED 497 Senior Design Project I	4 cr	BMED 498 Senior Design Project II	4 cr
	Technical Elective	4 cr	Technical Elective	4 cr
	Free Elective	3 cr	Free Elective	3 cr

8.6 | **Department of** Chemical Engineering

Introduction

The Chemical Engineering department supports the mutual needs of business, industry, and academia in chemical engineering education, research, and development. This is accomplished by providing appropriate mechanisms for technical exchange, collaboration, and employment of students. The department currently offers a B.Sc. degree in Chemical Engineering.

Bachelor of Science (B.Sc.) in Chemical Engineering

Chemical engineering applies physical and life sciences together with engineering and economics principles to produce, transform, transport, and properly use chemicals, materials, and energy. It essentially deals with the engineering of chemicals, energy, and the processes that create and/or convert them. Chemical Engineering differs from chemistry in its emphasis on commercial applications of chemical reactions and separations and techniques for designing, operating, and controlling processes. Modern chemical engineering also concerned with creating and processing materials and related techniques related fields such as nanotechnology, energy storage devices, and pharmaceutical engineering.

The Chemical Engineering B.Sc. program at Khalifa University educates engineers to design, develop, and operate chemical processes by which chemicals, petroleum products, food, pharmaceuticals, and consumer goods can be produced economically and safely.

Program Objectives

- Graduates will meet the expectations of employers of Chemical engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating with a Chemical Engineering degree will have the following abilities:

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Chemical Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering requirements, as well as Chemical Engineering core and Technical Electives requirements. The normal length of the program is 140 credits.

Chemical Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Chemical Engineering requires the following additional Math courses:

MATH 212	Calculus III	4 cr.
MATH 313	Applied Engineering Mathematics	4 cr.

Chemical Engineering Core Requirement (52 credits)

CHEM 211	Organic Chemistry	4 cr.
CHEM 311	Biochemistry	4 cr.
CHME 201	Chemical Engineering Fundamentals	3 cr.
CHME 240	Chemical Engineering Thermodynamics	3 cr.
CHME 321	Physical Chemistry for Engineering Students	4 cr.
CHME 335	Fluid Mechanics	4 cr.
CHME 343	Heat and Mass Transfer for Chemical Engineers	4 cr.
CHME 350	Chemical Engineering Laboratories	3 cr.
CHME 361	Separation Processes	4 cr.
CHME 371	Reaction Engineering	4 cr.
CMHE 431	Process Control	4 cr.
CHME 497	Senior Design Project I	3 cr.
CHME 498	Senior Design Project II	3 cr.
ENGR 399	Engineering Internship	1 cr.
MECH 325	Engineering Materials	4 cr.

Chemical Engineering Technical Electives (12 credits)

Students are required to take a total of 12 credits (four courses) of technical electives in the Chemical Engineering Program. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. Students can choose from the below list to satisfy both their technical and/or free elective requirements. Additional courses may be approved by the department as technical electives.

CHME 391	Independent Study I	1-3 cr.
CHME 451	Heterogeneous Catalysis and Chemical Kinetics	3 cr.
CHME 452	Petroleum Reservoir Engineering	4 cr.
CHME 453	Oil Refining and Gas Processing	3 cr.
CHME 470	Surface Chemistry	3 cr.
CHME 471	Corrosion Engineering	3 cr.
CHME 491	Independent Study II	1-3 cr.
CHME 495	Special Topics in Chemical Engineering	3 cr.
MECH 486	Sustainable Energy	3 cr.

Typical sequence for a B.Sc. Degree in Chemical Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Intro to General Chemistry for Engineering	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities & Social Sciences	3 cr		
Year 2	Free Elective	3 cr	CHME 240 Chemical Engr. Thermodynamics	3 cr
	MATH 212 Calculus III	4 cr	MATH 211 Linear Algebra & Diff. Eq.	4 cr
	PHYS 122 University Physics II	4 cr	BUSS 201 Fund. Accounting and Finance	3 cr
	CHEM 211 Organic Chemistry (with Lab)	4 cr	CHEM 311 Biochemistry (with Lab)	4 cr
	CHME 201 Chemical Engineering Fundamentals	3 cr	CHME 335 Fluid Mechanics	4 cr
SUMMER	HUMA XXX Humanities & Social Sciences	3 cr		
Year 3	ENGR 311 Innovation & Entrepreneurship in Engineering Design	4 cr	CHME 361 Separation Processes	4 cr
	MECH 325 Engineering Materials	4 cr	CHME 371 Reaction Engineering	4 cr
	CHME 321 Physical Chemistry for Engineers	4 cr	HUMA XXX Humanities & Social Sciences	3 cr
	CHME 343 Heat and Mass Transfer for Chemical Engineers	4 cr	MATH 313 Applied Engineering Math	4 cr
			CHME 350 Chemical Engineering Laboratories	3 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	CHME 497 Senior Design Project I	3 cr	CHME 498 Senior Design Project II	3 cr
	HUMA XXX Humanities & Social Sciences	3 cr	Free Elective	3 cr
	CHME 431 Process Control (with Lab)	4 cr	Technical Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	BUSS 301 Inside Organization	3 cr	Technical Elective	3 cr

8.7 | **Department of Civil** Infrastructure and Environmental Engineering

Introduction

Civil engineering is one of the broadest engineering disciplines, encompassing many interdependent technical specialties. Civil engineers plan, design, and supervise construction of a wide variety of facilities such as space stations, offshore structures, bridges, buildings, tunnels, highways, transit systems, dams, airports, irrigation projects, distribution facilities for water, and collection and treatment facilities for wastewater and hazardous wastes. Civil engineers are problem solvers. They give solutions to pollution, aging infrastructure, traffic congestion, energy needs, floods, earthquakes, urban development, and community planning. Graduates may work at established public and private organizations or in entrepreneurial endeavours. Future career opportunities for civil engineers may range from project management to collaboration with architects, contractors, and government officials on construction efforts.

Bachelor of Science (B.Sc.) in Civil Engineering

This program lays the foundation for the core civil engineering disciplines while engaging students to study and understand the overall global civil engineering profession and industry. Principles of science and engineering are applied to the design and analysis of problems in civil engineering in well-designed course sequences to ensure that students gain hands on and problem-based learning experiences. The mission of the civil engineering program at Khalifa University is to provide solid high quality education and prepare students for successful careers in this field.

Program Objectives

- Graduates will meet the expectations of employers of Civil engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating from the Department of Civil Infrastructure and Environmental Engineering degree program will have the following abilities

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Civil Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education requirements, College of Engineering requirements, as well as Civil Engineering core and Technical Electives requirements.

Civil Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Civil Engineering requires the following additional Math courses

MATH 212	Calculus III	4 cr.
MATH 213	Probability and Statistics for Engineers	4 cr.

Civil Engineering Core Requirement (58 credits)

ENGR 200	Statics	3 cr.
	Science Elective*	3 cr.
CIVE 180	Engineering Graphics and Visualization	3 cr.
CIVE 201	Engineering Dynamics	3 cr.
CIVE 225	Mechanics of Solids	3 cr.
CIVE 310	Geomatics	3 cr.
CIVE 332	Fundamentals of Construction Engineering and Management	3 cr.
CIVE 335	Fluid Mechanics	4 cr.
CIVE 336	Civil Engineering Materials	4 cr.
CIVE 338	Geotechnical Engineering	4 cr.
CIVE 340	Behavior & Analysis of Structures	3 cr.
CIVE 341	Design of Steel Structures	3 cr.
CIVE 370	Introduction to Environmental Engineering	4 cr.
CIVE 380	Transportation Engineering	3 cr.
ENGR 399	Civil Engineering Internship	1 cr.
CIVE 442	Design of Concrete Structures	3 cr.
CIVE 470	Foundation Engineering	4 cr.
CIVE 497	Senior Design Project I	2 cr.
CIVE 498	Senior Design Project II	2 cr.

* The Science Elective should be approved by the Department.

Civil Engineering Technical Electives (6 credits)

The following is a sample list of courses that will satisfy the technical electives in the Civil Engineering Program. The student must select a total of 6 credits from this list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. In addition, courses from the list below may be taken to satisfy the free electives requirement. Additional courses may be approved by the department as technical electives.

Civil Engineering Core Requirement (58 credits)

CIVE 391	Independent Study I	1-3cr.
CIVE 450	Coastal Engineering	3 cr.
CIVE 455	Blast Effects and Modern Protective Infrastructures	3 cr.
CIVE 463	Water & Wastewater Treatment Technologies	3 cr.
CIVE 465	Ground and Surface Water Hydrology and Contaminated Transport	3 cr.
CIVE 469	Air Pollution	3 cr.
CIVE 472	Pavement Design and Transportation	3 cr.
CIVE 473	Structural Building Design	3 cr.
CIVE 475	Earth Structures: Embankment, Slopes and Buried Structures	3 cr.
CIVE 480	Project Management and Contract Administration	3 cr.
CIVE 482	Project Control & Life Cycle Execution of Constructed Facilities	3 cr.
CIVE 484	Project Planning, Scheduling & Control	3 cr.
CIVE 485	Construction Project Management	3 cr.
CIVE 488	Advanced Construction Management	3 cr.
CIVE 491	Independent Study II	1-3 cr.
CIVE 492	Urban & Transportation Planning & Design	3 cr.
CIVE 493	Airport Planning and Traffic Management	3 cr.
CIVE 495	Special Topics in Civil Engineering	3 cr.

Typical sequence for a B.Sc. degree in Civil Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	Science Elective	3 cr	MATH 213 Probability & Statistics for Engineers	3 cr
	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 212 Calculus III	4 cr
	PHYS 122 University Physics II	4 cr	CIVE 201 Engineering Dynamics	3 cr
	ENGR 200 Statics	3 cr	CIVE 225 Mechanics of Solids	4 cr
	CIVE 180 Engineering Graphics and Visualization	3 cr	CIVE 310 Geomatics	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences HUMA XXX Humanities and Social Sciences	3 cr 3 cr		
Year 3	CIVE 370 Introduction to Environmental Engineering	4 cr	CIVE 335 Fluid Mechanics	4 cr
	CIVE 332 Fundamentals of Construction Engineering and Management	3 cr	CIVE 341 Design of Steel Structures	4 cr
	CIVE 336 Civil Engineering Materials	4 cr	Free Elective	3 cr
	CIVE 340 Behavior & Analysis of Structures	3 cr	CIVE 380 Transportation Engineering	4 cr
	Free Elective	3 cr	CIVE 338 Geotechnical Engineering	3 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	CIVE 497 Senior Design Project I	2 cr	CIVE 498 Senior Design Project II	3 cr
	BUSS 201 Fundamentals of Accounting and Finance	3 cr	BUSS 301 Inside Organizations	3 cr
	ENGR 311 Innovation & Entrepreneurship in Engineering Design	4 cr	Technical Elective	3 cr
	Technical Elective	3 cr	CIVE 442 Design of Concrete Structures	3 cr
	CIVE 470 Foundation Engineering	4 cr	HUMA XXX Humanities and Social Sciences	3 cr

8.8 | **Department of** Electrical and Computer Engineering

Introduction

The Electrical and Computer Engineering (ECE) department aims to serve the society through electrical and computer engineering by educating and inspiring forward looking professionals in the various fields of electrical and computer engineering, by creating, applying, and disseminating vital knowledge and technology, and by leading the professional activities of academia, industry and government.

ECE offers B.Sc. degrees in Electrical and Electronic Engineering (with an optional concentration in Power Systems) Communication Engineering, and Computer Engineering (with an optional concentration in Software Systems), as well as M.Sc. and Ph.D. programs in ECE. ECE encompasses advanced communications and information systems, information security, e-services and networks, multimedia communications, and embedded systems. ECE faculty collaborate with the many Research Institutes of Khalifa University on research related to robotics, communications, semiconductors, etc. They also collaborate frequently with prestigious research laboratories around the world. The ECE Research is aligned with the 2030 Abu Dhabi strategic plan calling for diversification of the economy beyond oil and gas and for promoting innovation, entrepreneurship and spinoffs in the semiconductor, energy, and ICT sectors, among others.

All ECE programs offer many benefits to business and industry. There is the opportunity to influence research and education, and to participate in long-range technical assessments of problems and directions in the field. Contacts with prospective employers are easily established; affiliates have early access to student resumes, and to student and faculty publications. Internships in local and national industry provide students with a complementary element to their education. The result of this interaction is greater excellence in both the research and teaching missions of the ECE department, whose vision is to achieve the stature of a world-class Department and become the premiere technology hub in the Gulf Region.

Bachelor of Science (B.Sc.) in Communication Engineering

The continued growth in all areas of communication technology means that communication engineering graduates are highly qualified for positions in novel product design and innovation, as well as product and systems management. All types of modern communications, from mobile phones and satellites, to digital television and internet, require the skills of communication engineers and provide a platform for rapid career development.

The communication engineering B.Sc. program at Khalifa University offers students the high quality education needed by all highly qualified future communication engineers. Students are offered opportunities to customize their education by selecting from a pool of technical elective courses.

Program Objectives

- Graduates will meet the expectations of employers of Communication engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating with a Communication Engineering degree will have the following abilities

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Communication Engineering, students must successfully complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering requirements, as well as Communication Engineering core and Technical Electives requirements. The normal length of the program is 140 credits.

Communication Engineering Math/Sciences Requirements (8 credits)

To satisfy the College of Engineering requirements, the Communication Engineering program requires the following additional Math courses

MATH 311	Probability and Statistics with Discrete Mathematics	4 cr.
MATH 312	Complex Variables with Applications	4 cr.

Communication Engineering Core Requirements (55 credits)

ECCE 210	Digital Logic Design	4 cr.
ECCE 220	Electric Circuits	4 cr.
ECCE 230	Object Oriented Programming	3 cr.
ECCE 260	Principles of Telecommunications	3 cr.
ECCE 302	Signal Processing	4 cr.
ECCE 312	Electronic Circuits and Devices	4 cr.
ECCE 316	Microprocessor Systems	4 cr.
ECCE 320	Applied Electromagnetics	3 cr.
ECCE 360	Communication Systems	4 cr.
ECCE 362	Digital Communications I	3 cr.
ECCE 364	Information Theory	3 cr.
ECCE 370	Communication Networks	3 cr.
ECCE 460	Wireless Communications	3 cr.
ECCE 470	Antennas and Propagation	3 cr.
ECCE 497	Senior Design Project I	3 cr.
ECCE 498	Senior Design Project II	3 cr.
ENGR 399	Engineering Internship	1 cr.

Communication Engineering Technical Electives (9 credits)

Students are required to take a total of 9 credits (three courses) from ECE department technical electives list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. Students can choose any course from the list to satisfy both their technical and/or free elective requirements as long as it is not a core requirement course for their program. Additional courses may be approved by the department as technical electives.

Typical sequence for a B.Sc. degree in Communication Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 311 Probability and Statistics with Discrete Mathematics	4 cr
	PHYS 122 University Physics II	4 cr	MATH 312 Complex Variables with Applications	4 cr
	HUMA XXX Humanities and Social Sciences	3 cr	ECCE 260 Principles of Telecommunications	3 cr
	ECCE 210 Digital Logic Design	4 cr	ECCE 220 Electric Circuits	4 cr
	ECCE 230 Object-Oriented Programming	3 cr	BUSS 201 Fundamentals of Accounting and Finance	3 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	ECCE 302 Signal Processing	4 cr	ECCE 362 Digital Communications I	3 cr
	ECCE 360 Communication Systems	4 cr	ECCE 370 Communication Networks	3 cr
	ECCE 320 Applied Electromagnetics	3 cr	ECCE364 Information Theory	3 cr
	ECCE 312 Electronic Circuits and Devices	4 cr	ENGR 311 Innovation and Entrepreneurship in Engineering Design	4 cr
	HUMA XXX Humanities and Social Sciences	3 cr	ECCE 316 Microprocessor Systems	4 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	ECCE 460 Wireless Communications	3 cr	BUSS 301 Inside Organizations	3 cr
	Free Elective	3 cr	ECCE 470 Antenna and Propagation	3 cr
	Technical Elective	3 cr	Free Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	ECCE 497 Senior Design Project I	3 cr	ECCE 498 Senior Design Project II	3 cr

Bachelor of Science (B.Sc.) in Computer Engineering

Computer Engineering is concerned with the design and development of computers and computer-based systems. It involves the study of hardware, software, and networking. A Computer Engineering degree provides a strong understanding of the relationship between computer hardware and software and all related issues. It is the key to many career opportunities in both government and industry sectors. Students are offered opportunities to customize their education by selecting from a pool of technical elective courses. Khalifa University's program also gives students the opportunity to specialize in software systems.

Program Objectives

- Graduates will meet the expectations of employers of Computer engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating with a degree in Computer Engineering will have the following abilities:

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Computer Engineering, students must successfully complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering requirements, as well as Computer Engineering core and Technical Electives requirements. Students may also opt for the Software Systems concentration. The normal length of the program is 140 credits.

Computer Engineering Math/Sciences Requirements (8 credits)

To satisfy the College of Engineering requirements, Computer Engineering requires the following additional Math courses

MATH 311	Probability and Statistics with Discrete Mathematics	4 cr.
MATH 312	Complex Variables with Applications	4 cr.

Computer Engineering Core Requirements (52 credits)

ECCE 210	Digital Logic Design	4 cr.
ECCE 220	Electric Circuits	4 cr.
ECCE 230	Object Oriented Programming	3 cr.
ECCE 260	Principles of Telecommunications	3 cr.
ECCE 302	Signals Processing	4 cr.
ECCE 312	Electronic Circuits and Devices	4 cr.
ECCE 316	Microprocessor Systems	4 cr.
ECCE 342	Data Structures and Algorithms	3 cr.
ECCE 336	Introduction to Software Engineering	3 cr.
ECCE 350	Computer Architecture and Organization	3 cr.
ECCE 354	Operating Systems	3 cr.
ECCE 356	Computer Networks	4 cr.
ECCE 450	Embedded Systems	3 cr.
ECCE 497	Senior Design Project I	3 cr.
ECCE 498	Senior Design Project II	3 cr.
ENGR 399	Engineering Internship	1 cr.

Computer Engineering Technical Electives (12 credits)

Students are required to take a total of 12 credits (four courses) from ECE department technical electives list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. Students can choose any course from the list to satisfy both their technical and/or free elective requirements as long as it is not a core requirement course for their program. Additional courses may be approved by the department as technical electives.

Computer Engineering – Software Systems (Concentration)

A concentration at Khalifa University leads to a specialized degree and will be specifies on the diploma and the student's academic record (transcripts). Before selecting their technical/free electives, Electrical and Electronic Engineering students have the option of selecting the Power Systems Concentration.

In case students opt for the Power Systems Concentration, instead of taking 12 credits of technical elective courses and 3 credits of free elective course, they should take the following five courses

ECCE 330	System Analysis and Design	3 cr.
ECCE 432	Introduction to Human Computer Interfaces	3 cr.
ECCE 434	Database Systems	3 cr.
ECCE 436	Software Testing and Quality Assurance	3 cr.
ECCE 438	Software Architecture	3 cr.

Typical sequence for a B.Sc. degree in Computer Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 311 Probability and Statistics with Discrete Mathematics	3 cr
	PHYS 122 University Physics II	4 cr	MATH 312 Complex Variables with Applications	4 cr
	HUMA XXX Humanities and Social Sciences	3 cr	ECCE 260 Principles of Telecommunications	3 cr
	ECCE 210 Digital Logic Design	4 cr	ECCE 220 Electric Circuits	4 cr
	ECCE 230 Object-Oriented Programming	3 cr	BUSS 201 Fundamentals of Accounting and Finance	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	ECCE 342 Data Structures and Algorithms	3 cr	ENGR 311 Innovation and Entrepreneurship in Engineering Design	4 cr
	ECCE 336 Introduction to Software Engineering	3 cr	ECCE 354 Operating Systems	4 cr
	ECCE 350 Computer Architecture and Organization	3 cr	ECCE 316 Microprocessor Systems	3 cr
	ECCE 312 Electronic Circuits and Devices	4 cr	Technical Elective	4 cr
	ECCE 302 Signal Processing	4 cr	ECCE 356 Computer Networks	3 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	ECCE 450 Embedded Systems	3 cr	BUSS 301 Inside Organizations	3 cr
	HUMA XXX Humanities and Social Sciences	3 cr	Free Elective	3 cr
	Free Elective	3 cr	Technical Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	ECCE 497 Senior Design Project I	3 cr	ECCE 498 Senior Design Project II	3 cr

Bachelor of Science (B.Sc.) in Electrical and Electronic Engineering

Electrical and Electronic systems are at the heart of the new industrial revolution and they play a vital role that affects nearly every aspect of our modern daily lives. These systems require professional engineers for their design, development, commissioning and service. The demand for such engineers is growing in UAE because of the new electrical and electronic industries.

The B.Sc. in Electrical and Electronic Engineering program at Khalifa University offers students quality education that provides them with the knowledge, techniques and skills that will be needed by the next generation of highly qualified engineers. The program has well-designed core courses to ensure that students gain hands-on and problem-based learning experiences. The program also gives the students the options of selecting technical electives from a pool of courses or specializing in Power Systems.

Program Objectives

- Graduates will meet the expectations of employers of Electrical and Electronic engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Electrical and Electronic Engineering, students must successfully complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, the College of Engineering requirements, as well as the Electrical and Electronic Engineering core and Technical Electives requirements. Students may also select the Power System concentration. The normal length of the program is 140 credits.

Electrical and Electronic Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Electrical and Electronic Engineering requires the following additional Math courses

MATH 311	Probability and Statistics with Discrete Mathematics	4 cr.
MATH 312	Complex Variables with Application	4 cr.

Electrical and Electronic Engineering Core Requirement (52 credits)

ECCE 210	Digital Logic Design	4 cr.
ECCE 220	Electric Circuits	4 cr.
ECCE 230	Object Oriented Programming	3 cr.
ECCE 260	Principles of Telecommunications	3 cr.
ECCE 302	Signals Processing	4 cr.
ECCE 312	Electronic Circuits and Devices	4 cr.
ECCE 316	Microprocessor Systems	4 cr.
ECCE 320	Applied Electromagnetics	3 cr.
ECCE 324	Electromechanical Systems	4 cr.
ECCE 360	Communication Systems	4 cr.
ECCE 415	Feedback Control Systems	4 cr.
ECCE 497	Senior Design Project I	3 cr.
ECCE 498	Senior Design Project II	3 cr.
ENGR 399	Engineering Internship	1 cr.

Electrical and Electronic Engineering Technical Electives (12 credits)

Students are required to take a total of 12 credits (four courses) from ECE department technical electives list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. Students can choose any course from the list to satisfy both their technical and/or free elective requirements as long as it is not a core requirement course for their program. Additional courses may be approved by the department as technical electives.

Electrical and Electronic Engineering – Power Systems (Concentration)

A concentration at Khalifa University leads to a specialized degree, which will be specified on the diploma and the student's academic record (transcripts). Before selecting their technical/free electives, Electrical and Electronic Engineering students have the option of selecting the Power Systems Concentration.

In case students opt for the Power Systems Concentration, instead of taking 12 credits of technical elective courses and 3 credits of free elective course, they should take the following five courses

ECCE 421	Power System Analysis	3 cr.
ECCE 422	High Voltage Engineering	3 cr.
ECCE 423	Power Electronics	3 cr.
ECCE 425	Power System Stability and Control	3 cr.
ECCE 426	Power Electronics for Renewables Integration	3 cr.

Typical sequence for a B.Sc. degree in Electrical and Electronic Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	ECCE 210 Digital Logic Design	4 cr	ECCE 260 Principles of Telecommunications	3cr
	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 312 Complex Variables with Applications	4 cr
	PHYS 122 University Physics II	4 cr	MATH 311 Probability and Statistics with Discrete Mathematics	4 cr
	HUMA XXX Humanities and Social Sciences	3 cr	ECCE 220 Electric Circuits	4 cr
	ECCE 230 Object-Oriented Programming	3 cr	BUSS 201 Fundamentals of Accounting and Finance	3 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	HUMA XXX Humanities and Social Sciences	3 cr	ENGR 311 Innovation and Entrepreneurship in Engineering Design	4 cr
	ECCE 302 Signal Processing	4 cr	ECCE 316 Microprocessor Systems	4 cr
	ECCE 320 Applied Electromagnetics	3 cr	ECCE 326 Semiconductors	4 cr
	ECCE 312 Electronic Circuits and Devices	4 cr	ECCE 324 Electromechanical Systems	4 cr
	ECCE 360 Communication Systems	4 cr		
SUMMER	ENGR 399 Internship	1 cr		
Year 4	ECCE 415 Feedback Control System	4 cr	Free Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	Technical Elective	3 cr	Technical Elective	3 cr
	Free Elective	3 cr	BUSS 301 Inside Organizations	3 cr
	ECCE 497 Senior Design Project I	3 cr	ECCE 498 Senior Design Project II	3 cr

Technical Electives for Electrical and Computer Engineering Programs (12 credits)

Students in any of the three Electrical and Computer Engineering Programs are required to take a total of 12 credits of technical electives. At most 3 credits of technical electives may be at level 300 and at most 3 credits may be for independent study. To satisfy their technical/free elective requirements, students may choose courses from the following list. Additional courses may be approved as technical electives by the department.

ECE Technical Electives

ECCE 320	Applied Electromagnetics	3 cr.
ECCE 360	Communication Systems	4 cr.
ECCE 362	Digital Communications I	3 cr.
ECCE 364	Information Theory	3 cr.
ECCE 370 or ECCE 356	Communication Networks or Computer Networks	3 cr. or 4 cr
ECCE 391	Independent Study I	1-3 cr.
ECCE 460	Wireless Communications	3 cr.
ECCE 470	Antennas and Propagation	3 cr.
ECCE 461	Digital Communications II	3 cr.
ECCE 462	Modulation and Coding Techniques	3 cr.
ECCE 472	Optical Communications	3 cr.
ECCE 482	Broadband Telecommunications	3 cr.
ECCE 484	Satellite Communications	3 cr.
ECCE 336	Introduction to Software Engineering	3 cr.
ECCE 350	Computer Architecture and Organization	3 cr.
ECCE 354	Operating Systems	3 cr.
ECCE 342	Data Structures and Algorithms	3 cr.
ECCE 330	System Analysis and Design	3cr.
ECCE 341	Java and Network Programming	3 cr.
ECCE 432	Introduction to Human Computer Interfaces	3 cr.
ECCE 434	Database Systems	3 cr.
ECCE 436	Software Testing and Quality Assurance	3 cr.
ECCE 438	Software Architecture	3 cr.
ECCE 440	Distributed Systems	3 cr.
ECCE 444	Computer Security	3 cr.
ECCE 446	Network Security	3 cr.
ECCE 448	Cloud Infrastructure and Services	3 cr.
ECCE 454	Artificial Intelligence	3 cr.

ECCE 326	Introduction to Semiconductor Devices	4 cr.
ECCE 324	Electromechanical Systems	4 cr.
ECCE 415	Feedback Control Systems	4 cr.
ECCE 401	Filter Synthesis	3 cr.
ECCE 404	Microwave Circuits and Devices	3 cr.
ECCE 406	Measurement and Instrumentation	3 cr.
ECCE 408	Digital Systems Design	3 cr.
ECCE 410	VLSI Systems Design	3 cr.
ECCE 411	Analog Integrated Circuits Design	3 cr.
ECCE 421	Power System Analysis	3 cr.
ECCE 422	High Voltage Engineering	3 cr.
ECCE 423	Power Electronics	3 cr.
ECCE 425	Power System Stability and Control	3 cr.
ECCE 426	Power Electronics for Renewables Integration	3 cr.
ECCE 450	Embedded Systems	3 cr.
ECCE 456	Image Processing and Analysis	3 cr.
ECCE 491	Independent Study II	1-3 cr.
ECCE 495	Special Topics in ECE	3 cr.

8.09 | **Department of** Humanities and Social Sciences

Introduction

The Department of Humanities and Social Sciences is part of the College of Engineering. This Department does not offer undergraduate degree programs at present; however, it runs courses that support degree programs across the University. The general areas and the courses offered are listed below

English Language Courses

ENGL 111	English Communication I	4 cr.
ENGL 112	English Communication II	4 cr.
ENGL 220	Technical Writing and Communication	3 cr.

Business Courses

BUSS 201	Fundamentals of Accounting and Finance	3 cr.
BUSS 301	Inside Organizations	3 cr.
BUSS 395	Special Topics in Business Studies	3 cr.

Humanities and Social Sciences Courses

HUMA 101	Arabic Language	3 cr.
HUMA 102	Islamic Culture	3 cr.
HUMA 105	Emirates Society	3 cr.
HUMA 106	Gulf Region Economic and Social Outlook	3 cr.
HUMA 110	Middle East Studies	3 cr.
HUMA 111	Islamic History	3 cr.
HUMA 112	Sciences in Islam	3 cr.
HUMA 130	Introduction to Linguistics	3 cr.
HUMA 140	Introduction to Psychology	3 cr.
HUMA 141	Introduction to Sociology	3 cr.
HUMA 142	Introduction to Science and Technology Studies	3 cr.
HUMA 210	Introduction to Islamic Law	3 cr
HUMA 211	Islam and Modernity	3 cr.
HUMA 212	History of Modern Science	3 cr.
HUMA 295	Special topics in Humanities	3 cr.
HUMA 220	Public Speaking	3 cr.
HUMA 311	Engineering Communication	3 cr.
ECON 120	Engineering Economics	3 cr.

8.10 | **Department of** Industrial and Systems Engineering

Introduction

Industrial and Systems Engineers make decisions concerning the best utilization of people, material, equipment and energy to minimize costs and make the organizations successful. They are productivity, quality, efficiency and optimization experts. They use sophisticated mathematical and statistical tools to design facilities, processes, supply chains etc., and generate optimal operation plans to produce better products and deliver better services. They are vital for businesses to become and remain competitive in the global markets.

Industrial and Systems Engineering (ISYE) requires strong analytical and creative thinking skills for effective decision-making. Industrial and Systems Engineers are thought leaders often known for their big picture and vision of any business or enterprise setting. Their ability to function on cross-functional teams consisting of several engineering disciplines offers them a rapid access to senior management positions.

ISYE graduates have the flexibility to work in a variety of sectors including manufacturing, production and operations, supply chain and logistics, transportation, healthcare, financial systems, etc. Career specializations include: Production and operations managers, process engineers, quality managers, operations research analysts, supply chain managers, healthcare managers and others.

Bachelor of Science (B.Sc.) in Industrial and Systems Engineering

The ISYE Program at Khalifa University provides a state-of-art undergraduate education to prepare students for successful and long-standing careers in the competitive global economy. The curriculum, led by world-class teachers, is based on strong fundamentals in operations research and is enriched by coursework that targets the specific needs of local industries. Students gain valuable industrial experience through a summer internship and also have the opportunity to participate in international exchange programs during their junior year.

Program Objectives

- Graduates will meet the expectations of employers of Industrial and Systems Engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating from the Department of Industrial and Systems Engineering degree program will have the following abilities:

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Industrial and Systems Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering Requirements, as well as Industrial and Systems Engineering core and Technical Electives requirements. The normal credit requirement of the program is 140 credits.

Industrial & Systems Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Industrial & Systems Engineering requires the following additional Math courses:

MATH 212	Calculus III	4 cr.
MATH 213	Probability and Statistics for Engineers	4 cr.

Industrial and Systems Engineering Core Requirement (55 credits)

ISYE 200	Engineering Economic Analysis	3 cr.
ISYE 201	Introduction to Systems Engineering	3 cr.
ISYE 251	Operations Research I	3 cr.
ISYE 271	Modern Methods of Manufacturing	4 cr.
ISYE 311	Quality Control and Reliability	4 cr.
ISYE 331	Stochastic Processes	3 cr.
ISYE 341	Simulation Modeling and Analysis	4 cr.
ISYE 351	Production, Operations, and Inventory Management	3 cr.
ISYE 352	Lean Manufacturing	3 cr.
ISYE 360	Human Factors and Safety Engineering	4 cr.
ISYE 361	Data and Information Engineering	3 cr.
ENGR 399	Internship	1 cr.
ISYE 430	Supply Chain and Logistics	4 cr.
ISYE 451	Operations Research II	3 cr.
ISYE 475	Facilities Planning and Warehousing	4 cr.
ISYE 497	Senior Design Project I	3 cr.
ISYE 498	Senior Design Project II	3 cr.

Industrial and Systems Engineering Technical Course Electives (9 credits)

The following is a sample list of courses that will satisfy the technical electives in the Industrial and Systems Engineering Program. The student must select a total of 9 credits from this list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. In addition, courses from the list below may be taken to satisfy the free electives requirement. Additional courses may be approved by the department as technical electives.

ISYE 391	Independent Study I	1-3 cr.
ISYE 401	Advanced Systems Engineering	3 cr.
ISYE 422	Reliability	3 cr.
ISYE 431	Forecasting and Time Series	3 cr.
ISYE 432	Advanced Stochastic Processes	3 cr.
ISYE 433	Advanced Statistics	3 cr.
ISYE 441	Advanced Simulation	3 cr.
ISYE 445	Six-Sigma Methodology and Applications	3 cr.
ISYE 461	Design of Human-Integrated Systems	3 cr.
ISYE 471	Advanced Supply Chain Logistics	3 cr.
ISYE 480	Financial Engineering	3 cr.
ISYE 481	Procurement and Supply Management	3 cr.
ISYE 485	Stochastic Manufacturing and Service Systems	3 cr.
ISYE 491	Independent Study II	1-3 cr.
ISYE 495	Special Topics in Industrial and Systems Engineering	3 cr.

Typical sequence for a B.Sc. degree in Industrial and Systems Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	MATH 211 Differential Equations and Linear Algebra	4 cr	ISYE 200 Engineering Economic Analysis	3 cr
	MATH 213 Probability & Statistics for Engineers	4 cr	MATH 212 Calculus III	4 cr
	PHYS 122 University Physics II	4 cr	ISYE 271 Modern Methods of Manufacturing	4cr
	ISYE 201 Intro to Systems Engineering	3 cr	HUMA XXX Humanities and Social Sciences	3 cr
	BUSS 201 Fundamentals of Accounting and Finance	3 cr	ISYE 251 Operations Research I	3 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	ISYE 331 Stochastic Processes	3 cr	HUMA XXX Humanities and Social Sciences	3 cr
	ISYE 311 Quality Control & Reliability	4 cr	Free Elective 1	3 cr
	ISYE 361 Data and Information Engineering	3 cr	ISYE 341 Simulation Modeling and Analysis	4 cr
	ISYE 351 Production, Operations and Inventory Management	3 cr	ISYE 352 Lean Manufacturing	3 cr
	ENGR 311 Innovation and Entrepreneurship in Engineering Design	4 cr	ISYE 360 Human Factors and Safety Engineering	4 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	Technical Elective 1	3 cr	BUSS 301 Inside Organizations	3 cr
	Free Elective 2	3 cr	ISYE 475 Facilities Planning and Warehousing	4 cr
	ISYE 430 Supply Chain and Logistics	4 cr	Technical Elective 2	3 cr
	ISYE 451 Operations Research II	3 cr	Technical Elective 3	3 cr
	ISYE 497 Senior Design Project I	3 cr	ISYE 498 Senior Design Project II	3 cr

8.11 | Department of Mechanical Engineering

Introduction

Mechanical engineers utilize their knowledge and skills across a wide range of industries. They play a major role in the design and manufacturing of complex engineering systems. The demand for mechanical engineers in the UAE will expand as the amount of manufacturing and industrial activity in the UAE continues to grow. Mechanical devices ranging from automotive parts to power plants require mechanical engineers in the design, manufacturing and support processes, making them employable across multiple industries.

Bachelor of Science (B.Sc.) in Mechanical Engineering

The mechanical engineering program is designed to provide comprehensive engineering education for students interested in mechanics, thermo-fluids, manufacturing, and controls/automation. Complex mechanical systems involve structures, advanced materials, sensors, and thermo-fluid systems. Given KU's mission, the students are exposed to this core engineering discipline through the study and application of the principles of engineering to a broad range of systems, ranging from nano devices to large scale power plants. Laboratories and industry-led projects allow graduates to be ready to create the next generation of ideas and products.

Program Objectives

- Graduates will meet the expectations of employers of Mechanical engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Outcomes

Students graduating from the Department of Mechanical Engineering degree program will have the following abilities

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulate, and solve engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) A recognition of the need for broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Structure and Requirements

To be recommended for the degree of B.Sc. in Mechanical Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover an extended set of the University General Education Requirements, College of Engineering requirements, as well as the Mechanical Engineering core and Technical Electives requirements. The normal length of the program is 140 credits.

Mechanical Engineering Math/Sciences Requirement (8 credits)

To satisfy the College of Engineering requirements, Mechanical Engineering requires the following additional Math courses:

MATH 212	Calculus III	4 cr.
MATH 223	Probability and Statistical Inference	4 cr.

Mechanical Engineering Core Requirement (55 credits)

MECH 180	Computer Aided Design	3 cr.
ENGR 200	Statics	3 cr.
MECH 201	Engineering Dynamics	3 cr.
MECH 225	Mechanics of Solids	4 cr.
MECH 240	Thermodynamics	3 cr.
MECH 270	Design for Manufacturability	4 cr.
MECH 325	Engineering Materials	4 cr.
MECH 335	Fluid Mechanics	4 cr.
MECH 350	Dynamic Systems and Vibration	3 cr.
MECH 356	Mechatronics	4 cr.
MECH 384	Control of Mechanical Systems	3 cr.
MECH 387	Machine Element Design	3 cr.
ENGR 399	Engineering Internship	1 cr.
MECH 443	Heat and Mass Transfer	4 cr.
MECH 486	Sustainable Energy	3 cr.
MECH 497	Senior Design Project I	3 cr.
MECH 498	Senior Design Project II	3 cr.

Mechanical Engineering Technical Electives (9 credits)

The following is a sample list of courses that will satisfy the technical electives in the Mechanical Engineering Program. The student must select a total of 9 credits from this list. At most 3 credits of the technical electives may be at 300-level and at most 3 credits may be independent study. In addition, courses from the list below may be taken to satisfy the free electives requirement.

AERO 426	Designing with Composites	3 cr.
ENGR 455	Finite Element Analysis	3 cr.
ENGR 465	Methods of Engineering Analysis	3 cr.
MECH 391	Independent Study I	1-3 cr.

MECH 405	Vibration Analysis	3 cr.
MECH 420	Materials: Strength and Fracture	3 cr.
MECH 421	Mechanics of Deformable Solids	3 cr.
MECH 422	Fatigue and Fracture Analysis	3 cr.
MECH 435	Fluid Machinery	3 cr.
MECH 441	Applied Thermodynamics	3 cr.
MECH 445	Heating and Air Conditioning	3 cr.
MECH 446	Internal Combustion Engines	3 cr.
MECH 450	Vehicle Engineering	3 cr.
MECH 455	Robotics	3 cr.
MECH 465	Bioengineering	3 cr.
MECH 485	Power Plant Systems Design	3 cr.
MECH 491	Independent Study II	1-3 cr.
MECH 495	Special Topics in Mechanical Engineering	3 cr.

Typical sequence for a B.Sc. degree in Mechanical Engineering

Year 1	ENGL 111 English Communication I	4 cr	ENGL 112 English Communication II	4 cr
	MATH 111 Calculus I	4 cr	MATH 112 Calculus II	4 cr
	CHEM 115 Introduction to General Chemistry for Engineers	4 cr	PHYS 121 University Physics I	4 cr
	ENGR 111 Engineering Design	4 cr	ENGR 112 Introduction to Computing	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 2	MECH 180 Computer Aided Design	3 cr	HUMA XXX Humanities and Social Sciences	3 cr
	MATH 211 Differential Equations and Linear Algebra	4 cr	MATH 212 Calculus III	4 cr
	PHYS 122 University Physics II	4 cr	MECH 240 Thermodynamics	3 cr
	ENGR 200 Statics	3 cr	MECH 201 Engineering Dynamics	3 cr
	MECH 270 Design for Manufacturability	4 cr	MECH 225 Mechanics of Solids	4 cr
SUMMER	HUMA XXX Humanities and Social Sciences	3 cr		
Year 3	ENGR 311 Innovation and Entrepreneurship in Engineering Design	4 cr	BUSS 201 Fundamentals of Accounting and Finance	3 cr
	MECH 325 Engineering Materials	4 cr	Free Elective	3 cr
	MATH 223 Probability and Statistical Inference	4 cr	MECH 335 Fluid Mechanics	4 cr
	MECH 350 Dynamic Systems & Vibration	3 cr	MECH 356 Mechatronics	4 cr
	MECH 384 Control of Mechanical Systems	3 cr	MECH 387 Machine Element Design	3 cr
SUMMER	ENGR 399 Internship	1 cr		
Year 4	BUSS 301 Inside Organizations	3 cr	Technical Elective	3 cr
	Technical Elective	3 cr	Free Elective	3 cr
	MECH 497 Senior Design Project I	3 cr	Technical Elective	3 cr
	HUMA XXX Humanities and Social Sciences	3 cr	MECH 498 Senior Design Project II	3 cr
	MECH 443 Heat and Mass Transfer	4 cr	MECH 486 Sustainable Energy	3 cr

8.12 | **Department of** Nuclear Engineering

The Department of Nuclear Engineering does not offer an undergraduate degree but students can choose the minor in nuclear engineering as a minor in any of the undergraduate degrees on offer. The minor in Nuclear Engineering is currently restricted to sponsored students from specific agencies. The student should check with registration office if they are eligible to enroll in this minor.

Minor in Nuclear Engineering

The Minor in Nuclear Engineering is designed to provide undergraduate students from other appropriate engineering programs (mechanical, electrical, chemical etc.) with the fundamentals of nuclear physics and engineering theory and practice, necessary to equip them with a sound understanding of the nuclear engineering that underpins a nuclear energy program.

The fundamental principle of nuclear power is to harness the energy released when a nuclear reaction results in the splitting of the uranium atom, a process called nuclear fission, which also results in the creation of ionizing radiation. The courses designed for this Nuclear Engineering Minor will cover the following three fundamental nuclear engineering areas of study necessary to achieve the program goals and learning outcomes given below:

- NUCE 301 – Radiation Science and Health Physics
- NUCE 401 – Introduction to Nuclear Reactor Physics
- NUCE 402 – Introduction to Nuclear Systems and Operation

Goals

The goals of the program are

- To provide graduates with fundamental knowledge in nuclear engineering.
- To enable graduates to relate nuclear engineering theory to practice.
- To equip graduates with design and problem solving skills in nuclear engineering.
- To prepare graduates for careers as nuclear engineering professionals.
- To encourage graduates to pursue self-learning and personal development experiences.

Student Outcomes

A student graduating with a Minor in Nuclear Engineering will be able to

a) Demonstrate a basic level of understanding in nuclear engineering.
b) Practice a sound level of nuclear safety awareness and culture.
c) Analyze and characterize existing nuclear engineering systems.
d) Design the basics of a nuclear engineering system, component, or process to meet desired needs.
e) Use the basic techniques, skills and modern tools necessary for nuclear engineering practice.
f) Conduct supervised investigation in the field of nuclear engineering with rigor and discrimination.
g) Communicate and write appropriately in the area of nuclear engineering.
h) Understand the basics of regulatory and ethical issues and professional responsibility related to nuclear engineering.
i) Realize the impact of nuclear engineering in a global and societal context.
j) Recognize the need for, and engage in, life-long learning.

Structure

Requirements : Students must take all five courses

NUCE 302 Applied Mathematics for Nuclear Engineering (or MATH 211 Differential Equations and Linear Algebra 4 cr.)	3 cr.
NUCE 303 Engineering Principles for Nuclear Engineering (or MECH 443 Heat and Mass Transfer 4 cr.)	3 cr.
NUCE 301 Radiation Science and Health Physics	3 cr.
NUCE 401 Introduction to Nuclear Reactor Physics	3 cr.
NUCE 402 Introduction to Nuclear Systems and Operation OR	3 cr.
NUCE 403 Introduction to Nuclear Technology and Reactor Systems	3 cr.

8.13 | MINOR IN UAV

The College of Engineering is excited to announce a new multidisciplinary minor degree program in Unmanned Aerial Vehicles (UAV). Being high-tech intelligent machines capable of traveling by air, land or sea without a human crew on board, UAVs have recently gained increasing popularity and strategic significance worldwide. Powered with advanced computing technology, sensing capability and mechanical design, unmanned aerial vehicles are versatile machines able to maneuver in diverse, and dangerous environments. Equipped with sensors, a UAV could go into the heart of a storm or a spreading wildfire to monitor threats to human lives and property or travel through remote areas to gather environmental data.

The future development of UAV is an essential pillar to safety, security and sustainability, which are both highlights of the promising Abu Dhabi 2030 plan. The demanding need of expertise in this field requires highly educated individuals who understand the fundamentals of UAV in terms of design, engineering, operation and sensor data analysis. To this end, the objective of the interdisciplinary minor in UAV is to provide students with skills and experiences that will help them better apply the knowledge gained in their majors to specialized problems in the field of Unmanned Aerial Vehicles.

Goals

In this minor the students will design, construct and test UAV systems. The topics of this course include: platform design and construction, actuator and propulsion system design, sensing system design (based on inertial sensors, positioning system, vision, and etc.), auto-pilot system design and performance tuning, ground control station development (data links, protocols, security, and etc.), and UAV operation and interfacing.

During the minor the students learn the theory and practice of the modelling and control of UAV systems. The topics include: the first-principles modelling and simulation of fixed-wing and rotorcraft UAVs, flight dynamics modelling via system identification, on-board flight control system design, and control performance tuning of the auto-pilot system. During the minor the students will learn advanced topics on navigation systems for UAVs based and advanced sensing. These topics include trajectory planning, path planning and obstacle avoidance (classical and reactive paradigms), and localization and mapping algorithms.

The UAV Minor is currently restricted to UAE Nationals. The students should check with the registration office if they are eligible to enrol in this minor.

Structure

Requirements : Students must take all six courses (Total 18 credits)

ROBO 301 Dynamic and Control Systems OR (AERO/MECH 201 AND (AERO/MECH 350 OR ECCE 415))	3 cr.
ROBO 302 Signals and Communications OR (ECCE 302 AND (ECCE 356 or ECCE 360))	3 cr.
ROBO 401 UAV Modeling and Control	3 cr.
ROBO 402 UAV Sensing	3 cr.
ROBO 403 UAV Navigation	3 cr.
ROBO 404 UAV Systems	3 cr.

Restrictions

ROBO 301 System Dynamics and Control (3-0-3)

Students majoring in Aerospace and Mechanical Engineering are not allowed to take this course rather they have to take the combination AERO/MECH 201 AND (AERO/MECH 350 OR ECCE 415)

ROBO 302 Signals and Communications (3-0-3)

Students majoring in Electrical and Electronic, Communication, or Computer Engineering are not allowed to take this course rather they have to take the combination ECCE 302 AND (ECCE 356 or ECCE 360)

COURSE DESCRIPTIONS

09

Course Title, Code and Credit Value

Each course offered at the University has a unique code, a title and a credit value. The course code consists of four letters that reflect its discipline or field of study, followed by a three-digit number that indicates its level. The title of the course gives an indication of its content.

The credit value of the course has three numbers

- The first one gives the number of lecture hours per week,
- The second shows the number of laboratory or problem solving hours per week,
- The third one gives the overall credit value of the course which will contribute to the particular degree requirements.

The example below further explains the course code and value information

MATH	111	Calculus 1	4 - 0 - 4
Letters part of the code	Numerical part of the code	Course title	› Lecture hours per week › Laboratory hours Per week › Overall credit value

AERO 201 Engineering Dynamics (3-0-3)
*(Cross listed with MECH 201; CIVE 201)
Prerequisite: ENGR 200
Review of kinematics and kinetics of particles: rectilinear and curvilinear motions; Newton's second law; energy and momentum methods. Kinematics and kinetics of rigid bodies: plane motion of rigid bodies; forces and accelerations; energy and momentum methods.

AERO 215 Introduction to Aerospace Engineering (2-3-3)
Prerequisite: ENGR 111
Introduction to the field of aerospace engineering, basic aerospace systems and disciplines, and a working vocabulary of the field. Demonstration of conceptual design through examples.

AERO 220 Aerospace Materials (3-0-3)
Prerequisite: PHYS 121
Materials (metals, alloys, polymers) in engineering service; relationship of inter-atomic bonding, crystal structure and defect structure (vacancies, dislocations) to material properties; polymers, ceramics, composites, phase diagrams and alloys; microstructure control (heat treatment) and mechanical properties; material failure; corrosion.

AERO 225 Mechanics of Solids (3-3-4)
*(Cross listed with MECH 225)
Prerequisite: ENGR 200
The course is an introduction to the mechanics of deformable solids applied to basic engineering structures. It covers the concepts of stress and strain at a point; deformation of axial members; symmetric and unsymmetrical bending of elastic and elastic-perfectly plastic beams; torsion of open and closed section; beam deflection; stress and strain transformations, and elastic buckling of columns.

AERO 240 Thermodynamics (3-2-4)
Prerequisite: PHYS 121
Co-requisite: MATH 212
Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties of pure substance, the first law analysis of closed and open systems, the concept of entropy, and the second law of thermodynamics. Integration of these concepts into the analysis of basic power and refrigeration cycles.

AERO 321 Aerospace Structures (3-0-3)
Prerequisite: AERO 225 (AERO 320)
Basic concepts of the design/failure criteria for aerospace structures, advanced strength of materials analysis of elastic structures, materials selection, structural assemblies, vibration and bending of plates and beams and analysis of aircraft skin structures.

AERO 335 Aerodynamics I (3-3-4)
Prerequisites: MATH 212; AERO 215
Introduction to aerodynamics; conservation equations (integral and differential forms) for mass, momentum, and energy; potential flow; irrotational versus rotational flow; airfoil and wing analysis; boundary layers on plates and airfoils.

AERO 336 Aerodynamics II (3-0-3)
Prerequisites: AERO 240; AERO 335
Introduction to compressible flows. Compressibility effects on airfoil and wing aerodynamics. Normal Shock Waves. Oblique Shock and Expansion Waves. Compressible Flow through Nozzles, Diffusers, and Wind Tunnels. Subsonic Compressible Flow over Airfoils: Linear Theory, Linearized Supersonic Flow. Elements of Hypersonic Flow.

AERO 350 Dynamic Systems and Control (3-3-4)
Prerequisites: MATH 211; AERO 201, PHYS 122
Mathematical modeling of mechanical, electrical, and non-engineering systems; basic concepts in dynamic systems analysis – equilibrium, stability, linearization; mechanical vibrations: free and forced vibration of single degree of freedom systems, transient and steady state response, resonance, free vibration of two degree of freedom systems; control systems: basics of feedback control, transfer functions and block diagrams, design specifications based on step response, PID control, applications.

AERO 391 Independent Study I (Variable course credits from 1 to 3)
Prerequisite: Junior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

AERO 415 Aerospace Materials Manufacturing (3-0-3)
Prerequisites: AERO 225 (AERO 320); AERO 220
Aerospace materials and manufacturing; properties and processing of polymers, composites and metal alloys. Analysis of selected manufacturing processes including injection molding, extrusion, liquid composites molding, autoclave, out of autoclave, and metal manufacturing processes. Discussions will be presented on important material properties that influence different manufacturing processes.

AERO 425 Design of Aerospace Structures (3-0-3)
Prerequisite: AERO 321
This course provides the basics of the elements of aircraft structural analysis using an applications-oriented approach. Topics to be covered include landing gear analysis, tapered wing beams, frame cutouts, and composite materials.

AERO 426 Designing with Composites (3-0-3)
Prerequisite: AERO 225/ MECH 225
Reinforcing mechanisms in composite materials; material properties. Strength and elastic constants of unidirectional composites; Analysis of laminated plates and sandwich structures. Environmental effects and durability. Damage tolerance. Design of aerospace composite structures.

AERO 430 Intermediate Aerodynamics (3-0-3)
Prerequisite: AERO 336
Fundamentals of the 1st and 2nd laws of thermodynamics applied to aerodynamic systems and control volumes. Applications of gas dynamics to incompressible and compressible flows through nozzles, diffusers, and airfoils. Isentropic flows to include Prandtl-Meyer expansions, and non-isentropic flows to include normal and oblique shocks, and flows with simple friction and heat transfer.

AERO 431 **Viscous Flows (3-0-3)**
Prerequisite: AERO 336
Viscous incompressible fluid flows. Topics include derivation of equations governing viscous compressible fluid motion; specializations to simple flows; boundary-layer theory; similarity solutions; introduction to turbulence and Reynolds stresses.

AERO 433 **Introduction to Computational Fluid Dynamics (2-3-3)**
Prerequisite: AERO/MECH 335 (AERO/MECH 330)
The course provides the students with an introduction to the methods and analysis techniques used in computational solutions of fluid mechanics and aerodynamics problems. Model problems are used to study the interaction of physical processes and numerical techniques via computational fluid dynamics (CFD) software. The student will use the CFD techniques to solve some real world problems.

AERO 435 **Rotorcraft Aerodynamics and Performance (3-0-3)**
Prerequisite: AERO 335
Rotorcraft history and fundamentals. Momentum theory: hover, axial climb and descent, autorotation, forward flight, momentum theory for coaxial and tandem rotors. Blade element analysis. Rotor airfoil aerodynamics. Rotor blade dynamics and trim. Helicopter performance, height-velocity curves, conceptual design. High-speed rotorcraft.

AERO 440 **Aerospace Propulsion (3-0-3)**
Prerequisite: AERO 336
The mechanics and thermodynamics of aerospace propulsion systems including cycle analysis. Component analysis and operating principles of turbojet, turbofan, and other variations of air breathing aircraft propulsion units. Introduction to the operating principles of rocket and space propulsion units.

AERO 441 **Introduction to Combustion (3-0-3)**
Prerequisite: AERO/MECH 240 (AERO/MECH 340)
Introduction to fuel types and classification, gas phase mixtures, combustion process and combustion thermodynamics. Emphasis on chemical equilibrium, chemical kinetics, and modeling of reacting fluid mechanical systems. Integration of these tools into the understanding and analyzing detonation phenomenon and laminar premixed and non-premixed flames.

AERO 450 **Flight Dynamics and Stability (3-0-3)**
Prerequisites: AERO 335; AERO 350
Airplane motions and coordinate systems; lift and drag; pitching moment and static stability; steady cruise of the airplane; rigid body dynamics in six degrees of freedom; modeling of the six aerodynamic force and moment coefficients; longitudinal motion and stability; lateral motion and stability; motion control and autopilot design via eigenvalue placement; examples of longitudinal motion control.

AERO 461 **Aviation Management and Certification (3-0-3)**
Prerequisite: Senior standing and approval of the department
Product development, quality control. Strategic organizational analysis and design. Airworthiness, type certification and planning, delegation of authority, airplane flight manual. Aerospace system design and safety.

AERO 465 **Space Dynamics and Control (2-3-3)**
Prerequisite: AERO 350
Basic concepts of orbital mechanics with application to satellites: keplerian motion, orbital elements, orbital transfer and fundamentals of state space control. Basic concepts of spacecraft attitude dynamics: three-dimensional rigid-body kinematics, stability and dynamics of symmetric and tri-inertial bodies, disturbance effects and attitude determination and control.

AERO 470 **Aircraft Design Laboratory**
Prerequisites: AERO 225; AERO 335; AERO 350
Aircraft design principles blending synthesis, analysis and test. The iterative nature of the design process. Elements of aircraft performance calculation and optimization. Extensive, design oriented laboratory experiments performed by student teams. Focus is on student design and realization of experimental procedure, instrumentation, and data acquisition and analysis, with extensive laboratory reports.

AERO 485 **Spacecraft Design (2-3-3)**
Prerequisite: AERO 450
Types of spacecraft. Fundamentals of orbital mechanics. The design of spacecraft and spacecraft subsystems with emphasis on mission requirements and current design methods: spacecraft configuration, payload, structural, propulsion, attitude control, thermal, power, communication and other related subsystems. Spacecraft integration and testing.

AERO 491 **Independent Study II (Variable course credits from 1 to 3)**
Prerequisite: Senior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

AERO 495 **Special Topics in Aerospace Engineering**
Prerequisite: Topic specific
This course mainly deals with new trends in Aerospace Engineering and emerging technologies. Course is repeatable if title and content differ.

AERO 497 **Senior Design Project I (1-3-2)**
Prerequisite: Senior Standing or approval of department
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

AERO 498 **Senior Design Project II (0-6-2)**
Prerequisite: AERO 497
Continuation of AERO 497

9.2 | **BMED** Biomedical Engineering

BMED 202 **Biomedical Engineering Fundamentals (2-4-4)**
Prerequisite: ENGR 111
Co-requisites: MATH 211, PHYS 122
Study the conservation laws of mass, energy, charge, and momentum as applied to problems in biomedical engineering.

BMED 211 **Physiological Systems and Modeling I (2-4-4)**
Prerequisite: ENGR 112
Co-requisites: BMED 202; MATH 211
The primary objective of this course is to introduce to students on how to use mathematical modeling to describe homeostasis phenomena in human physiology at the protein, cell and organ level. Introducing the basics in control process as well as the concepts of model formulation, validation, and simulation will also be established. Chemical kinetics, transport equations and feedback systems will be the main focus in this course.

BMED 212 **Physiological Systems and Modeling II (2-4-4)**
Prerequisite: BMED 211
The primary objective of this course is to apply the principles and concepts used in BMED 211 (Physiological Systems and Modeling I) to model the physiology of neuronal signaling, muscle, cardiovascular and respiratory systems. The course introduces these physiological systems, coupled with modeling techniques and mathematics of higher complexity. The models will be employed to relate to pathophysiology of the respective systems.

BMED 291 **Independent Study I (Variable course credits from 1 to 4)**
Prerequisites: Sophomore standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

BMED 321 **Mechanics for Biomedical Engineers (2-4-4)**
Prerequisites: BMED 202; MATH 211
This is an introductory course in engineering mechanics. The primary objective is to give students an understanding of the basic principles of statics (equilibrium), dynamics (kinematics and kinetics) and strength of materials (stress, strain, mechanical properties) as applied to problems in biomedical engineering.

BMED 322 **Functional Biomechanics (2-4-4)**
Prerequisites: BMED 212; BMED 321
A study of the biomechanical principles underlying the kinetics and kinematics of normal and abnormal human motion. Emphasis is placed on the interaction between biomechanical and physiologic factors (bone, joint, connective tissue and muscle physiology and structure) in skeleto-motor function and the application of such in testing and practice in rehabilitation.

BMED 331 **Biotransport Phenomena (2-4-4)**
Co-requisites: BMED 212; MATH 211
The primary objective of this course is to study the fundamental principles of fluid, heat, and mass transfer with particular emphasis on physiological and biomedical systems. The course also explores the similarities between the fundamental principles of momentum, heat, and mass transfer and develops the mathematical description.

BMED 341 **Molecular and Cellular Physiology I (3-3-4)**
Prerequisite: CHEM 211
Co-requisite: BMED 212
This course provide students with an advanced understanding of current topics and techniques in molecular biology, while developing skills in critical thinking and written expression. The goal of this course is to develop a comprehensive understanding of the basic fundamental concepts of molecular biology. This will be achieved both from the perspective of established molecular mechanisms for regulating the fundamental processes of a cell, and also from a technical laboratory-based applied perspective for using molecular biology as an experimental tool

BMED 342 **Molecular and Cellular Physiology II (3-3-4)**
Prerequisite: BMED 341
The primary objective of this course is to emphasize the study of eukaryotic cell structure and function, including bioenergetics, membrane transport, cellular communication, flow of genetic information, immune responses and cell division. Experimental techniques used in understanding cell biology will be discussed along with the cellular basis of human disease.

BMED 351 **Biomedical Circuits and Signals (3-3-4)**
Pre-requisites PHYS 122, BMED 212
The primary objective of this course is to study analogue, digital electronic circuits and their application to biomedical instrumentation and physiological measurements. The course will focus strongly on electronic hardware and software design issues required to produce medical instruments, which satisfy International standards for safety, performance and quality control. Students will be equipped with the fundamental knowledge required to design Biosignal processing system.

BMED 352 **Fundamentals of Biomedical Signal Processing (3-3-4)**
Prerequisite: BMED 351
The primary objective of this course is to study analogue and digital signal processing techniques and microcomputer system, and their application to biomedical instrumentation and physiological measurements. This course is designed for students who are expected to have prior knowledge in circuits and physiological system modelling. The main focus is on the technical aspects of biosignal processing and its hardware implementation in medical instruments.

BMED 391 **Independent Study II (Variable course credits from 1 to 4)**
Prerequisite: Junior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

BMED 411 **Biomaterials (3-3-4)**
Prerequisite: BMED 331
Co-requisites: BMED 342; BMED 322; CHEM 311
Introduction to the field of biomaterials used in the design of medical devices, and to augment or replace soft and hard tissues. Discussion of bulk properties, applications, and in vivo behavior of different classes of natural and synthetic biomaterials. Analysis of biological response and biocompatibility, degradation and failure processes of implantable biomaterials/devices. This course involves a significant amount of hands-on work in order to perform detailed characterization of biomaterials and it revolves around two main projects.

BMED 412 **Regenerative Medicine (3-3-4)**
Prerequisite: BMED 331
Co-requisites: BMED 342; CHEM 311
The purpose of the course is to provide a basic grounding in the principles and practice of regenerative medicine, this course will cover basic molecular and developmental biology relevant to the understanding of differentiation and development at the molecular, cellular and organismal levels.

BMED 413 **Application of Bio-molecular Tools (2-4-4)**
Prerequisite: CHEM 211; BMED341
This course will focus on delivery of the principles of genomics, genetic epidemiology and DNA-based marker

assisted testing. It will reinforce the basic principles of these disciplines with emphasis on case studies from forensic science, health science, food science and conservation to deliver a course with an emphasis on developing a student's practical and problem solving skills.

BMED 421 Physiological Control Systems (2-4-4)
Prerequisite: BMED 352
This course will expose students to the design of physiological control systems from engineering viewpoints. How states of "health" versus "disease" can be explained from the standpoint of physiological control system function (or dysfunction) will be studied.

BMED 422 Rehabilitation Engineering (2-4-4)
Prerequisite: BMED 322
Co-requisite: BMED 352
This is a project-based course that focuses via literature search and experimental work on the rehabilitative and neural aspects of biomedical engineering, including human performance measurement and analysis, nerve stimulation, electromyography, motor control and stimulation; Students also learn about hardware and software applications for rehabilitation engineering and assistive devices.

BMED 430 Bioinformatics (2-4-4)
Prerequisite: ENGR 112, MATH 211
This course aims to introduce future engineers to bioinformatics tools and analysis methods. Fundamental and current topics in bioinformatics, genomics and proteomics will be highlighted through lectures and literature reviews, that simultaneously develop critical thinking and oral presentations of students. Students will also familiarize themselves with the R project for statistical computing.

BMED 491 Independent Study III (Variable course credits from 1 to 4)
Prerequisite: Senior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

BMED 495 Special Topics in Biomedical Engineering
Prerequisite: Topic Specific
This course mainly deals with new trends in Biomedical Engineering and emerging technologies. Course is repeatable if title and content differ.

BMED 497 Biomedical Engineering Senior Design I (1-9-4)
Prerequisite: Senior standing or approval of department
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

BMED 498 Biomedical Engineering Senior Design II (0-12-4)
Prerequisite: BMED 497
Continuation of BMED 497.

9.3 | BUSS Business Studies

BUSS 201 Fundamentals of Accounting and Finance (3-0-3)
Prerequisite: None
This course provides an introduction to financial and management accounting. It is aimed at providing a broad understanding of the theory and practice of financial accounting, management accounting and financial management, both for non-specialist students and as a foundation for further study in the area. This course examines the basic principles and underlying concepts and the ways in which accounting statements and financial information can be used to improve the quality of decision-making.

BUSS 296 Directed Study (1 to 3 credits)
Prerequisite: Approval of academic advisor and department chair.
Directed study gives students the opportunity to explore an area of interest without having extensive knowledge or experience in the subject area or field of study. As a result, faculty direction and guidance are critical. A formal written report is usually required.

BUSS 301 Inside Organizations (3-0-3)
Prerequisite: Junior Standing
Increasingly, to maintain success in today's hyper-competitive markets, firms depend less on advantages associated with economies of scale, technology, patents, and access to capital but more on innovation, speed, and adaptability. These latter sources of competitive advantage are largely derived from investments in a firm's human capital. As such, much of an organization's success will depend on leadership capacity, owners' and line managers' talents as caretakers of human capital. Therefore, this course will focus on Human Resources (HR) principles and practices underlying effective human capital management. It is designed to acquaint students with practices that will make them more effective in approaching people-related business issues; including the context (e.g., legal, organizational, leadership) in which these practices are conducted.

BUSS 395 Special Topics in Business Studies
Prerequisite: Topic Specific
Course is repeatable if title and content differ.

9.4 | CHEM Chemistry

CHEM 115 Introduction to General Chemistry for Engineers (3-2-1-4)
Prerequisite: None
This course introduces atomistic hypothesis of nature and Avogadro's number, basic chemical reactions and their engineering applications, stoichiometry, atomic structure, periodic table properties, molecular geometry and applications, gas laws and gaseous, liquid, and solid states of matter, ionic and covalent bonding, descriptive chemistry of metallic and non-metallic elements with basic geometric ideas about structure, basic concepts in electrochemistry and thermochemistry, and basic chemistry of large molecules and polymers with overview of engineering applications

CHEM 211 Organic Chemistry (3-3-4)
Prerequisite: CHEM 115
This course provides an introduction to naming, structure, bonding, reactivity, and properties of organic compounds such as alkanes, alkenes, alkynes, alkyl halides, aromatic compounds, alcohols, amines, and carbonyl

compounds in the views of atomic and molecular orbital theories. These basic principles are applied to a variety of topics ranging from chemical reactions to biomolecules.

CHEM 311 **Biochemistry (3-3-4)**
Prerequisite: CHEM 211
The overall goal of this course is for the student to gain a basic working knowledge of biochemical concepts and techniques which will be necessary for future scientific endeavors.

9.5 | **CHME** CHEMICAL Engineering

CHME 201 **Chemical Engineering Fundamentals (3-0-3)**
Prerequisites: CHEM 115, PHYS 121, MATH 112
This course introduces the students to the chemical engineering profession and lays the foundation for advanced courses on analysis of material processes and plant design. It covers basic calculations in mass and energy balance using process flow sheeting and develops the concepts of phase equilibria, heat and mass transfer, fluid flow and reaction engineering in the context of physical, chemical and petroleum- related industrial processes.

CHME 240: **Chemical Engineering Thermodynamics (3-0-3)**
Prerequisite: CHME 201
Co-requisite: MATH 212
Work and energy; conversion of energy; theory of gases and other states of matter; applications to energy conversion devices. Second Law of thermodynamics, entropy, and equilibrium, with applications. Review of classical engineering thermodynamics. Multicomponent systems & multicomponent phase equilibria. Equilibrium in chemically reacting systems, heterogeneous equilibrium, Gibbs phase rule, and electrochemical processes.

CHME 321 **Physical Chemistry for Engineers (3-3-4)**
Prerequisites: CHME 201, PHYS 122, MATH 211
This course develops student understanding of chemical reactions and the properties of molecular systems. The tools of chemical kinetics will be used to derive the rate equations governing different types of chemical reactions. The kinetic theory of gases will be introduced and the properties of gas phase reactions will be derived starting from basic assumptions and equations of state. The fundamental postulates of quantum mechanics will be used to explain the observed atomic spectra of elements and diatomic molecules. Molecular vibrational spectroscopy of simple molecules will be discussed. Applications of quantum mechanics will be emphasized in the description of molecular orbitals in organic molecules.

CHME 335 **Fluid Mechanics (3-3-4)**
Co-requisite: MATH 211
Prerequisites: PHYS 121; MATH 212
This course introduces students to concepts of fluids and examines the forces on them. Conservation of mass, momentum, and energy are fundamental to the physics. Various mathematical representations are considered, including differential and integral formulations. The complexity of fluid dynamics motivates the notions of simplifying assumptions, dimensional analysis, boundary layers, and shock waves, among others.

CHME 343 **Heat and Mass Transfer for Chemical Engineers (3-3-4)**
Prerequisite: CHME 335
Mechanisms of heat and mass transfer. Steady and transient heat conduction and mass diffusion. Convective heat and transfer: free and forced convection for laminar and turbulent flows; heat exchangers, the Reynolds analogy with mass and momentum transfer. Radiation heat transfer between black and grey surfaces. Heat and mass transfer in chemically reacting systems.

CHME 350 **Chemical Engineering Laboratories (2-2-3)**
Prerequisite: CHME 343
Co-requisite: CHME 361; CHEM 371
This is an inquiry-based laboratory course that exposes junior students to a stage-gate development process on defining, designing and testing experimental systems to study their performance to identify associated economic constraints. The course is based on a selection of applied bench-scale experiments and computer simulations to complement the fundamental topics covered in fluid flow, heat and mass transfer, separation processes and reaction engineering courses. A majority of this course will focus on project management, team work, computational design and simulation, instrumentation handling and safety observations, statistical analysis of experimental data in addition to formal communication of scientific results.

CHME 361 **Separation Processes (3-3-4)**
Prerequisites: CHME 335; CHME 343; CHME 240
This course concerns the design and analysis of unit operations relevant to chemical engineering separations. It covers the fundamental aspects of single and multi-staged processes using both equilibrium and rate-governed methods. Examples include distillation, absorption, stripping, extraction, adsorption, ion-exchange, chromatography, and membrane-based separation techniques.

CHME 371 **Reaction Engineering (3-3-4)**
Prerequisites: MATH 211; CHME 321; CHME 240; CHME 361
This course applies the concepts of reaction rate, stoichiometry and equilibrium to the analysis of chemical and biological reacting systems. Derivation of rate expressions from reaction mechanisms and equilibrium or steady state assumptions. Design of chemical and biochemical reactors via synthesis of chemical kinetics, transport phenomena, and mass and energy balances. Topics in this course include: chemical/biochemical pathways; enzymatic, pathway, and cell growth kinetics; batch, plug flow and well-stirred reactors for chemical reactions and cultivations of microorganisms and mammalian cells; heterogeneous and enzymatic catalysis; heat and mass transport in reactors, including diffusion to and within catalyst particles and cells or immobilized enzymes.

CHME 391 **Independent Study I (variable course credits from 1 to 3)**
Prerequisite: Junior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

CHME 431 **Process Control (3-3-4)**
Prerequisites: MATH 211; CHME 350; CHME 361; CHME 371
The course introduces the key concepts in automatic control and instrumentation of process plants. Material and energy balances are extended to unsteady state (dynamic) systems and Laplace Transforms are introduced as a means of conveniently representing process control systems and solving ordinary differential equations. Commonly used sensing, transmission and final control elements are described and depicted in piping and Instrumentation Diagrams (P&IDs). The course is delivered through a combination of lectures, tutorials and exposure to simulation programs currently used in industry.

CHME 451 **Heterogeneous Catalysis and Chemical Kinetics (3-0-3)**
Prerequisites: CHME 240; MATH 212; CHME 371
Basic concepts in heterogeneous catalysis and green chemistry, catalyst preparation and catalyst characterization, Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration. Industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis, Commercial catalytic reactors (fixed bed, fluidized bed, trickle-bed, slurry, etc.). Heat and mass transfer and its role in heterogeneous catalysis. Calculations of effective diffusivity and thermal conductivity of porous catalysts. Reactor modeling. Emphasizes the chemistry and engineering aspects of catalytic processes along with problems arising in industry. Catalyst deactivation kinetics and modeling.

CHME 452 **Petroleum Reservoir Engineering (3-3-4)**
Prerequisites: CHME 335, CHME 240
To apply the basic reservoir engineering methods to solve reservoir engineering problems. – This course will cover: reserves estimation, Darcy law, reservoir rock and fluid properties; compressibility, viscosity, capillary pressures, permeability. Porosity, fluid saturations, permeability, interfacial tension, wettability, capillary pressure, effective. Multiphase fluid flow mechanics in porous media; relative permeability; P-T diagrams for oils, dry gas, wet gas, condensates; material balance. Introduction to secondary production methods; immiscible flooding; miscible flooding. Fluid Flow in Porous Media. Introduction to pressure tests; drawdown and build-up methods. PVT analysis; drive mechanisms of a reservoir; water influx. An introduction to oil and gas material balance equations, drive indices. An introduction to performance prediction techniques.

CHME 453 **Oil Refining and Gas Processing (3-0-3)**
Prerequisites: CHEM 311; CHME 240; CHME 361; CHME 451
Characterization of crude oil. Petroleum products and refinery configuration. Basics on heterogeneous catalysis. Unit operations of petroleum refining including distillation, catalytic cracking, reforming, hydro treating and hydrocracking, coking and gas treatment. Gasoline components. Refinery products and economics. Manufacture of petrochemical feedstock from petroleum and petroleum products. Environmental control. Refinery safety measures and handling of hazardous materials. Quality control of products. Description and design of the major processes for gas compression, dehydration, acid gas removal and tail gas cleanup, sulfur recovery, cryogenic extraction of natural gas liquids (NGL). Process simulation of natural gas processes.

CHME 470 **Surface Chemistry (3-0-3)**
Prerequisites: CHME 240, CHME 321
Introduction to concepts in liquid and solid surfaces, and in interfaces. Topics in liquid surfaces will include capillarity, surface tension, and thermodynamics of liquid interfaces, charge and surfactants. Topics in solid surfaces will include structure, and the thermodynamics and kinetics of adsorption and desorption processes (including physisorption and chemisorption). Topics in interfaces will include contact angle, wetting and thin films. These topics will be supported by discussion of physical techniques used to characterize surfaces, and relevant applications of surfaces and interfaces in engineering.

CHME 471 **Corrosion Engineering (3-0-3)**
Prerequisites: MECH 325, CHME 240, CHME 321
The course is an introduction to the principles of electrochemistry as well as the essential elements of electrochemical corrosion. This introduction is followed by development of the thermodynamic and kinetic aspects of electrochemistry, including potential-Ph (Pourbaix) diagrams, mixed potential theory and the theory and application of passivity. The goal is to provide a foundation for understanding the forms of corrosion, the mechanisms of corrosion, electrochemical methods to study and measure corrosion, and the principles and methods leading to mitigation of corrosion problems that might occur in engineering practice.

CHME 491 **Independent Study II (variable course credits from 1 to 3)**
Prerequisites: Senior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

CHME 495 **Special Topics in Chemical Engineering**
Prerequisite: Topic specific
This course mainly deals with new trends in Chemical and Petroleum Engineering and emerging technologies. Course is repeatable if title and content differ.

CHME 497 **Senior Design Project I (1-6-3)**
Prerequisite: Senior Standing or approval of department
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

CHME 498 **Senior Design Project II (0-9-3)**
Prerequisite: CHME 497
Continuation of CHME 497

9.6 | CIVE Civil Engineering

CIVE 180 **Engineering Graphics and Visualization (3-0-3)**
Prerequisite: ENGR 112
This course is an introduction to graphical communication concepts and tools used by engineers. It covers visualization and technical sketching skills, implications related to manufacturing processes, computer-aided design methods, and development and interpretation of drawings of civil engineering structures.

CIVE 201 **Engineering Dynamics (3-0-3)**
*(Cross listed with AERO 201; MECH 201)
Prerequisite: ENGR 200
Review of kinematics and kinetics of particles: rectilinear and curvilinear motions; Newton's second law; energy and momentum methods. Kinematics and kinetics of rigid bodies: plane motion of rigid bodies; forces and accelerations; energy and momentum methods.

CIVE 225 **Mechanics of Solids (3-0-3)**
Prerequisite: ENGR 200
The course is an introduction to the mechanics of deformable solids applied to basic engineering structures. It covers the concepts of stress and strain at a point; deformation of axial members; symmetric and asymmetric bending of elastic and elastic-perfectly plastic beams; torsion of open and closed section; beam deflection; stress and strain transformations, and elastic buckling of columns.

CIVE 238 Geology for Civil Engineering (3-0-3)
Prerequisite: PHYS 121
This course focuses on concepts of physical geology and the geologic processes relevant to civil and environmental engineering practices. Topics include: the nature and structure of earth, earth's history, formation of rocks, chemical and physical properties of minerals, and basic techniques for geologic field and site characterization. This course satisfies the requirement for a Science Elective for Civil Infrastructure and Environmental Engineering students.

CIVE 310 Geomatics (2-3-3)
Prerequisites: CIVE 180; MATH 112
The course is an introduction to Geomatics. It covers Plane and topographic surveying; distance, angle, and elevation difference measurement; error theory; traverse computations; topographic mapping; horizontal and vertical curves; CADD applications; GPS and GIS.

CIVE 332 Fundamentals of Construction Engineering and Management (3-0-3)
Prerequisite: ENGR 111
This course offers a sampler of the broad construction engineering and project management topics. It covers the project management tools and practices as performed throughout the construction processes, including bidding; contract format and construction administration; construction documents; reading and interpreting contract plans; project planning and scheduling; resource management and project control; cash flow analysis; risk management and safety in construction.

CIVE 335 Fluid Mechanics (3-3-4)
Prerequisites: PHYS 121; MATH 212
This course introduces students to concepts of fluids and examines the forces on them. Conservation of mass, momentum, and energy are fundamental to the physics. Various mathematical representations are considered, including differential and integral formulations. The complexity of fluid dynamics motivates the notions of simplifying assumptions, dimensional analysis, and boundary layers among others.

CIVE 336 Civil Engineering Materials (3-3-4)
Prerequisites: CHEM 115; CIVE 225
The course is an introduction to scientific concepts of civil engineering materials. It covers relationship between macroscopic material properties and response and microscopic properties; physical, mechanical, surface, fracture, and rheological properties of civil engineering materials including metals, composites, polymers, and Portland cement concrete.

CIVE 338 Geotechnical Engineering (3-3-4)
Prerequisite: CIVE 225
This course is an introduction to the basic principles that govern the behavior of soils, foundations, and other geotechnical engineering works. The central concepts to be covered in this class are: engineering properties of soils, soil classification, permeability, stresses in soil due to applied loads, consolidation, compaction, shear strength and applications to engineering design.

CIVE 340 Behavior and Analysis of Structures (3-0-3)
Prerequisite: CIVE 225
This course is to study behavior and analysis of statically determinate and indeterminate beams, frames, and trusses. It covers displacement calculations using the method of virtual work, analysis of statically indeterminate structures by consistent displacements and slope-deflection equations, and the basic fundamentals of using the direct stiffness method for analyzing structures.

CIVE 341 Design of Steel Structures (3-0-3)
Prerequisites: CIVE 336; CIVE 340
This course is to understand the fundamentals of structural steel design of structural members such as beams and columns and their connections based on the Load and Resistance Factor Design method. It covers design of structural members for tension, flexure, shear, compression, and combined loads, and design of bolted and welded connections.

CIVE 370 Introduction to Environmental Engineering (3-3-4)
Prerequisites: CHEM 115; MATH 112
This course introduces environmental problems and their resolutions including water and wastewater treatment, air pollution and control, and solid and hazardous waste management. It covers the fundamental theory, principles, and preliminary design of unit operations in environmental engineering. Laboratory classes illustrate analytical techniques used in the analysis of environmental samples, and demonstrate the mechanisms involved in the treatment processes.

CIVE 380 Transportation Engineering (2-3-3)
Prerequisite: CIVE 310
This course is an introduction to transportation engineering with specific emphasis on the planning, design, and operation of transportation facilities including highways, ramps, signal lights, pedestrian crossings, and stop signs. Factors that cause congestions are analyzed and solutions are discussed.

CIVE 391 Independent Study I (Variable course credits from 1 to 3)
Prerequisites: Junior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

CIVE 442 Design of Concrete Structures (3-0-3)
Prerequisites: CIVE 336; CIVE 340
This course is a basic understanding of the analysis and design of reinforced concrete structures. It covers properties of reinforced concrete, behavior and ultimate strength design of reinforced concrete beams, slabs, columns, and footings, and design for flexure, shear, compression, bond, and anchorage.

CIVE 450 Coastal Engineering (3-0-3)
Prerequisites: CIVE 335; CIVE 370
This course is designed to give an overview of the analysis and design procedures used in the field of coastal engineering. The course covers basic wave properties in the near shore region, coastal sediment transport processes and the preliminary design of shore and harbor protection structures.

CIVE 455 Blast Effects and Modern Protective Infrastructures (3-0-3)
Prerequisites: CIVE 341; CIVE 342
Threat and Hazard Assessment. Conventional and Nuclear Environments. Conventional and Nuclear Loads on Structures. Behavior of Structural Elements. Dynamic Response and Analysis. Connections, Openings, Interfaces, and Internal Shock. Structural Systems-Behavior and Design Philosophy.

CIVE 463 Water and Wastewater Treatment Technologies (3-0-3)
Prerequisites: CIVE 335; CIVE 370
Design of unit operations for coagulation, sedimentation, filtration and disinfection for treatment of drinking water. Introduce the chemistry of drinking water treatment processes. Design of facilities for physical, chemical, and biological treatment of wastewater; and treatment and disposal of sludge. Coverage of advanced wastewater treatment and land treatment systems.

CIVE 465 Ground and Surface Water Hydrology and Contaminated Transport (3-0-3)
Prerequisites: CIVE 335; CIVE 370
A comprehensive introduction to groundwater and surface water hydrology. Contaminant transport of hazardous chemicals, environmental regulations, groundwater flow, well hydraulics, transport of contaminants in the subsurface environment, hydrologic cycle, surface water hydrology, hydrographs, rational method for storm water runoff, and storm water collection system design.

CIVE 469 Air Pollution (3-0-3)
Prerequisites: CHEM 115; CIVE/MECH 335
An in-depth instruction into air pollution covering such topics as the causes, sources, and effects of air pollution. Topics include: legislative standards (ambient and source) for pollutants, regional and global air pollution issues, indoor air pollution, air pollution instrumentation and gas flow measurements, basic meteorology, and design of facilities for air pollution control.

CIVE 470 Foundation Engineering (3-3-4)
Prerequisite: CIVE 338
This course focuses on geotechnical design of shallow and deep foundations, including spread footings, mats, driven piles, and drilled piers. Coverage includes bearing capacity, settlement, and group effects of the various foundation types. Additional topics include geotechnical proposal and report writing, subsurface exploration, and construction of deep foundations.

CIVE 472 Pavement Design and Transportation (3-0-3)
Prerequisites: CIVE 338; CIVE 380
Fundamental theory and design principles of both flexible and rigid pavements. Theory and practice in transportation systems to include airfield and highway design, traffic analyses, horizontal and vertical roadway alignment, pavement evaluation and maintenance, strengthening techniques, and repair.

CIVE 473 Structural Building Design (3-0-3)
Prerequisites: CIVE 341; CIVE 342
Design of a multi-story steel and reinforced concrete building, including structural frame, floor and roof system, and foundation. Computer-aided analysis and design.

CIVE 475 Earth Structures: Embankment, Slopes and Buried Structures (3-0-3)
Prerequisites: CIVE 338; CIVE 342
Analyses of lateral earth pressures, slope stability, and stresses on buried structures, design of cantilever retaining walls, mechanically stabilized earth walls, sheet piling, and slurry walls.

CIVE 480 Project Management and Contract Administration (3-0-3)
Prerequisite: CIVE 332
Students take an owner's project requirements through stages of scope definition, budgeting and planning, conceptual design, scheduling, and construction contract administration. Students apply engineering standards and consider realistic issues including engineering economics, constructability, environmental requirements, sustainability, and safety. The course addresses and applies management topics and concepts of planning, organizing, leading, and controlling in the context of a capstone engineering project. The course concludes with a project competition involving construction industry professionals.

CIVE 482 Project Control and Life Cycle Execution of Constructed Facilities (3-0-3)
Prerequisite: CIVE 332
This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. This course introduces further awareness of analytical tools and extends the basic foundation for advanced topics in construction engineering and management.

CIVE 484 Project Planning, Scheduling and Control (3-0-3)
Prerequisite: CIVE 332
This course emphasizes the fundamental principles of modern management methods of planning and scheduling for construction projects. Covered topics include pre-bid planning; construction project planning using WBS; project network; estimating activity duration, CPM scheduling; resource management using resource allocation and leveling; project time-cost trade-offs; project monitoring and control; and, earned value analysis integrating cost and schedule.

CIVE 485 Construction Project Management (3-0-3)
Prerequisite: CIVE 480
This course emphasizes the methods and materials of construction as well as the management practices required to run a successful construction project. Topics include construction materials, project planning, scheduling, cost estimating, and field engineering. A semester project, in the form of a detailed study of a major construction project, complements the classroom experience.

CIVE 488 Advanced Construction Management (3-0-3)
Prerequisite: CIVE 485
This course will cover construction methods, equipment, and cost estimation of construction materials, excavation, foundation, retaining walls, formwork, pavements and other aspects of civil engineering construction projects by integrating geotechnical reports, materials specifications, quality control, equipment, estimation, scheduling, and design details.

CIVE 491 Independent Study II (Variable course credits from 1 to 3)
Prerequisite: Senior Standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

CIVE 492 Urban Transit Planning and Operations (3-0-3)
Prerequisite: CIVE 380
The objective of this course is to introduce the fundamentals of urban transit planning and operations. The course will cover several topics, including public transit planning, role of transit in urban areas, classification of transit modes, fundamentals of transit performance and operational analysis, capacity analysis, scheduling, network design, transit economics, and mode selection.

CIVE 493 **Airport Planning and Traffic Management (3-0-3)**
Prerequisite: CIVE 380
This course introduces students to the fundamentals of airport systems, airport operations, and airport administrative management. The course topics includes the history of airport systems, planning, operations of airfields, airspace and traffic management, terminals and ground access, security, economic perspectives, and capacity/delay analyses.

CIVE 495 **Special Topics in Civil Engineering**
Prerequisite: Topic specific
This course mainly deals with new trends in Civil Engineering and emerging technologies. Course is repeatable if title and content differ.

CIVE 497 **Senior Design Project I (1-3-2)**
Prerequisite: Senior standing or approval of department
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

CIVE 498 **Senior Design Project II (0-6-2)**
Prerequisite: CIVE 497
Continuation of CIVE 497.

9.7 | ECCE Electrical and Computer Engineering

ECCE 200 **Fundamentals of Electronic Systems (3-3-4)**
Prerequisite: PHYS 122
Restrictions: Students majoring in Electrical and Electronic, Communication, or Computer Engineering are not allowed to take this course for credits.
This course introduces some of the fundamental concepts of electric and electrical circuits, linear analog electronic circuits and devices, and digital logic circuits. Topics covered include Voltage source, Current Source, Energy Sources, Electrical Motor and Generator basic principle, Ohm's Law, KVL and KCL circuits. DC steady state analysis of Resistive, RC, RL, and RLC circuit, Basic circuit theory nodal, mesh and source transformation. Transient analysis of simple electric circuits RC, and RL and some application. Basic operation of semiconductor devices. Diode, BJT and its application. Description of Small signal amplifier circuits and operational amplifiers. Binary system and basic logic gates. Design of simple combinational and sequential logic circuits. Basic structure of a central processing unit and a microcomputer system.

ECCE 210 **Digital Logic Design (3-3-4)**
Prerequisite: ENGR 112
Data representation in digital computers. Boolean algebra. Minimization and implementation of logic functions. Design of combinational circuits. Programmable devices, multiplexers, decoders, memory and tri-state devices. Basic ALU design. Elements of sequential circuits: latches, flip-flops and counters. Design of synchronous sequential machines. Introduction to CAD tools and hardware description languages. Laboratory experiments provide hands-on experience in the simulation, implementation and testing of combinational and sequential logic circuits.

ECCE 220 **Electric Circuits (3-3-4)**
Prerequisites: MATH 211; PHYS 122
Voltage and current independent and dependent sources. Ohm's and Kirchhoff's laws. Circuit theorems: Nodal and Mesh analysis, superposition and source transformation, Thevenin, Norton and maximum power transfer theorem. Transient and step responses of first-order and second-order RC, RL and RLC circuits. Phasor representation and steady state AC analysis. Transfer function of filter circuits and Bode plot. Poles and zeros of AC circuits and their resonance, bandwidth and quality factors. Two-Port Networks

ECCE 230 **Object-Oriented Programming (2-3-3)**
Prerequisite: ENGR112
Foundation of object oriented concepts and programming. Basic Object Oriented Programming (OOP) concepts: objects, classes, methods, parameter passing, information hiding, inheritance, exception handling and polymorphism. Java language elements and characteristics, including data types, operators, control structures, search and sort algorithms.

ECCE 260 **Principles of Telecommunications (3-0-3)**
Co-requisites: MATH 312; ECCE 220
Review and terminology of telecommunications. Basics on telecommunication signals. The basic elements of a telecommunications system. Communications channels, characteristics and modelling. Performance metrics of telecommunication systems; PCM, data transmission, and data encoding. Basics on Modulation. Data multiplexing techniques; The OSI model, types and basic topologies of telecommunication networks; Internet-based networking. Cellular and ad-hoc wireless networks.

ECCE 302 **Signal Processing (3-3-4)**
Prerequisites: MATH 312
Co-requisite: ECCE 220
Time/space-domain analysis of analog and discrete signals: basic signals, properties and operations. Time/space-domain analysis of signal processing systems: properties, block diagrams, differential/difference equations, LTI systems, impulse response, and convolution. Frequency analysis of signals: Fourier series and transform, sampling and reconstruction, Laplace transform and z-transform, other transforms. Frequency analysis of signal processing systems: frequency response (gain and phase), transfer function, z-transfer function, stability analysis, Bode and Nyquist plots. Fundamentals of filter design. Laboratory experiments covering various aspects of analog and digital signal processing supplement the course.

ECCE 312 **Electronic Circuits and Devices (3-3-4)**
Prerequisite: ECCE 220
Introduction to semiconductors. Operation of pn-junction and its applications as rectifiers, clippers, and voltage regulators. Operation of bipolar junction transistors (BJT) and field effect transistors (FET). Small signal modeling of BJTs and FETs. Use of BJTs and FETs as single stage amplifiers. BJT, JFET and MOSFET differential and multistage amplifiers. Amplifier classification and Power amplifiers. Practical nonlinear operational amplifier circuits.

ECCE 316 **Microprocessor Systems (3-3-4)**
Prerequisites: ECCE 210; ENGR 112
Introduction to current microprocessor, microcontroller and microcomputer systems: basic components, memory map, organization and processor architecture. Hardware and software models of microprocessor and microcontroller systems. Processor instructions and assembly language programming. Exception handling: interrupts, traps and exception processing. Memory decoding, input/output interfaces and programming peripheral devices. Laboratory experiments provide hands-on experience in the use of cross-assemblers, C-programming, simulators and actual microprocessor/microcontroller hardware.

ECCE 320 Applied Electromagnetics (3-0-3)
Prerequisites: PHYS 122; MATH 211
Time-varying fields and Maxwell's equations, Wave equation and its solution, Plane waves in lossless media, Flow of electromagnetic power, Plane waves in conducting media, Reflection and refraction at a planar interface, Transmission line parameters and equations, Smith chart techniques, Impedance matching and transformation, Quarter-wave transformers, Single-stub tuners, Rectangular waveguides, Propagating and evanescent modes.

ECCE 324 Electromechanical Systems (3-3-4)
Prerequisites: ECCE 220
Introduction to the concepts of active, reactive, and apparent power. Fundamentals of mechanics, fundamental of mutual inductance, electric and magnetic circuits, ideal transformers, Phasor diagrams, magnetizing current and core loss, equivalent circuits of transformers, voltage regulation and efficiency of transformers, three-phase circuits. Mechanical energy conversion device, DC machines, three-phase induction machines, synchronous generators.

ECCE 326 Introduction to Semiconductor Devices (4-0-4)
Prerequisites: MATH 211; PHYS 122
This course is designed to provide an introduction to the mechanisms of device operation. It introduces and explains terminology, models, properties, and concepts associated with semiconductor devices and offer insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET.

ECCE 330 System Analysis & Design (3-0-3)
Prerequisite: ECCE 336
Design principles, patterns, notations and methodologies with focus on object-oriented and scenario-based design. From requirements to design to implementation; reconcile the models; refining and verifying the models; Domain partitioning; object design; Model-driven design and Unified Modeling Language (UML). Structural and behavioral design descriptions and specifications; Adding software behavior; Introduction to software architecture (styles and view models); Test-driven development; User interfaces.

ECCE 336 Introduction to Software Engineering (3-0-3)
Prerequisite: ECCE 230
Introduction to Software Engineering; The Software Process; Project Management Concepts; Software Requirements Engineering Using Unified Modeling Language (UML) Use-Cases; System Models; Architectural Design; Object-Oriented Software Design; Testing and Maintenance; Emerging software development methods.

ECCE 341 Java and Network Programming (2-3-3)
Prerequisite: ECCE 230
Java basics, exception handling, I/O. Java Graphics: applets, AWT, Swing, Graphics, listeners. Java OO features: inheritance, abstract classes, polymorphism, interfaces, inner classes, anonymous classes. Basics of network programming. Java network programming: multithreading, URLs, sockets, RMI. Emerging Mobile Java Technology.

ECCE 342 Data Structures and Algorithms (2-3-3)
Prerequisites: ECCE 230; MATH 311
Review of object-oriented design. Analysis of algorithm complexity. Fundamental data structures: Concept of Abstract Data Types (ADTs), Queues, Stacks, Lists, Trees; Fundamental computing algorithms: binary search trees, hash tables, heaps, balanced trees, sorting algorithms, searching algorithms.

ECCE 350 Computer Architecture and Organization (3-0-3)
Prerequisite: ENGR 112
Co-requisite: ECCE 210
Fundamentals of computer system design. Measuring and reporting performance. Elements of machine and assembly languages. Instructions types and formats, operations, addressing modes, stacks. Classifying instruction set architecture. Data representations, Integer and floating point representations. Computer arithmetic, ALU design. Pipelining, instruction pipelining, hazards, pipeline performance. Memory system hierarchy design and cache memory. I/O fundamentals and operations and interrupt handling. Introduction to parallel computers and alternative architectures.

ECCE 354 Operating Systems (3-0-3)
Prerequisite: ECCE 350
Historical perspective of operating systems. Operating system concepts, functions and structure. Processes, threads, process synchronization, interprocess communication, process scheduling. Memory management and virtual memory. Device management. File management.

ECCE 356 Computer Networks (3-3-4)
Prerequisite: ECCE 260
Introduction to computer communications. Fundamentals of computer networks theory, design, implementation, protocols, analysis and operation. OSI model. Data transmissions and transmission media. Local and wide area networks, IP networks, switching techniques, routing, congestion control, quality of service. Network applications. Introduction to network security. Implementation, analysis and management of computer networks and their various protocols.

ECCE 360 Communication Systems (3-3-4)
Prerequisite: MATH 312; ECCE 260
Co-requisite: ECCE 302
Introduction: Classification of signals, Review of Fourier series and transforms, Introduction to modulation, Linear and non-linear modulation: DSB-AM, DSB-SC, SSB-SC, FM, PM, Base-band transmission: PCM, PAM, Noise effects in analogue & pulse modulations, Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Principles of operations of telephony.

ECCE 362 Digital Communications I (2-3-3)
Prerequisite: ECCE 360
Waveform Coding: PCM, DPCM and DM. Baseband Digital Signals: NRZ and RZ signals and line coding, baseband pulse shaping for ISI-free transmission, eye diagrams and equalization. Band pass Digital Modulation: ASK, FSK, PSK and DPSK, power spectral densities, statistical decision theory and the optimum receiver for digital modulation schemes. Carrier and timing recovery.

ECCE 364 Information Theory (3-0-3)
Prerequisites: ECCE 360; MATH 311
History of information theory, Information measure, Entropy, Information rate, Memory less sources, Sources with memory, Information transmission on discrete channels (mutual information, discrete channel capacity), Continuous channel, Channel capacity, Shannon theory, Coding applications (Huffman coding), Fundamentals of statistical decision theory.

ECCE 370 Communication Networks (3-0-3)

Prerequisite: ECCE 360

Basic data and telecommunication networks, OSI Model, Network configuration, Circuit switching, packet switching, Basic switch design, Space and time division switching, Traffic fundamentals, Erlang capacity, Basic traffic models, Signaling systems, SS7 standard, Multiplexing, FDM, TDM, CDM, WDM, Medium access control, Framing and digital carrier systems, SDH, ATM protocols and standards, ISDN, xDSL, , IP based networks, MPLS technology.

ECCE 391 Independent Study I (Variable course credits from 1 to 3)

Prerequisite: Junior standing and approval of the department

This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

ECCE 401 Filter synthesis (3-0-3)

Prerequisite: ECCE 302

Design of passive filters: Approximation theory, network synthesis and frequency transformation. Delay filters. Continuous-time active filters: single and multiple-amplifier filters using operational and operational-trans conductance amplifies, second and high-order sections. Switched-capacitor filters. RF filters design. Designing filters using CAD packages.

ECCE 404 Microwave Circuits and Devices (2-3-3)

Prerequisite: ECCE 312

Type of transmission lines suitable for low and high frequency applications. Components, connectors, attenuators, cavities, dielectric resonators, terminations, couplers, T-junction, isolators and impedance transformers. Signal amplification using Klystrons and traveling wave tubes. Microwave devices, diodes, bipolar and FET transistors. Operation of single and double balanced mixers.

ECCE 406 Instrumentations and Measurements (2-3-3)

Prerequisites: ECCE 302; ECCE 312

Measurements of L, C and R using bridge circuits. Z-, y-, abcd- and s-parameters. Microwave measuring equipments such as spectrum and network analyzers. Digital Measurement systems and data acquisitions. Logic analyzers. Types and descriptions of data acquisition systems. Performing advanced measurements using spectrum and network analyzers such as time domain reflectometer measurements, and noise measurements. Comparison of simulated and practical results.

ECCE 408 Digital Systems Design (3-0-3)

Prerequisite: ECCE 210

Design and analysis of practical modern digital systems. Simulation, synthesis, and FPGA-based implementation of digital systems using hardware description languages (HDLs). Design space of integer and floating-point arithmetic units. Power- and performance-oriented design techniques and evaluation metrics.

ECCE 410 VLSI Systems Design (3-0-3)

Prerequisites: ECCE 312; ECCE 210

Introduction to the fabrication of digital VLSI (Very Large Scale Integrated Circuits) systems. Design and layout of VLSI circuits for complex digital systems. CMOS technology using standard-cell-based design flow. Circuit characterization and performance. Interconnect, timing and synchronization issues. Low-power and deep submicron designs. Fault models and design for testability techniques. VLSI design methodologies. Commercial CAD simulation and synthesis tools.

ECCE 411 Analog Integrated Circuits Design (3-0-3)

Prerequisite: ECCE 312

CMOS analogue circuit modeling. CMOS device characterization. Basic MOS building blocks. Two-stage CMOS amplifiers. High-performance op-amps. Switched-Capacitor Circuits. Sigma-Delta data converters. CAD simulation software tools for analog circuit design.

ECCE 415 Feedback Control Systems (3-3-4)

Prerequisite: ECCE 302

Modeling of mechanical and electro-mechanical systems. Principles of feedback. Open loop response, and time domain specifications. Stability analysis and Routh-Hurwitz criterion. Root locus construction. Lead/lag compensator design using root locus. Bode plots and stability (gain and phase) margins. Lead/lag and PID controller design and PID tuning. State variable approach, State feedback controller design, stability analysis and pole placement.

ECCE 421 Power System Analysis (3-0-3)

Prerequisite: ECCE 324

Power system analysis is a concern not only for big generators and operators of the public electricity network. It is also the business of those who generate, transform and distribute their own power (for example, large sections of the petrochemical industry) and those who rely on efficiently transmitted power for transport of passengers and goods. The effective, efficient and reliable generation, transmission and distribution of electrical power at the most economic rates is thus basic to the success of any modern economy.

ECCE 422 High Voltage Engineering (3-0-3)

Prerequisite: ECCE 324

The course covers the basic concepts of electrical insulation requirements and over voltages in power system. It includes over voltages in electrical systems, electrical breakdown in gases, solids and liquids, generation of high voltages and high currents, measurements of high voltages and currents, high voltage testing and insulation, overhead insulators (material, shape, performance), underground cables (single and three-core cables, electrical stresses in cables; equivalent circuits).

ECCE 423 Power Electronics (3-0-3)

Prerequisites: ECCE 312; ECCE 324

Operation of power semiconductor devices such as power diodes, IGBTs, MOSFETs, and thyristors; Switching losses, snubber circuits, single/three phase(s), half/full wave, half/fully controlled converters with R, RL, and RLC loads, continuous and discontinuous current operations, effect of overlap, design of power converters circuits and their applications on DC electric drives motion control, PSpice simulator.

ECCE 425 Power System Stability and Control (3-0-3)

Prerequisites: ECCE 324; ECCE 421

The course covers the basic concepts of power system stability; including steady-state stability studies, using small-signal dynamic models, and transient stability analysis considering both rotor angle (equal area criteria) and time (time-stepping solutions). Power-frequency control and voltage-reactive power control in an interconnected power network are then discussed before a brief examination of the process of voltage collapse.

ECCE 426 Power Electronics for Renewables Integration (3-0-3)

Prerequisite: ECCE 423

The course covers the design and operation of single-phase and three-phase AC Voltage Regulators, design and operation of DC-to-AC single-phase and three-phase inverters, voltage controlled and current controlled inverters,

square wave and PWM inverters design, applications of power semi-conductor devices on motion control of AC electric drives and Power Systems, integration of wind and solar photovoltaic energy conversion systems, PSpice simulator

ECCE 432 Introduction to Human Computer Interfaces (3-0-3)
Prerequisite: ECCE 336
Human Factors of Interactive Software; HCI Theories Principles and Guidelines; HCI Design; Principles of user interface design, development, and programming; HCI Development Tools; Expert Reviews; Usability Testing; User interface evaluation; Web based user interfaces.

ECCE 434 Database Systems (2-2-3)
Prerequisite: ECCE 230
Introduction to the theory, design and implementation of database systems; Data models; Entity-relationship model; Relational model; SQL query language; Data integrity; Normalization; Storage access.

ECCE 436 Software Testing and Quality Assurance (3-0-3)
Prerequisite: ECCE 336
Overview of the maintenance and testing activities within the software life cycle; Software Maintenance: Major maintenance activities. Estimating maintenance costs and productivity; Quality Assurance: Examination of various quality/complexity metrics; Software validation planning; Software testing fundamentals including test plan creation and test case generation, black-box and white-box testing techniques, unit integration, validation and system testing, and object-oriented testing.

ECCE 438 Software Architecture (3-0-3)
Co-requisite: ECCE 330
Introduction to Software Architecture; Architecture Descriptions: Architecture Description Languages, Architecture Styles, A Model of software Architecture; Repository Model; Layered Model; Client-Server Model; Inter-Process Communication: Remote Procedure Call (RPC) versus Object Request Broker (ORB); N-Tiered Client-Server; Design Patterns; Specialized Software Architectures; Techniques and criteria used for the evaluation of software architecture.

ECCE 440 Distributed Systems (3-0-3)
Prerequisite: ECCE 354; ECCE 356
Characterization of distributed systems. Software layers, models of distribution, interprocess communication, client-server. Middleware, remote procedure calls, interface specification languages, remote method invocation. Distributed object-based systems. Operating systems support, multiprocessing vs. multithreading, load sharing, synchronization. Distributed File and name services. Fault tolerance. Security requirements and mechanisms.

ECCE 444 Computer Security (2-2-3)
Prerequisite: ECCE 354
Introduction to computer security. Fundamentals of cryptography: Substitution ciphers, hashing, symmetric and asymmetric crypto. Program Security: detect and exploit vulnerabilities in programs. Web vulnerabilities: SQL injection, cross site scripting. Identification and Authentication: Username and passwords, spoofing attack, password cracking. Access control: access control matrix and list, role based access control, multi-level security, access control in operating system such as Linux. Malware and Malware detection. Emerging threats: overview of other threats.

ECCE 446 Network Security (3-0-3)
Prerequisite: ECCE 356 or ECCE 370
Modern network security vulnerabilities, threats, and attacks. Penetration testing and network scanning. Digital signatures, certificates, and PKI. Entity authentication and Kerberos. Network security protocols: SSL, TLS, IPSec. Network Firewalls, IDS/IPS, and Honeynets. Wireless security.

ECCE 448 Cloud Infrastructure and Services (3-0-3)
Pre-requisite: ECCE 356; ECCE 354
Cloud Computing: history, computing paradigms, business drivers, drawbacks. Classic Data Center (CDC) vs. Virtualized Data Center (VDC). Cloud services models, deployment models, and economics. Amazon Elastic Compute Cloud (EC2). Cloud Infrastructure and Management. Virtualization: compute, storage, networking, desktop and applications. Business Continuity in VDC. Cloud Migration strategies and factors. Cloud Security: concerns and countermeasures, access control and identity management, and best practices.

ECCE 450 Embedded Systems (3-0-3)
Prerequisite: ECCE 316
Introduce the main hardware and software elements of an embedded system. Fundamental concepts and design techniques of embedded systems. Architecture and programming of embedded processors. Basic services provided by real-time operating system ("RTOS") kernels. Design and development of multitasking code and application software. Interfacing, device drivers and input/output devices. Applications of embedded systems in consumer electronics, mobile, automotive, aerospace, digital control and other real time systems.

ECCE 454 Artificial Intelligence (3-0-3)
Prerequisite: ECCE 342
This course covers the fundamental aspects of classic and modern Artificial Intelligence. Topics include: AI History, solving problems by searching, knowledge representation and reasoning techniques, agents, machine learning, evolutionary computation and fuzzy logic.

ECCE 456 Image Processing and Analysis (3-0-3)
Prerequisite: ECCE 302 or BMED 352
Digital Image Processing Fundamentals, Human Visual Perception, Digital Image Acquisition Pipeline, Monochrome and Color Images, Color Spaces, Intensity Transformation, Histogram Equalization, Color Enhancement, Image Interpolation, Image Assessment techniques, Frequency Domain Representation, 2D Filters, Smoothing and Sharpening Filters, Filtering in the Spatial and Frequency Domains, Noise Reduction and Restoration, Image Segmentation, Image Compression.

ECCE 460 Wireless Communications (3-0-3)
Prerequisites: ECCE 362 (or ECCE 356)
Introduction to modern wireless communications, Cellular communication fundamentals, Cellular design concepts, Interference and capacity, Trunking and traffic models, Air interface, Propagation models and mechanisms, Modulation, Coding, Multiple access techniques, Large/small scale fading, Diversity techniques, Wireless network structure and management, Standard wireless security protocols and mechanisms, Next generation wireless communication systems standards. Common wireless data network standards, Wireless applications.

ECCE 461 Digital Communications II (3-0-3)
Prerequisites: ECCE 362 or ECCE 356
Introduction to 2G and 3G wireless communications, Communication Channel Models: AWGN, multipath fading,

delay spread, Doppler spread, impulsive noise, MIMO channels, colored noise. Equalization Methods: decision feedback equalization, linear and non-linear equalization, Maximum likelihood sequence estimator, minimum-mean-square error methods, adaptive equalization, Spread Spectrum Techniques: CDMA, direct sequence and frequency hopping methods, OFDM, Smart Antenna Systems.

ECCE 462 Modulation and Coding Techniques (3-0-3)
Prerequisite: ECCE 362 or ECCE 356
Advanced Modulation Techniques: M-ary orthogonal and non-orthogonal signals with coherent and non-coherent detection. Design Trade-Offs: The bandwidth efficiency plane, the error probability planes. Advanced Channel Coding Techniques: Cyclic and convolution codes, Interleaving, Turbo codes, Puncturing, block and trellis coded modulation, space-time coding.

ECCE 470 Antennas and Propagation (3-0-3)
Prerequisite: ECCE 320
Antenna fundamentals, Radiation from a short current dipole, far field approximation, Radiation pattern, and Radiation resistance. Radiation integral approach, dipole and monopole antennas, Image techniques, Antenna arrays, Broadside and end-fire arrays, Pattern multiplication, Pattern synthesis, Binomial and Chebyschev arrays, Aperture antennas, Fourier-transform method, Field equivalence principle, Sky-wave and space-wave propagation, line-of-sight microwave links.

ECCE 472 Optical Communications (3-0-3)
Prerequisite: ECCE 320
Elements of optical communication systems; Slab and multi-layer planar waveguides, Optical fibers, Step-index and graded-index fibers, Single-mode and multi-mode fibers, Fiber attenuation and dispersion, Optical sources and transmitters, Light-emitting diodes, Semiconductor laser diodes, Optical detectors and receivers, Photodiodes, Optical system design, Types of noises and system impairments, Power budget, Power penalty; Dispersion compensation.

ECCE 482 Broadband Telecommunications (3-0-3)
Prerequisite: ECCE 362 or ECCE 356
Traditional Cable Networks, Two way Hybrid Fiber/Coax Cable (HFC) Access Networks, Cable Modems, IP telephony, Competing Access Technologies, Optical Transmitters, Optical Receivers, Optical Amplifiers, Performance Analysis and Design of the Forward and Reverse Links, Cable Data Transport, SONET/SDH and RPR Systems.

ECCE 484 Satellite Communications (3-0-3)
Prerequisite: ECCE 360 or ECCE 356
Overview of Satellite Services, Orbital Mechanics, transmission losses, the link budget power equation, system noise, carrier to noise ratio, the uplink, the downlink, the combined uplink and downlink carrier to noise, possible modes of interference, interference between the different satellite circuits, Satellite Access Techniques, Direct Broadcast Satellite Services, VSAT.

ECCE 491 Independent Study II (Variable course credits from 1 to 3)
Prerequisite: Senior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

ECCE 495 Special Topics in Communication Engineering
Prerequisite: Topic specific
This course mainly deals with new trends in Communication Engineering and emerging technologies. Course is repeatable if title and content differ.

ECCE 497 Senior Design Project I (1-6-3)
Prerequisites: Senior standing and approval of department
Students will pursue an in-depth project of significance in communication engineering by going from concept to working prototype. Some of the proposed design projects may involve interaction with industry. The students normally work in teams under faculty supervision. The project fosters teamwork between group members and allows students to develop their project management, technical writing, and technical presentation skills. Formal interim and final reports and presentations are required from each group.

ECCE 498 Senior Design Project II (0-9-3)
Prerequisite: ECCE 497
Continuation of ECCE 497.

9.8 | ECON Economics

ECON 120 Engineering Economics (3-0-3)
Prerequisites: MATH 112; ENGL 112
This course introduces microeconomic concepts and analysis and provides an overview of macroeconomic issues. Topics studied include: the nature and dimensions of competition, the concepts of demand and supply, theories of the firm and individual behavior, market structure, competition and monopoly, costs and incentives, wage determination, and employment, the determination of output, employment, unemployment, interest rates, and inflation. Monetary and fiscal policies are discussed.

9.9 | ENGL English Language

ENGL 111 English Communication I (4-0-4)
Prerequisite: IELTS Band-6 (or TOEFL IBT 79)
This is an academic writing course that introduces students to the conventions and practices of academic writing and critical thinking. Students will develop understanding of the writing process and will gain understanding of the relationship between good writing and the development of critical, analytical and interpretative reading skills.

ENGL 112 English Communication II (4-0-4)
Prerequisite: ENGL 111
This course focuses on the development of argumentative writing and further develops writing, reading and analytical skills developed in English 111. The course will develop the skills to produce effective persuasive writing. It provides extensive practice in the use and integration of sources

ENGL 220 Technical Writing and Communication (3-0-3)
Prerequisite: ENGL 112
This course focuses on technical writing genres and style, and presentation techniques. Students will practice communicating technical information ethically for specialist, educated and general audiences using appropriate formats in order to achieve purposes such as informing, instructing and persuading. Oral presentation skills will

enhance and develop techniques covered in ENGL 112, Students will be required to prepare a range of reports and other business and technical genres for print and online media.

9.10 | ENGR Engineering

ENGR 111 Engineering Design (2-4-4)
Prerequisite: None
This course exposes freshman engineering students to the breadth of engineering disciplines and introduces them to the fundamentals of design thinking and the design process. Students will be forming teams and working together on open-ended and ill-structured multidisciplinary design projects introduced by various engineering departments. The project work is enhanced with lectures and reading on design theory and methods, project management techniques, engineering graphics, and engineering ethics.

ENGR 112 Introduction to Computing (3-1-2-4)
Prerequisite: None
Introduction to computer systems: computer hardware components, operating system, compiling, debugging, libraries, linking. Programming based problem solving that includes program development lifecycle. Imperative programming: data types, conditional expressions and statements, repetitive structures, arithmetic and logic operators, functions, arrays, strings, pointers, structures, file I/O.

ENGR 200 Statics (3-0-3)
Prerequisite: PHYS 121
A vector treatment of force systems and their resultants: equilibrium of trusses, beams, frames, and machines, including internal forces and three-dimensional configurations, static friction, properties of areas, and distributed loads and hydrostatics.

ENGR 295 Special Topics in Engineering
Prerequisite: Sophomore Standing and Topic specific
This course mainly deals with new trends in Engineering and emerging technologies. Course is repeatable if title and content differ.

ENGR 296 Directed Study (1 to 3 credits)
Prerequisite: Approval of academic advisor and department chair.
Directed study gives students the opportunity to explore an area of interest without having extensive knowledge or experience in the subject area or field of study. As a result, faculty direction and guidance are critical. A formal written report is usually required.

ENGR 311 Innovation and Entrepreneurship in Engineering Design (2-4-4)
Prerequisite: Junior Standing
This course introduces students to the principles and practice of innovation and entrepreneurship in engineering design, as well as the techniques that managers use to manage innovation effectively. The three main phases of innovation and entrepreneurship: identification, invention, implementation, are explored at length. The course uses a hands-on approach to engage students in the full process of innovation and entrepreneurship from needs finding and screening, to concept generation and selection, and to the development of viable business and financial strategies, plans and models. The emphasis of the course is on the development of innovative and competitive needs-based solutions for real world engineering problems.

ENGR 399 Engineering Internship (0-0-1)
Prerequisites: 75 credits by end of fall semester, of which, 15 credits earned in Major
Students are required to spend a minimum of 8 continuous weeks on an approved internship program. The internship provides students with practical, on-the-job experience which allows them to integrate theory with "real world" situations. It is academically supervised by a faculty member and professionally supervised by the company's internship supervisor who provides feedback to the university about the student's progress. A formal report, that documents the work undertaken during the internship period, must be submitted to the Department within the first two weeks of the semester following the internship. The report and the complete course activities are graded on Pass/Fail basis by a faculty member.

ENGR 390 Engineering Ethics (1-0-1)
Prerequisite: Junior Standing, ENGR 111, ENGL 112
Ethical issues in the practice of engineering: safety and liability, professional responsibility to clients and employers, personal rights, conflicts of interest, professional autonomy, whistle blowing, risk assessment, intellectual property, computers and their impact on ethics, sustainable development, legal obligations and the place and the purpose of engineering codes of ethics, codes and the environment, obligations to environment.

ENGR 440 Design Support Analysis (2–0–2)
Prerequisite: MATH 311
This course is designed to teach students the elements of product support and the analysis of design as related to the manufacturability, maintainability and supportability of aerospace products. The students will be expected to conduct a life cycle cost analysis and logistics plan for a design.

ENGR 455 Finite Element Analysis (3-0-3)
Prerequisite: MATH 211; ENGR 200
Students learn the basic theory of finite element analysis (FEA) applied to stress analysis and design of mechanical components. Various applications using the ANSYS FEA software will illustrate this course and enable students to efficiently use FEA in mechanical design.

ENGR 465 Methods of Engineering Analysis (3-0-3)
Prerequisite: MATH 211
Selected topics from math analysis with engineering application. Topics include Vector calculus, ordinary differential equations, partial differential equations, and calculus of variations.

9.11 | HUMA Humanities

HUMA 101 Arabic Language (3-0-3)
Prerequisite: None
This course aims at developing the ability of students in acquiring skills and competencies in the Arabic language. For the most part, it will teach the students procedural techniques regarding the functional text structure either in Classical or in Standard Arabic. Therefore, focus will be on linking students with both their academic specialization and their Arab and Islamic environment. The ultimate objective is to develop the students' communication skills using the Arabic language.

HUMA 102 Islamic Culture (3-0-3)
Prerequisite: None
This course is delivered in Arabic. The course aims at keeping the student in touch with their Islamic culture by taking them through the civilization established by prominent scholars and men. The students are expected to compare this culture with the existing ones. The course consists of a general review of Islam as a religion and an approach to life.

HUMA 105 Emirates Society (3-0-3)
Co-requisite: ENGL 111
This course focuses on basic knowledge related to the nature of the UAE society and its political, geographical, cultural, demographical and social aspects. It also studies the perspective view of the Emirates Society in highlighting the contemporary international changes.

HUMA 106 Gulf Region Economic and Social Outlook (3-0-3)
Co-requisite: ENGL 111
The course explores the economic structure and the social conditions of the Gulf region. It focuses on the economic and social factors governing the Gulf communities and the impact of these factors at the regional and the global levels.

HUMA 110 Middle East Studies (3-0-3)
Co-requisite: ENGL 111
The course introduces the Middle East geographically, socio-culturally and historically, with a special focus on the Arab world. The course discusses the current and most important political, economic and social and cultural changes in the Middle East. The course introduces historical and current events, and introduces and surveys current issues and debates surrounding the Middle East.

HUMA 111 Islamic History (3-0-3)
Co-requisite: ENGL 111
The course provides a comprehensive overview of the Islamic history from the pre-Islamic to the contemporary Islamic World. The course focuses on major events that represent turning points in the history of the Islamic Nations. The course stresses the factors and reason that led to the rise and fall of Islamic regimes.

HUMA 112 Sciences in Islam (3-0-3)
Prerequisite: ENGL 111
The birth of science and innovation in the Islamic World; the contribution of scientists in different areas of science and technology like chemistry, astronomy, mathematics, physics, fine technology, building machines, how the Western civilization benefited from the Islamic civilization will be addressed.

HUMA 130 Introduction to Linguistics (3-0-3)
Prerequisite: ENGL 112
An introduction to the study of language as an object in the mind, as a phenomenon in society, and as a component of computer technology. The constituents of language (morphology, phonetics, syntax) will be examined as well as the role of language in society (sociolinguistics, register, written and spoken language, power) and the application of computers to linguistics (computational linguistics, corpora, computer languages as language). The course should provide a useful grounding for students whose degree involves the analysis and application of natural or invented languages.

HUMA 140 Introduction to Psychology (3-0-3)
Prerequisite: ENGL 111
An introduction to selected concepts, methods, and vocabulary of psychology. Focus of study will be on the individual and the conditions that influence behavior. Topics that will be covered include: growth and development, learning and thinking, emotions and motivations, personality and assessment, maladjustment and mental health, groups and social interaction, and social influence and society.

HUMA 141 Introduction to Sociology (3-0-3)
Prerequisite: ENGL 112
An analysis of the social and cultural forces which govern human behaviour. The principal topics include: social interaction and organization, socialization processes, primary groups including the family, collective behaviour, population and the relationship between social life and the environment.

HUMA 142 Introduction to Science and Technology Studies (3-0-3)
Prerequisite: ENGL 112
This course will introduce students to major sociological and philosophical issues in the field of contemporary science and technology studies (STS). Topics to be addressed include the relationships between culture, society, scientific inquiry, and technological development. Special emphasis will be placed on the language, debates and controversies that shape real -world applications of science and technology.

HUMA 210 Introduction to Islamic Law (3-0-3)
Prerequisite: None
This course is delivered in Arabic. It explores classical and contemporary understandings of Islamic law, with an emphasis on Islamic legal methodology. It will begin with an analysis of the major schools of Islamic law and will then move to classical and contemporary understandings of how differences are resolved in Islamic law.

HUMA 211 Islamic and Modernity (3-0-3)
Prerequisite: ENGL 112
The study of the encounter between Islam and modernity, since the early nineteenth century when the Muslim world came face to face with a powerful West, until the present time. The focus will be on the intellectual and political components of modernity and their impact on Muslim culture and society.

HUMA 212 History of Modern Science (3-0-3)
Prerequisite: ENGL 112
This course offers a survey of the history of science from the beginnings of the Copernican Revolution in the Sixteenth Century to the beginnings of aviation and the origins of the Nuclear Age in the early Twentieth Century (1543-1904). Developments and innovation in science will be considered in relation to the biographies, and historical and social and cultural contexts of the key figures in the history of modern science.

HUMA 220 Public Speaking (3-0-3)
Prerequisite: ENGL 112
This course helps students to develop poise and confidence when doing speeches in front of an audience. Students will learn speaking and listening skills while learning the psychology of public speaking and how to improve their own public speaking abilities. They will both prepare their own speeches to present before an audience as well as observe and evaluate others speeches.

HUMA 295 **Special Topics in Humanities and Social Sciences**
Prerequisite: Topic specific
This course mainly deals with various trends in Humanities and Social Sciences. Course is repeatable if title and content differ.

HUMA 296 **Directed Study (1 to 3 credits)**
Prerequisite: Approval of academic advisor and department chair.
Directed study gives students the opportunity to explore an area of interest without having extensive knowledge or experience in the subject area or field of study. As a result, faculty direction and guidance are critical. A formal written report is usually required.

HUMA 311 **Engineering Communication (3-0-3)**
Prerequisites: ENGL 112; Junior Standing
This Engineering Communication course is designed to practice specific detailed written and oral communications used in Engineering. The course covers written documents and oral communication produced in response to the context of the Engineering curriculum and/or issues related to it. Students will work on realistic contextualized tasks with the aim of developing communication strategies necessary to meet the academic and entry-level professional requirements in Engineering.

9.12 | ISYE Industrial and Systems Engineering

ISYE 200 **Engineering Economic Analysis (3-0-3)**
Prerequisite: BUSS 201
This course will introduce economic analysis for the comparison of engineering alternatives to make informed financial decisions. Topics include time value of money, present-worth analysis, annual equivalence analysis, rate-of-return analysis, and methods to address project uncertainty.

ISYE 201 **Introduction to Systems Engineering (3-0-3)**
Prerequisites: MATH 112; ENGR 112
This course provides an understanding of the processes and management practices associated with the systems engineering discipline, highlights how systems engineering principles can be applied to technical projects. Students will become familiar with common SE terms, standards, and procedures and acquire knowledge and skills necessary to engineer complex, multi-disciplinary systems

ISYE 251 **Operations Research I (3-0-3)**
Prerequisite: MATH 211
This course introduces Operations Research and deterministic mathematical modeling with emphasis on linear programming. Topics include mathematical modeling of industrial problems, graphical interpretation, simplex method, duality and sensitivity analysis; general solution strategies; and utilization of modeling languages and solvers for computer solution.

ISYE 271 **Modern Methods of Manufacturing (3-3-4)**
Prerequisite: ENGR 112; PHYS 121
This course introduces modern methods of manufacturing with emphasis on processes and techniques such as digital and additive manufacturing to address the interaction of design, materials, energy, and processing. Laboratory instruction and hands-on experience in machining, process planning, economic justification, and current manufacturing methodologies.

ISYE 311 **Quality Control & Reliability (3-3-4)**
Prerequisite: MATH 213
This course will introduce theory and methods of quality control, system level reliability and maintenance engineering. Topics covered include process capability indices, attributes and variables control charts, time weighted control charts (CUSUM and EWSA), process and improvement with design of experiments, hazard functions, life distributions, censoring, accelerated life testing, structure functions, reliability and maintenance systems, replacement theory .

ISYE 331 **Stochastic Processes (3-0-3)**
Prerequisite: MATH 211; MATH 213
To learn techniques for modeling stochastic systems, introduce methods for using stochastic models in solving engineering design problems. Analyze probability models that capture short and long term effects of randomness on the systems using a broad range of mathematical and computational tools. Applications such as inventory, reliability, queuing models, and service systems will be discussed.

ISYE 341 **Simulation Modeling and Analysis (3-3-4)**
Prerequisites: ENGR 112; ISYE 331
Discrete event simulation methodology emphasizing the statistical basis for simulation modeling and analysis. Overview of computer languages and simulation design. Applications include a variety of industrial situations, including manufacturing and logistics simulations.

ISYE 351 **Production, Operations and Inventory Management (3-0-3)**
Prerequisite: MATH 213; ISYE 200; ISYE 251; ISYE 271
This course introduces students to concepts of operations management in manufacturing and non-manufacturing sectors. The course analyzes the interrelationships among the component blocks of the system: forecasting, inventory models, aggregate planning, production scheduling, material and capacity planning, and operations scheduling. The course also includes an overview of integrated production planning and control including MRP II.

ISYE 352 **Lean Manufacturing (3-0-3)**
Prerequisite: ISYE 351
This course will introduce students to lean philosophy and tools, and will teach students how to design lean manufacturing systems. It will identify differences between push and pull type manufacturing systems. While the course primarily focuses on manufacturing systems it will also provide basic knowledge needed to design lean service systems.

ISYE 360 **Human Factors & Safety Engineering (3-3-4)**
Prerequisite: ISYE 201
An introduction to human capabilities and their limitations in engineered systems to increase productivity and work safely. Topics include the range of human motions, senses, and cognitive abilities; the incorporation of the human element into system and product design; communicating critical information to human users; ergonomics and safety in workplace design; safety in workplace.

ISYE 361 **Data and Information Engineering (3-0-3)**
Prerequisite: ENGR 112
This course introduces data modeling and the design and implementation of databases to extract and represent information for various industry applications. Topics include relational models and normalization, entity-relationship models, manipulation of data using Structured Query Language, data visualization and analysis tools, and retrieving data from external sources such as ERP systems and data warehouses.

ISYE 391 Independent Study I (Variable course credits from 1 to 3)
Prerequisites: Junior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

ISYE 401 Advanced Systems Engineering (3-0-3)
Prerequisite: ISYE 201
This course introduces advanced level to systems methodology, design, and management, an overview of systems engineering as a professional and intellectual discipline, and its relation to other disciplines, such as operations research, management science, and economics.

ISYE 422 Reliability (3-0-3)
Prerequisite: ISYE 321
To understand and learn system level reliability and maintenance engineering, specific topics include hazard functions, life distributions, censoring, life tables, nonparametric and parametric estimation and inference, accelerated life testing, structure functions, reliability and maintenance systems, replacement theory.

ISYE 430 Supply Chain and Logistics (3-3-4)
Prerequisites: ISYE 251, ISYE 351
This course will introduce supply chain and logistics activities that support the physical supply of raw and semi-finished materials to a firm, the planning and control of operations, and the delivery of the products or services up to the final customers, with the objective of achieving a sustainable competitive advantage and optimizing the value of long-term performance of the firm and supply chain as a whole.

ISYE 431 Forecasting and Time Series (3-0-3)
Prerequisites: MATH 213; ISYE 211
The objective of this course is to teach the students how to model and forecast using time series data, statistical techniques for forecasting and use of standard statistical software. Topics include: time series regression, decomposition methods, exponential smoothing, and the Box-Jenkins forecasting methodology. This course will provide students with hands-on experience in modeling and forecasting techniques.

ISYE 432 Advanced Stochastic Processes (3-0-3)
Prerequisite: ISYE 331
This course covers the analysis and modeling of stochastic processes. Topics include measure theoretic probability, martingales, renewal theory, elements of large deviations theory, Brownian motion, stochastic integration and Ito calculus and functional limit theorems. In addition, the course will go over some applications to finance engineering, insurance, queuing and inventory models.

ISYE 433 Advanced Statistics (3-0-3)
Prerequisite: MATH 213
This course introduces Advanced Inferential Statistics and the conceptual underpinnings of statistical methods and how to apply them to address more advanced problems. Topics covered includes design of experiments, nonparametric statistics, and Bayesian statistics. Learning how to effectively use data and use of statistics-oriented programming language such as R or SAS

ISYE 441 Advanced Simulation (3-0-3)
Prerequisite: ISYE 341
This course provides an advanced treatment of discrete-event simulation models and analysis techniques. Topics include large-scale and complex industrial systems; probability theory and queuing theory; random number and random variate generation, input modeling, output analysis, sensitivity analysis, design of experiments, comparison of alternative systems.

ISYE 445 Six-Sigma Methodology & Applications (3-0-3)
Prerequisite: MATH 213
This course introduces the concept, deployment and practice of Six-Sigma, Six-Sigma methodologies for process improvement and process/product design including: DMAIC and DMADV methods; overview of different quality management tools applied in Six-Sigma projects; Six-Sigma project management and applications of Six-Sigma tools in real world projects.

ISYE 451 Operations Research II (3-0-3)
Prerequisite: ISYE 251
This course will introduce a variety of optimization problems with integer variables and constraints. Topics covered include assignment problems, transportation, transshipment problems, network flows problems, and IP algorithms such as Cutting Planes, Branch & Bound. Applications include the Knapsack Problem and the Traveling Salesman Problem. Appropriate Optimization software tools will be used to solve a variety of practical problems.

ISYE 461 Design of Human-Integrated Systems (3-0-3)
Prerequisites: MATH 213; CMPE 211
Introduction to the effective design of information technology to support human activity in the workplace. Topics include general cognitive systems engineering concepts and principles and specific concepts and principles of interface design, task analysis, prototyping, and empirical usability evaluation methods. Case studies and individual and group design projects help students apply the concepts and principles in domains such as service, management, manufacturing, transportation and control systems.

ISYE 475 Facilities Planning and Warehousing (3-3-4)
Prerequisites: ISYE 351
Design of facilities for the most efficient flow and storage of raw materials, work-in-process, and completed stock through a work place. Topics include facilities layout planning models, space-activity relationships, materials handling, storage, and warehousing in relation to trends toward reduced inventory, smaller lot sizes, and just-in-time production using current modeling and analysis tools.

ISYE 480 Financial Engineering (3-0-3)
Prerequisites: MATH 213; ISYE 251
This is an introductory course on financial engineering, technical difficulty of the subject is kept at a minimum, while the major ideas and concepts underlying modern financial engineering are explained and illustrated. Students will learn about the different types of interest, annuities, debt retirement methods, investing in stocks and bonds. The course covers the binomial model for stock prices, portfolio management, and an elementary introduction to continuous time models and the Black-Scholes formula.

ISYE 481 **Procurement and Supply Management (3-0-3)**
Prerequisite: ISYE 351
Procurement supplies the organization with a flow of materials and services that ensure continuity of supply by maintaining effective relationships with existing sources and by developing other sources of supply either as alternatives or to meet emerging or planned needs. Topics include sourcing strategies, outsourcing, pricing and total cost of ownership.

ISYE 485 **Stochastic Manufacturing And Service Systems (3-0-3)**
Prerequisite: ISYE 331
Models for describing stochastic movements of parts and material in manufacturing facilities, supply chains, inventory systems, and equipment maintenance networks. Analysis of congestion, delays, machine usage, line balancing, equipment availability, inventory ordering policies, and system crashes. Basics of Markov Chains and queuing theory.

ISYE 491 **Independent Study II (Variable course credits from 1 to 3)**
Prerequisites: Senior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

ISYE 495 **Special Topics in Industrial Engineering (3-0-3)**
Prerequisites: Senior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

ISYE 497 **Senior Design Project (1-6-3)**
Prerequisites: ISYE 311; ISYE 341; ISYE 352
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

ISYE 498 **Senior Design Project II (0-9-3)**
Prerequisite: ISYE 497
Continuation of ISYE 497

9.13 | JAPN Japanese

JAPN 101 **Elementary Japanese I (3-0-3)**
Prerequisite: None
This course is designed for those who have no prior knowledge of Japanese. Students will become familiar with Japan's language and culture through short passages or dialogues related to standard situations encountered in Japan, using audio-visual material. The course does not only teach basic language skills, but also builds up vocabulary, an understanding of grammar and basic sentence structures as a foundation for oral comprehension and teaches Hiragana, Katakana . The attention paid to each of the four basic language skills, listening, speaking, reading, and writing, is carefully attuned to the goal of creating a balanced competence profile.

JAPN 102 **Elementary Japanese II (3-0-3)**
Prerequisite: JAPN 101 or Placement Exam
The course is a continuation of JAP101and continues to build up the four basic language skills. Apart from building vocabulary and reinforcing grammatical concepts acquired in JAP101, communication skills will take center stage. While listening and speaking are thus at the center of the curriculum, the course will also contain rigorous materials related to central grammatical properties of contemporary Japanese.

9.14 | KORA Korean

KORA 101 **Elementary Korean I (3-0-3)**
Pre-requisite: None
This course is designed for those who have no prior knowledge of Korean. Students will study the language's orthography, phonetics, grammar and vocabulary. It provides complete beginners of Korean with a solid foundation in all four language skills: reading, writing, speaking and listening. The course introduces simple communication in most essential daily life situations such as greetings, self-introduction, weather, shopping, time and appointments, past activities, and future plans.

KORA 102 **Elementary Korean II**
Prerequisite: KORA 101 or placement exam
This course is designed for students who have a basic knowledge of the Korean language. It provides a foundation that will enable students to improve and acquire language skills in listening, speaking, reading and writing. In addition, students will develop communication skills for routine tasks and situations.

9.15 | MATH Mathematics

MATH 111 **Calculus I (3-1-4)**
Prerequisite: MATH 002 or placement test
This course will introduce students to the theory and techniques of single variable differential and integral calculus. Applications of single variable calculus for modeling, and solving, real-world problems in science and engineering will also be included. Students will be expected to demonstrate an understanding of the underlying principles of the subject, in addition to being able to apply the techniques of calculus in a problem-solving context.

MATH 112 **Calculus II (4-0-4)**
Prerequisite: MATH 111 (C grade or higher)
This is a second semester calculus course for students who have previously been introduced to the basic ideas of differential and integral calculus. Over the semester we will study the following topics: Applications and methods of integration, infinite sequences and series and the representation of functions by power series, polar and parametric equations and curves, functions of two variables, partial derivatives, double integrals.

MATH 211 **Differential Equations and Linear Algebra (4-0-4)**
Prerequisites: MATH 112
This course introduces ordinary differential equations with a focus on the solution techniques for first order equations, higher order homogeneous and nonhomogeneous linear equations with constant coefficients, linear and almost linear systems, and Laplace transforms. The course also covers basic topics of linear algebra, including linear systems, basic properties of matrices, vector spaces, and eigenvalues and eigenvectors.

MATH 212 **Calculus III (4-0-4)**
Prerequisite: MATH 112
This course considers the development of differential, integral and vector calculus for functions of several variables. The course also includes the application of concepts from multivariable calculus to the study of curves and surfaces in space, the study of vector fields, optimization, areas, volumes and flux. The topics covered in this course are interesting, as well as important, with numerous scientific and engineering applications

MATH 213 **Probability and Statistics for Engineers (4-0-4)**
Prerequisite: MATH 112
The course introduces students to probability models and statistical methods for data analysis. The course will cover introductory probability theory, several discrete and continuous probability distributions, and different statistical inference methods such as point estimation/interval estimation for the mean and the variance (based on one and two samples), hypothesis testing for the mean and the variance (based on one and two samples) and simple linear regression.

MATH 214 **Mathematical and Statistical Software (3-0-3)**
Prerequisites: ENGR 112; MATH 223
Co-requisite: MATH 211
This course provides students with an introduction to the two major software packages used in the Applied Mathematics and Statistics program, and its concentrations. Students will receive significant hands-on training in the use of MATLAB for mathematical applications, and R for statistical applications.

MATH 223 **Probability and Statistical Inference (4-0-4)**
Co-requisite: MATH 211
The course provides a mathematically rigorous introduction to the Theory of Probability and Inferential Statistics and presents numerous applications in various fields. It covers random variables/vectors, expectation and variance and probabilistic limit theorems. These (probabilistic) tools are then used to present inferential statistics methods, including point/interval estimation, Hypothesis Testing and regression models.

MATH 311 **Probability and Statistics with Discrete Mathematics (4-0-4)**
Prerequisite: MATH 112
An introduction to probability theory and statistics, with an emphasis on applications and problem solving. Probability and statistics is an important foundation for computer engineering fields such as artificial intelligence, data structures and algorithms, data communications and networking, and image processing and analysis. This course also covers an introduction to elementary discrete mathematics for computer engineering, emphasizing mathematical definitions and proofs as well as applicable methods.

MATH 312 **Complex Variables with Applications (4-0-4)**
Prerequisite: MATH 211
This course provides students with a sound knowledge of complex variables and complex integrals, Laplace and Fourier transforms, Fourier integrals and series along with a brief introduction to Boundary Value Problems (BVPs). After this course, students will be able to apply strong mathematical tools to model and solve a wide range of the practical problems in engineering and technology.

MATH 313 **Applied Engineering Mathematics (4-0-4)**
Prerequisite: MATH 211
This course presents numerical and analytical methods to solve mathematical models in engineering science, including algebraic equations, ordinary differential equations, and partial differential equations. Applications will include wave motion and heat conduction. The course includes computer based projects.

MATH 314 **Real Analysis and Probability (4-0-4)**
Prerequisites: MATH 211; MATH 212; MATH 223
This course provides students with an introduction to the fundamental concepts and theory which underpin many of the applied mathematics and statistics courses that follow in the Applied Mathematics and Statistics Program.

MATH 315 **Advanced Linear Algebra (3-0-3)**
Prerequisites: MATH 211
Survey of the mathematical structure of vector spaces and linear transformations within a scientific and engineering context. Topics include: vector spaces, matrices, linear mappings, scalar products and orthogonality; symmetric, Hermitian, and unitary operators, eigenvalues and eigenvector theorems, diagonolization and the spectral theorem; applications including convex sets, separating hyper-planes, Krien-Milman theorem.

MATH 316 **Partial Differential Equations (3-0-3)**
Prerequisites: MATH 314
The course introduces the modern theory of partial differential equations in both classical and variational formulations. Students will have the opportunity to study some of the following topics: Series solutions of ODEs, Legendre's and Bessel's ODEs, PDEs and their classifications, Well-posedness, Green's functions and integral representations, Non-linear PDEs, Sobolev spaces and related Theorems, Variational formulation of PDEs, Weak solutions and the Lax-Milgram formulation.

MATH 317 **Nonparametric Statistics (3-0-3)**
Prerequisites: MATH 214; MATH 314
The course provides an overview of modern nonparametric statistics and aims at familiarizing students with a wide range of ideas in this field. A combination of theoretical results and computational techniques will be presented with the clear goal of developing a thorough understanding of a number of useful methods for analyzing data.

MATH 318 **Multivariate Statistics (3-0-3)**
Prerequisites: MATH 211; MATH 212; MATH 214
This course provides a thorough introduction to multivariate statistical analysis methods. Particular emphasis will be placed on methods for analyzing categorical data. All methods will be illustrated with real data sets using the open-source software R.

MATH 319 **Numerical Analysis I (3-0-3)**
Prerequisites: MATH 211; MATH 214
A survey of numerical methods for scientific and engineering problems. Topics include numerical solution of linear and nonlinear algebraic equations, interpolation and least squares approximation, numerical integration and differentiation, eigenvalue problems, and an introduction to the numerical solution of ordinary differential equations. Emphasis is placed on efficient computational procedures including the use of library and student-written procedures using MATLAB.

MATH 399 **Internship (0-0-1)**
Prerequisite: Junior standing and approval of department
Students are required to spend a minimum of eight continuous weeks on an approved internship program. The internship provides students with practical, on-the-job experience which allows them to integrate theory with "real world" situations. It is academically supervised by a faculty member and professionally supervised by the

company's internship supervisor who provides feedback to the university about the student's progress. A formal report, that documents the work undertaken during the internship period, must be submitted to the Department within the first two weeks of the semester following the internship. The report and the complete course activities are graded on a Pass/Fail basis by a faculty member.

MATH 411 Modern Algebra (3-0-3)
Prerequisite: MATH 315
This course provides students with a survey of properties of fundamental elements of modern algebra such as groups, rings, and fields and their applications to engineering. Topics include: sets and functions, fundamental theorems of groups, rings, and fields; homorphism theorems; Galois theory; applications to number theory and encryption, coding theory and error correcting codes.

MATH 412 Optimization (3-0-3)
Prerequisites: MATH 317; MATH 318
This course introduces the principal methods and algorithms for linear, nonlinear, and multi-objective optimization. Emphasis is on methodology and the underlying mathematical structures. Topics include the simplex method, convex optimization, optimality conditions for nonlinear optimization, interior point methods for convex optimization, Newton's method, duality theory, Lagrange multiplier theory, multi-objective decision making, goal programming, stochastic optimization, fuzzy optimization, and applications in finance and management.

MATH 413 Game Theory (3-0-3)
Prerequisite: MATH 315
Introduction to the mathematical theory of games and game theoretic analysis. Topics include: combinatorial and strategic games, Zermelo's algorithm, strictly competitive games, minimax theorem; non-cooperative games and Nash equilibrium; games with mediated communication, repeated games and finite automata; common knowledge and incomplete information; applications in economics, biology, and political science.

MATH 414 Discrete Mathematics (3-0-3)
Prerequisite: MATH 315
Review of propositional and predicate calculus. Introduction to naïve set theory. Relations including equivalence relation and partial order. Cardinality including surjective and injective functions. Recursion and induction including well order. Boolean algebras, Knot Theory and Graph Theory.

MATH 415 Design of Experiments (3-0-3)
Prerequisites: MATH 317; MATH 318
A review of simple designs and analysis of variance, followed by an introduction to block designs, Latin Squares and Related Designs, Full Factorial Designs, 2-level Full Factorial and Fractional Factorial Designs, Response surface methods and designs, Designs with Random Factors, Nested Designs, and split-plot Designs.

MATH 416 Sample Survey Design and Analysis
Prerequisite: MATH 214
This course will focus on methodological issues regarding the design, implementation, analysis, and interpretation of surveys and questionnaires in variety of applied areas such as education, healthcare, social sciences, etc.

MATH 419 Numerical Analysis II (3-0-3)
Prerequisite: MATH 319
Introduction to the theory and practical methods for numerical solution of differential equations. Runge-Kutta and multistep methods, stability theory, stiff equations, boundary value problems. Finite element methods for boundary value problems in higher dimensions. Direct and iterative linear solvers. Discontinuous Galerkin methods for conservation laws.

MATH 421 Econometrics (3-0-3)
Prerequisite: MATH 317; MATH 318
Fundamentals of statistical time series analysis and econometrics are presented and developed for models used in the modern analysis of financial data. Techniques are motivated by examples and developed in the context of financial applications.

MATH 422 Stochastic Differential Equations (3-0-3)
Prerequisite: MATH 314
Stochastic Differential Equations are used extensively in economics and finance. Reflecting this, this course provides an introduction to stochastic differential equations emphasizing applications and computations. It considers strategies for exact, approximate, and numerical solutions of SDEs, and emphasizes the relationship with partial differential equations.

MATH 423 Financial Risk Analysis (3-0-3)
Prerequisite: MATH 412
This course aims to provide an overview of the main theoretical concepts underlying the analysis of financial risk and to show how these concepts can be implemented in practice in a variety of financial contexts. Additionally students will learn how to examine and manage risk and its impact on decisions and the potential outcomes.

MATH 424 Optimal Control Theory (3-0-3)
Prerequisite: MATH 412
This course aims to provide an overview of deterministic and stochastic control theory in both discrete and continuous time. We will apply the theory to relevant problems in finance and economics.

MATH 425 Financial Portfolio Management (3-0-3)
Prerequisite: MATH 412
This course concerns making sound financial decisions in an uncertain world. Increasingly, financial decision-makers are depending on optimization techniques to guide them in their decisions. Topics to be covered will include asset/liability management, option pricing and hedging, risk management, and portfolio selection. Optimization techniques to be covered will include linear and nonlinear programming, integer programming, dynamic programming, and stochastic programming.

MATH 431 Computational Methods in Biology (3-0-3)
Prerequisite: BMED 211
Co-requisite: MATH 419
This course presents an overview of important applications of computers to solve problems in biology. Major topics covered are computational molecular biology, modeling and simulation including computer models of population dynamics, biochemical kinetics, cell pathways, neuron behavior, and mutation and development of models of physiological systems using the compartmental framework. The final part of the course introduces techniques to analyze and interpret the "classical" models of theoretical ecology.

MATH 432 Mathematical Models in Biology (3-0-3)
Prerequisite: MATH 316; MATH 419; BMED 211
This course provides an introduction to the application of differential equations (ODEs and PDEs) to develop

mathematical models of real-world phenomena in the biological sciences. Topics will include drug infusion, epidemics, chemical kinetics and enzymatic reactions, population growth and oxygen diffusion in muscles.

MATH 433 Biostatistics (3-0-3)
Prerequisite: MATH 318; BMED 211
This course provides an introduction to Biostatistics. In particular, methods and concepts of statistical analysis and sampling in the biological sciences are presented. A thorough coverage of Sequential Analysis methods and Survival Analysis methods, and their applications in Biology, are included.

MATH 434 Bioinformatics (3-0-3)
Prerequisite: MATH 433; BMED 202
Principles of protein structure, techniques within the framework of basic shell scripting and web-based bioinformatics databases/tools, principles of sequence alignment, automation/use of existing applications for the analysis of large datasets.

MATH 435 Mathematical Imaging (3-0-3)
Prerequisite: MATH 412
Mathematical Imaging provides a comprehensive treatment of the mathematical techniques used in imaging science. Students will become familiar with concepts such as image formation, image representation, image enhancement, noise, blur, image degradation, edge detection, filtering, de-noising, morphology, image transforms, image restoration, image segmentation, image quality measure, fractal image coding, with applications to Bio-imaging and Medical Imaging.

MATH 450 Senior Project I (3-0-3)
Prerequisite: Successful completion of the first six semesters of the program
This is a two semester course in which students will conduct a research project under the close supervision of one faculty member. Typically, this will be an individual research experience for the student although small group projects, consisting of no more than two student members, may be considered in exceptional circumstances. Students will present the results of their research in the form of a written thesis and an oral presentation to faculty and students.

MATH 451 Senior Project II (3-0-3)
Prerequisite: MATH 450
Continuation of MATH 450.

9.16 | MECH Mechanical Engineering

MECH 180 Computer Aided Design (2-3-3)
Prerequisite: None
The course introduces students to key concepts, techniques and applications of a Computer Aided Design (CAD) 3D Solid Modeling system. An introduction of visualization techniques in 2D and 3D, including hand sketching, is followed by an exploration of the parametric solid modeling environment, sketching and features.

MECH 201 Engineering Dynamics (3-0-3)
*(Cross listed with AERO 201; CIVE 201)
Prerequisite: ENGR 200
Review of kinematics and kinetics of particles: rectilinear and curvilinear motions; Newton's second law; energy and momentum methods. Kinematics and kinetics of rigid bodies: plane motion of rigid bodies; forces and accelerations; energy and momentum methods.

MECH 225 Mechanics of Solids (3-3-4)
*(Cross listed with AERO 225)
Prerequisite: ENGR 200
The course is an introduction to the mechanics of deformable solids applied to basic engineering structures. It covers the concepts of stress and strain at a point; deformation of axial members; symmetric and asymmetric bending of elastic and elastic-perfectly plastic beams; torsion of open and closed section; beam deflection; stress and strain transformations, and elastic buckling of columns.

MECH 240 Thermodynamics (3-0-3)
Prerequisite: PHYS 121
Co-requisite: MATH 212
Introduction to the concept of energy and the laws governing the transfer and transformations of energy. Emphasis on thermodynamic properties of pure substance, the first law analysis of closed and open systems, the concept of entropy, and the second law of thermodynamics. Integration of these concepts into the analysis of basic power and refrigeration cycles.

MECH 270 Design for Manufacturability (3-3-4)
Co-requisite: MECH 180
Introduction to DFM methodologies and tools; designing for primary manufacturing processes (cutting fundamentals, casting, forming, and shaping); plastics production processes and designing with plastics (snap-fits, integral hinges, etc.); ceramics and powder metal production; design for assembly (DFA); rapid prototyping, and computer integrated manufacturing (CIM).

MECH 325 Engineering Materials (3-3-4)
Prerequisites: CHEM 115; PHYS 121
Materials (metals, alloys, polymers) in engineering practice; relationship of inter-atomic bonding, crystal structure and defect structure (vacancies, dislocations) to material properties; polymers, ceramics, composites, phase diagrams and alloys; microstructure control (heat treatment) and mechanical properties; material failure; corrosion.

MECH 335 Fluid Mechanics (3-3-4)
Prerequisite: PHYS 121, MATH 212
This course introduces students to concepts relating to fluids and examines the forces on them. Conservation of mass, momentum, and energy are fundamental to the physics. Various mathematical representations are considered, including differential and integral formulations. The complexity of fluid dynamics motivates the notions of simplifying assumptions, dimensional analysis, boundary layers, and shock waves, among others.

MECH 350 Dynamic Systems and Vibration (3-0-3)
Prerequisites: MATH 211; MECH 201, PHYS 122
Mathematical modeling of mechanical, electrical, hydraulic, electrical, and/or thermal systems; basic concepts in dynamic systems analysis – equilibrium, linearization; mechanical vibrations: free and forced vibration of single degree-of-freedom systems, transient and steady-state response, resonance, free vibration of two degree-of-freedom systems; transfer functions and block diagrams, design specifications based on step response, applications.

MECH 356 Mechatronics (3-3-4)
Prerequisite: MECH 350
Principles of mechatronic systems, modeling, time & frequency domain analysis. Feedback in mechatronic

systems, prototype systems, PID controllers. Electronic components in mechatronic systems. Sensors, actuators, microcomputers, programming. Signal measurement, A/D and D/A conversion, quantization, digital filters and principles of Digital Signal Processing, digital controllers. Mechatronic system design and experiments.

MECH 384 Control of Mechanical Systems (2-3-3)
Co-requisite: MECH 350
Introduction to the control of mechanical and vibrating systems. State space and transfer function representations. Control specifications and control system architectures. PID and alternative controller design. Root locus and frequency domain designs. Application examples.

MECH 387 Machine Element Design (2-3-3)
Prerequisites: MECH 225; MECH 270
Design and analysis of machinery for load bearing and power transmission. Consideration of material failure modes. Design and selection of machine elements: shafts, rolling element bearings, bolts, belts, and power transmissions such as gears.

MECH 391 Independent Study I (Variable course credits from 1 to 3)
Prerequisite: Junior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

MECH 405 Vibration Analysis (3-0-3)
Prerequisite: MECH 350
Free and forced vibrations of one and two degree- of-freedom systems. Vibration measurement and isolation. Numerical methods for multi-degree-of-freedom systems. Modal analysis techniques. Dynamic vibration absorbers. Shaft whirling. Vibration of continuous systems: bars, plates, beams and shafts. Energy methods. Holzer method.

MECH 420 Materials: Strength and Fracture (3-0-3)
Prerequisite: AERO/MECH 220
The course is an introduction to the mechanics of fracture for engineering materials. It covers the analysis and prevention of failure in metals, polymers, ceramics and composites; plastic deformation and plastic collapse; initiation and propagation of cracks; environment-assisted cracking, and fatigue.

MECH 421 Mechanics of Deformable Solids (3-0-3)
Prerequisites: MECH 225
The course is an introduction to the theory of elasticity. It covers the concepts of deformation, stress and strain in a continuum; Formulation and solution strategy for boundary value problems in linear elasticity; Concepts of work and energy and the principle of virtual work; Problems in plane stress and plane strain in two-dimensional elasticity and solution using stress functions; Solutions to axial deformation, bending and torsion problems for elastic cylinders.

MECH 422 Fatigue and Fracture Analysis (3-0-3)
Prerequisites: MECH 225
The course is an introduction to elastic and elastic-plastic fracture mechanics and fatigue. It covers the topics of stress concentration due to defects, linear elastic fracture mechanics, energy methods in fracture mechanics, stress analysis of cracks and stress intensity, stress-life and strain-life methods of fatigue analysis and design, and initiation and propagation of fatigue cracks under cyclic loading.

MECH 435 Fluid Machinery (3-0-3)
Prerequisite: MECH 335
The basic operating principles of fluid machinery and fluid power installations. Topics covered include: pipelines, centrifugal pumps and fans, hydraulic turbines, high pressure hydraulic systems and positive displacement pumps. Problem analysis emphasizes mechanical engineering applications.

MECH 441 Applied Thermodynamics (3-0-3)
Prerequisite: MECH 240
Gas and vapour power cycles: reheat, regeneration, combined gas/vapour cycles, cogeneration. Heat pump and refrigeration cycles: vapour compression cycles, absorption refrigeration and gas refrigeration. Mixtures of perfect gases and vapours: stoichiometry and combustion.

MECH 443 Heat and Mass Transfer (3-3-4)
Co-requisite: MECH 335
Mechanisms of heat and transfer: fundamental physical mechanisms and applications. Steady and transient conduction: Convective heat and mass transfer and the Reynolds analogy: free and forced convection for laminar and turbulent flows; heat exchangers. Radiative heat transfer between black and grey surfaces. Fundamentals of mass diffusion.

MECH 445 Heating and Air Conditioning (3-0-3)
Prerequisite: MECH 240
Environmental demands for residential, commercial and industrial systems. Methods of altering and controlling environment. Air distribution. Refrigeration methods, equipment and controls. Integrated year-round air-conditioning and heating systems; heat pumps. Cooling load and air-conditioning calculations. Thermal radiation control. Component matching. System analysis and design.

MECH 446 Internal Combustion Engines (3-0-3)
Prerequisite: MECH 240
The basic operating principles of internal combustion engines. Topics covered include: engine thermodynamics, thermochemistry and fuels, engine fluid mechanics and heat transfer and pollutant emissions. Problem analysis emphasizes propulsion and power-generation applications in mechanical engineering.

MECH 450 Vehicle Engineering (3-0-3)
Prerequisites: MECH 386; MECH 350
The course emphasizes the engineering and design principles of road transport vehicles. Topics to be covered include: performance characteristics, handling behaviour and ride quality of road vehicles.

MECH 455 Robotics (3-0-3)
Prerequisites: MECH 356
This course is an introduction to kinematics, dynamics, and control of robot manipulators. Emphasis is placed on computer use in control of actual robots and in simulation of mathematical models of robots.

MECH 465 Bioengineering (3-0-3)
Prerequisite: MECH 225
Co-requisite: MECH 325
This is an introductory course to bioengineering. Basic mechanical description of the hierarchical structure of an organism: molecules, membranes, cells, tissues, skeleton, and locomotion, will be covered. Conservation of material, energy, charge and momentum in biological systems will also be covered.

MECH 485 **Power Plant Systems Design (3-0-3)**
Prerequisite: MECH 443
This course covers a detailed engineering analysis and design of a thermal power plant, including heat balance, selection of equipment (boiler, turbines, heat exchangers, pumps, cooling tower), performance evaluation, economic evaluation and feasibility studies.

MECH 486 **Sustainable Energy (2-3-3)**
Prerequisite: MECH 240
The course provides introductory coverage of energy production, conversion, distribution and storage systems for different sources of energy including fossil fuel; nuclear power; biomass energy; geothermal energy; hydropower; wind energy, and solar energy. Emphasis is placed on the sustainable use of energy in light of economic, environmental, and societal constraints.

MECH 491 **Independent Study II (Variable course credits from 1 to 3)**
Prerequisites: Senior standing and approval of the department
This course gives an undergraduate student the opportunity to participate in an individual or group oriented project, study and/or research study under direction of a faculty member. A formal report is required.

MECH 497 **Senior Design Project I (1-6-3)**
Prerequisites: MECH 325; MECH 384; MECH 387
Participation in team projects dealing with design and development of a product or a system. Number of project will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to draw upon their engineering background, experience, and other pertinent resources. Oral and written presentations are required.

MECH 498 **Senior Design Project II (0-9-3)**
Prerequisite: MECH 497
Continuation of 497

9.17 | NUCE Nuclear Engineering

NUCE 301 **Radiation Science and Health Physics (3-0-3)**
Prerequisites: PHYS 122; MATH 211 (or NUCE 302)
This course provides students with an understanding of radiation science, including radiation shielding, as a foundation to understanding the theoretical and practical aspects of radiological protection and a working knowledge of radiation protection legislation. Topics covered include introduction to modern physics, radioactivity, nuclear reactions, and radiation interactions with matter, radiation detection, protection, dose, and legislation.

NUCE 302 **Applied Mathematics for Nuclear Engineering (3-0-3)**
Prerequisites: MATH 112 or equivalent
This course recaps some of the undergraduate mathematics materials relevant to the advanced graduate courses. Furthermore, basic introductory material for the numerical analysis will be also provided to the students.

NUCE 303 **Mechanics & Thermal-hydraulics Principles for Nuclear Engineering (3-0-3)**
Prerequisite: PHYS 121 or equivalent
This course provides students with a thorough understanding in mechanics of materials and thermal hydraulics related topics and concepts. The specific subjects are selected on the basis of their relevance and applicability to nuclear engineering technology.

NUCE 401 **Introduction to Nuclear Reactor Physics (3-0-3)**
Co-requisite: NUCE 301
This course provides the students with the basic understanding of nuclear reactor physics. It also provides students with the fundamental principles and practical applications related to the utilization of nuclear energy from fission. It covers the concepts of neutron diffusion in one-group and multi-group contexts. It also gives a brief introduction to the subject of time-dependent nuclear reactor.

NUCE 402 **Introduction to Nuclear Systems and Operation (3-0-3)**
Prerequisites: (MECH 240 and MECH 335) OR NUCE 303; NUCE 401
This course provides students with an overview of nuclear systems and power plants, including operation steps, energy transport schemes, various power reactor types, safety principles, and control functions, as a foundation to understanding the theoretical and practical aspects of nuclear plant design and operation and a working knowledge of various safety features

NUCE 403 **Introduction to Nuclear Technology and Reactor Systems (3-0-3)**
Prerequisites: (MECH 240 and MECH 335) OR NUCE 303; NUCE 401
Note: Students can either take NUCE 402 or NUCE 403 but not both.
This course provides the students with a general description of nuclear energy systems including the performance and operation principles as well as methods for the design and critical analysis of these systems at TAMU, USA. Then, the course provides the students with more practical design of nuclear system and operation including design and functionality of major component in NPP and hands-on exercises of various NPP simulator at KU, UAE. The course includes Field Trips and visits to various Laboratories and Facilities.

9.18 | PHYS Physics

PHYS 121 **University Physics I (3-2-1-4)**
Prerequisite: MATH 111
Co-requisite: CHEM 115
This course gives a vector-based and calculus-based introduction to fundamental concepts in Newtonian mechanics, mechanical conservation laws, waves, and heat. The course introduces one and two dimensional motion description and modeling using force, energy, and momentum methods. Different types of motion are discussed such as rectilinear, circular, rotational, simple harmonic, and waves.

PHYS 122 **University Physics II (3-2-1-4)**
Prerequisites: PHYS 121; MATH 112
This course uses basic vector calculus and advanced techniques in integration to determine the spatial and temporal distribution of charges, currents and electromagnetic fields. Basic elements of electric and material properties and basic elements of electric circuits are also introduced. Electromagnetic waves and applications to physical optics are discussed.

9.19 | ROBO Robotics

ROBO 301 **System Dynamics and Control (3-0-3)**
Prerequisite: MATH 211
Restrictions: Students majoring in Aerospace and Mechanical Engineering are not allowed to take this course.
The contents include both dynamic modelling of mechanical and electromechanical systems, different types of controller designs and their practical applications. Review of kinematics and kinetics of particles; Kinematics and kinetics of plane motion of rigid bodies; Principles of feedback; Time domain specifications and stability analysis; PID controller design and PID tuning; Root Locus method.

ROBO 302 **Signals and Communications (3-0-3)**
Prerequisite: MATH 211
Restrictions: Students majoring in Electrical and Electronic, Communication, or Computer Engineering are not allowed to take this course.
Complex numbers and functions, conformal mapping, analytic functions, elements of residue theory, Fourier and Laplace transform and its properties and linear time invariant systems. Introduction to data and computer communications, fundamentals of computer networks theory, design, protocols, analysis and operation, OSI model, data transmissions and transmission media, local and wide area networks and IP networks, computer networks and their protocols.

ROBO 401 **UAV Modeling and Control (3-0-3)**
Prerequisite: ROBO 301 or (AERO/MECH 201 & AERO 350/MECH 384)
The course covers the theory and practice of the modeling and control of UAV systems. The key topics of this course include: the first-principles modeling and simulation of fixed-wing and rotorcraft UAVs, flight dynamics modeling via system identification, on-board flight control system design, and control performance tuning of the auto-pilot system.

ROBO 402 **UAV Sensing (3-0-3)**
Prerequisite: ROBO 302 or (ELCE 302 & (CMPE 324 or CMME 320))
Note: Students can take CMPE 324 or CMME 320 as a co-requisite instead of prerequisite.
The course contents the following topics: Inertial Sensor Based Navigation, Satellite Positioning (GPS, GLONASS) Based Navigation, Computer Vision, Image Processing, Object Matching, Object Localization and Image Based Tracking Lidar and Radar based 3D Mapping and Sensing

ROBO 403 **UAV Navigation (3-0-3)**
Prerequisites: ROBO 401, ROBO 402
In this course, students will study navigation systems for UAVs including: Trajectory Planning, Path Planning and Obstacle Avoidance (classical and reactive paradigms), Localization and Mapping, SLAM, Visual SLAM

ROBO 404 **UAV Syst=ems (2-3-3)**
Prerequisites: ROBO 401, ROBO 402
Co-requisite: ROBO 403
This is a practical course where the students will design, construct and test their own UAV systems. The key topics of this course include: platform design and construction, actuator and propulsion system design, sensing system design (based on inertial sensors, positioning system, vision, and etc.), auto-pilot system design and performance tuning, ground control station development (data links, protocols, security, and etc.), and UAV operation and interfacing.

9.20 | SDAS Student Development and Academic Success

SDAS 100 **Student Development and Academic Success (1-0-1)**
Prerequisite: Students on Probation
The purpose of this course is to teach students on probation the behaviors, skills, attitude and strategies they need to turn their academic performance and results from negative to positive. To help students learn how to take responsibility of their learning, understand themselves in relation to their skills, abilities and learning styles.

FACULTY INFORMATION

10

A

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Al-Homouz, Dirar,
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Al-Khateeb, Ashraf,
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Beeley, Philip,
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