جامعة خليفة
Khalifa University

ku.ac.ae

# UNDEGRADUATE ACADEMIC CATALOG 2022-2023

**Nurturing tomorrow's leaders...**
Growing the knowledge economy.


جامعة خليفة
Khalifa University

# **TABLE OF** CONTENTS

**PROVOST'S MESSAGE** 09
**ACADEMIC CALENDAR** 10
**EMAIL DIRECTORY** 12
**ORGANIZATIONAL POSITIONAL STRUCTURE** 13
**BOARD OF TRUSTEES** 14
**STUDENT CATALOG OF RECORD** 15
**THE UNIVERSITY** 16
UNIVERSITY VISION AND GOALS 17
ACCREDITATION 18
UNIVERSITY FINANCIAL RESOURCES 18
ADMISSION REQUIREMENTS AND FEES 18
UNDERGRADUATE ADMISSIONS 18
UNDERGRADUATE ADMISSIONS REQUIREMENTS 18
UNDERGRADUATE ADMISSIONS - TYPES 19
UNDERGRADUATE ADMISSIONS - DOCUMENTS 23
UNDERGRADUATE ADMISSIONS - PROCEDURE 24
SCHOLARSHIPS AND STIPENDS 24
**ACADEMIC REGULATIONS** 30
DEGREE PROGRAMS OFFERED 31
GENERAL EDUCATION REQUIREMENTS 32
GENERAL EDUCATION LEARNING OUTCOMES 32
DEGREE MAJORS, MINORS, TRACKS AND CONCENTRATIONS 33
**GRADUATING** 36
GUIDELINES FOR GRADUATING WITHIN EXPECTED TIME 37
**STUDENT REGISTRATION** 40
ORIENTATION PROGRAM 41
REGISTRATION PROCESS 41
REGISTRATION DEADLINES 41
REGISTRATION HOLDS 41
**ACADEMIC ADVISING** 42
ACADEMIC ADVISING GUIDING PRINCIPLES 43
CHANGE OF ACADEMIC ADVISOR 43
FACULTY OFFICE HOURS 43
PLAN OF STUDY 43
**MANAGING COURSES** 44
DROPPING/ADDING COURSES 45
COURSE RESTRICTIONS, PREREQUISITES AND CO-REQUISITES 45
AUDITING COURSES 45
LIMITATION OF COURSES OFFERED 45

**WITHDRAWAL, DISCONTINUING AND RESUMING STUDIES** 46
NATIONAL SERVICE LEAVE 47
COURSE WITHDRAWAL 47
TEMPORARY LEAVE OF ABSENCE AND RESUMING STUDIES 47
PERMANENT WITHDRAWAL FROM THE UNIVERSITY 48
**ACADEMIC YEAR** 50
**ACADEMIC CREDIT SYSTEM** 52
LANGUAGE OF INSTRUCTION AND EXAMINATION 53
TOTAL DEGREE CREDITS AND SEMESTER LOAD 53
COURSE TITLE, CODE, CREDIT VALUE AND DESCRIPTION 53
STUDENT CLASSIFICATION, FULL AND PART-TIME STATUS 54
GRADUATION RESIDENCY REQUIREMENTS 54
**GRADES AND GRADE POINT AVERAGES** 56
POLICY AND GRADING SCALES 57
GRADE POINT AVERAGE (GPA) 58
INCOMPLETE GRADES 58
REPETITION OF COURSES 58
GRADE CHANGES AND APPEALS 58
**ATTENDANCE** 60
INSTITUTIONAL SANCTIONS 61
EXCUSED ABSENCE 61
LEAVE OF ABSENCE AND REINSTATEMENT 62
**EVALUATION AND EXAMINATIONS** 64
ASSESSMENT OF STUDENT LEARNING 65
EXAMINATIONS 65
RECORDS AND TRANSCRIPTS 65
ACADEMIC STANDING 65
ACADEMIC HONORS 65
ACADEMIC GOOD STANDING 66
ACADEMIC PROBATION 66
ACADEMIC DISMISSAL 66
STUDENT RIGHTS AND RESPONSIBILITIES 68
ACADEMIC INTEGRITY 69
STUDENT ACADEMIC RIGHTS 69
STUDENT RESPONSIBILITIES 69
CONFIDENTIALITY AND PRIVACY OF STUDENT RECORDS 70
STUDENT ACADEMIC REGULATIONS AND POLICIES 71
ACADEMIC INTEGRITY CODE 71
PLAGIARISM 71
OTHER FORMS OF ACADEMIC DISHONESTY 73

| | |
|---|---|
| PROCEDURES AND PENALTIES FOR ACADEMIC INTEGRITY CODE OFFENSES | **73** |
| INVESTIGATION AND PENALTIES BY THE HEARING COMMITTEE | **74** |
| **CAMPUS FACILITIES AND SERVICES** | **78** |
| LABORATORIES AND WORKSHOPS | **79** |
| EHS PROCEDURES FOR LAB AND WORKSHOP FACILITIES | **79** |
| BUILDING ACCESS AFTER HOURS | **79** |
| HEALTH SERVICES | **79** |
| EMERGENCY SERVICES | **79** |
| PRAYER ROOMS | **80** |
| STUDENT LOUNGES | **80** |
| SPORT FACILITIES | **80** |
| FOOD OUTLETS AND RETAILS | **80** |
| TELECOMMUNICATION CUSTOMER SERVICES (ETISALAT) | **81** |
| BANKING SERVICES | **81** |
| RESIDENCE VISA AND GOVERNMENT AFFAIRS | **81** |
| **STUDENT SERVICES OFFICE** | **82** |
| STUDENT LIFE | **83** |
| TRANSPORTATION SERVICE | **83** |
| STUDENT RESIDENCES | **83** |
| **CENTER FOR TEACHING AND LEARNING** | **84** |
| CAREER DEVELOPMENT. | **85** |
| EXTERNAL SCHOLARSHIPS | **85** |
| STUDENT SUCCESS OFFICE | **86** |
| COMMUNITY SERVICES | **86** |
| COUNSELING SERVICES | **86** |
| STUDENT ACTIVITIES AND EVENTS | **86** |
| STUDENT CONDUCT REGULATIONS | **89** |
| SPECIAL NEEDS ACCOMMODATIONS | **90** |
| NON-ACADEMIC STUDENT CONDUCT | **90** |
| DRESS CODE | **90** |
| STUDENT CODE OF CONDUCT | **90** |
| STUDENT GRIEVANCES AND APPEALS | **90** |
| PREPARATORY PROGRAM | **91** |
| CURRICULUM | **91** |
| COURSE DESCRIPTIONS | **92** |
| **COLLEGE OF ARTS AND SCIENCE** | **94** |
| COLLEGE MISSION | **95** |
| COLLEGE VISION | **95** |
| COLLEGE UNDERGRADUATE DEGREE PROGRAMS | **95** |
| COLLEGE UNDERGRADUATE MINORS | **95** |

DEPARTMENT OF CHEMISTRY 96
BACHELOR OF SCIENCE IN CHEMISTRY 96
DEPARTMENT OF BIOLOGY 103
BACHELOR OF SCIENCE IN CELL AND MOLECULAR BIOLOGY 104
DEPARTMENT OF EARTH SCIENCES 107
BACHELOR OF SCIENCE IN EARTH AND PLANETARY SCIENCES 108
DEPARTMENT OF ENGLISH 115
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCE 118
DEPARTMENT OF MATHEMATICS 122
BACHELOR OF SCIENCE IN APPLIED MATHEMATICS AND STATISTICS 122
DEPARTMENT OF PHYSICS 134
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCE 134
**COLLEGE OF ENGINEERING** 142
COLLEGE MISSION 143
COLLEGE VISION 143
COLLEGE UNDERGRADUATE DEGREE PROGRAMS 143
COLLEGE UNDERGRADUATE MINORS 144
DEPARTMENT OF AEROSPACE ENGINEERING 145
BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING 145
DEPARTMENT OF BIOMEDICAL ENGINEERING 150
BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING 150
DEPARTMENT OF CHEMICAL ENGINEERING 157
BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING 157
DEPARTMENT OF CIVIL INFRASTRUCTURE AND ENVIRONMENTAL ENGINEERING 163
BACHELOR OF SCIENCE IN CIVIL ENGINEERING 163
DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE 169
BACHELOR OF SCIENCE IN COMPUTER ENGINEERING 170
BACHELOR OF SCIENCE IN COMPUTER SCIENCE 175
BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING 183
MINOR IN ARTIFICIAL INTELLIGENCE 190
DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING 192
BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS ENGINEERING 192
DEPARTMENT OF MECHANICAL ENGINEERING 198
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING 197
DEPARTMENT OF NUCLEAR ENGINEERING 203
MINOR IN NUCLEAR ENGINEERING 203
DEPARTMENT OF PETROLEUM ENGINEERING 205
BACHELOR OF SCIENCE IN PETROLEUM ENGINEERING 205
**COURSE DESCRIPTIONS** 212
COLLEGE OF ARTS AND SCIENCE COURSES 213

| | |
|---|---|
| BIOL BIOLOGY | 213 |
| BUSS BUSINESS STUDIES | 215 |
| CHEM CHEMISTRY | 218 |
| CHNA CHINESE | 225 |
| ENGL ENGLISH | 225 |
| EPSS EARTH AND PLANETARY SCIENCES | 226 |
| GENS GRAND CHALLENGES | 229 |
| HUMA HUMANITIES AND SOCIAL STUDIES | 229 |
| JAPN JAPANESE | 234 |
| KORA KOREAN | 234 |
| LTCM LITERATURE AND COMMUNICATION | 235 |
| MATH MATHEMATICS | 238 |
| PGEG PETROLEUM GEOSCIENCES | 247 |
| PHYS PHYSICS | 253 |
| SCED SCIENCE EDUCATION | 259 |
| SDAS STUDENT DEVELOPMENT AND ACADEMIC SUCCESS | 260 |
| SPAN SPANISH | 260 |
| PREPARATORY PROGRAM COURSES | 261 |
| COLLEGE OF ENGINEERING COURSES | 262 |
| AERO AEROSPACE ENGINEERING | 263 |
| BMED BIOMEDICAL ENGINEERING | 268 |
| CHEG CHEMICAL ENGINEERING | 272 |
| CIVE CIVIL ENGINEERING | 278 |
| COSC COMPUTER SCIENCE | 283 |
| ECCE ELECTRICAL AND COMPUTER ENGINEERING | 288 |
| ENGR ENGINEERING | 300 |
| ISYE INDUSTRIAL AND SYSTEMS ENGINEERING | 301 |
| MEEN MECHANICAL ENGINEERING | 307 |
| NUCE NUCLEAR ENGINEERING | 314 |
| PEEG PETROLEUM ENGINEERING | 315 |
| ADDITIONAL COURSES | 320 |
| **COLLEGE OF ART AND SCIENCES FACULTY LISTING** | 322 |
| **COLLEGE OF ENGINEERING FACULTY LISTING** | 334 |

# **PROVOST'S** MESSAGE

Welcome to Khalifa University, where you will spend the next few years of your educational journey.

High-quality education is beneficial to you and an important prerequisite towards understanding and addressing societal challenges relating to energy, environment, healthcare, security, communications, transportation and civil infrastructure, amongst others.

The diverse community of scholars at Khalifa University will help prepare you to face these challenges and to make your unique contribution to the solutions demanded by them. Beyond a high-quality grounding in your chosen subject area, you will also need a variety of other attributes to succeed as a leader, including the ability to communicate and to work in teams, competence in working 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 all of these skills.

Our University is a dynamic institution offering high quality education and practical experience. We strive to create a learning culture that exemplifies excellence in teaching and scholarship, which promotes lifelong learning and prepares individuals for leadership and service in the global society. We have the responsibility to help you develop as complete and well-rounded individuals and maximize your potential to pursue careers with passion and purpose.

We offer a diverse range of degree programs that are designed to meet the criteria set by national and international accreditation bodies. Our faculty and staff are highly qualified, experienced and dedicated professionals, who are always willing to impart their knowledge and experience to our students. The University has world-class facilities which will make your learning experience productive and enjoyable.

This Catalog provides you with information to make your academic planning easier. Decisions about majors, specializations and courses require careful consideration, and the Catalog 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 professional expertise of our faculty and administrative staff. Your academic advisor will be happy to give you the appropriate advice.

I look forward to meeting you and to sharing the great adventure of university life with you and the rest of our community. I believe you will find Khalifa University to be a stimulating and supportive environment in which to shape your future and wish you every success and happiness during your time here.

**Professor Bayan Sharif**
Provost,
Khalifa University

# **ACADEMIC** CALENDAR

## FALL SEMESTER 2022

| | Date | Event Name | Type |
|---|---|---|---|
| AUG | 22 | Faculty reporting | Academic |
| | 23-26 | New student orientation | Academic |
| | 29 | Classes begin - Fall | Academic |
| SEP | 2 | End of add/drop for PG | Academic |
| | 23 | Run Census Report | Academic |
| OCT | 10 | Prophet Birthday | Public Holiday |
| | 21 | Mid-Grade Due Date | Academic |
| NOV | 4 | Last Day to withdraw with “W” | Academic |
| | 14-18 | Advisement Period for Spring 2023 | Academic |
| | 21-25 | Early Registration for Summer Fall 2023 | Academic |
| DEC | 1 | Commemoration Day | Public Holiday |
| | 2 | National Day | Public Holiday |
| | 9 | Last day of classes | Academic |
| | 12 | Final Exam Begin & Thesis Submission | Academic |
| | 22 | Final Exam End | Academic |
| | 23 | Final Grades Due | Academic |
| | 26 | Winter Break | Academic |

## FALL SEMESTER 2023

| Month | Date | Event Name | Type |
|---|---|---|---|
| JAN | 9 | Faculty Reporting | Academic |
| | 10-11 | New Student Orientation | Academic |
| | 16 | Classes Begin | Academic |
| | 20 | End of add/drop UG | Academic |
| | 27 | End of add/drop PG | Academic |
| FEB | 10 | Run Census Report | Academic |
| MAR | 10 | Mid-Grade Due Date | Academic |
| | 24 | Last day to Withdraw with “W” | Academic |
| | 27-31 | Spring Break | Academic |
| APR | 10-14 | Advisement Period for Summer Fall 2023 | Academic |
| | 17-21 | Early Registration Fall 2023 | Academic |
| | 24 | Eid El Fitr | Public Holiday |
| MAY | 5 | Last day of Classes | Academic |
| | 8 | Final Exam Begin & Thesis Submission | Academic |
| | 18 | Final Exam End | Academic |
| | 22 | Final Grades Due | Academic |
| JUN | 5 | Classes Begin & Internship Begin | Academic |
| | 7 | End of add/drop for UG | Academic |
| | 9 | End of add/drop for PG | Academic |
| | 23 | Mid-Grade Due Date | Academic |
| | 29 | Eid Al Adha | Public Holiday |
| JUL | 3 | Last day to withdraw with “W” & Run Census Report | Academic |
| | 17 | Last day of Classes | Academic |
| | 18 | Final Exams Begin | Academic |
| | 20 | Final Exams Begin | Academic |
| | 24 | Final Grades Due | Academic |

NOTE: Islamic Holidays are subject to change. This calendar does not apply for the College of Medicine and Health Sciences.

# **E-MAIL** DIRECTORY

To contact a Khalifa University department or office, please refer to the KU Directory.

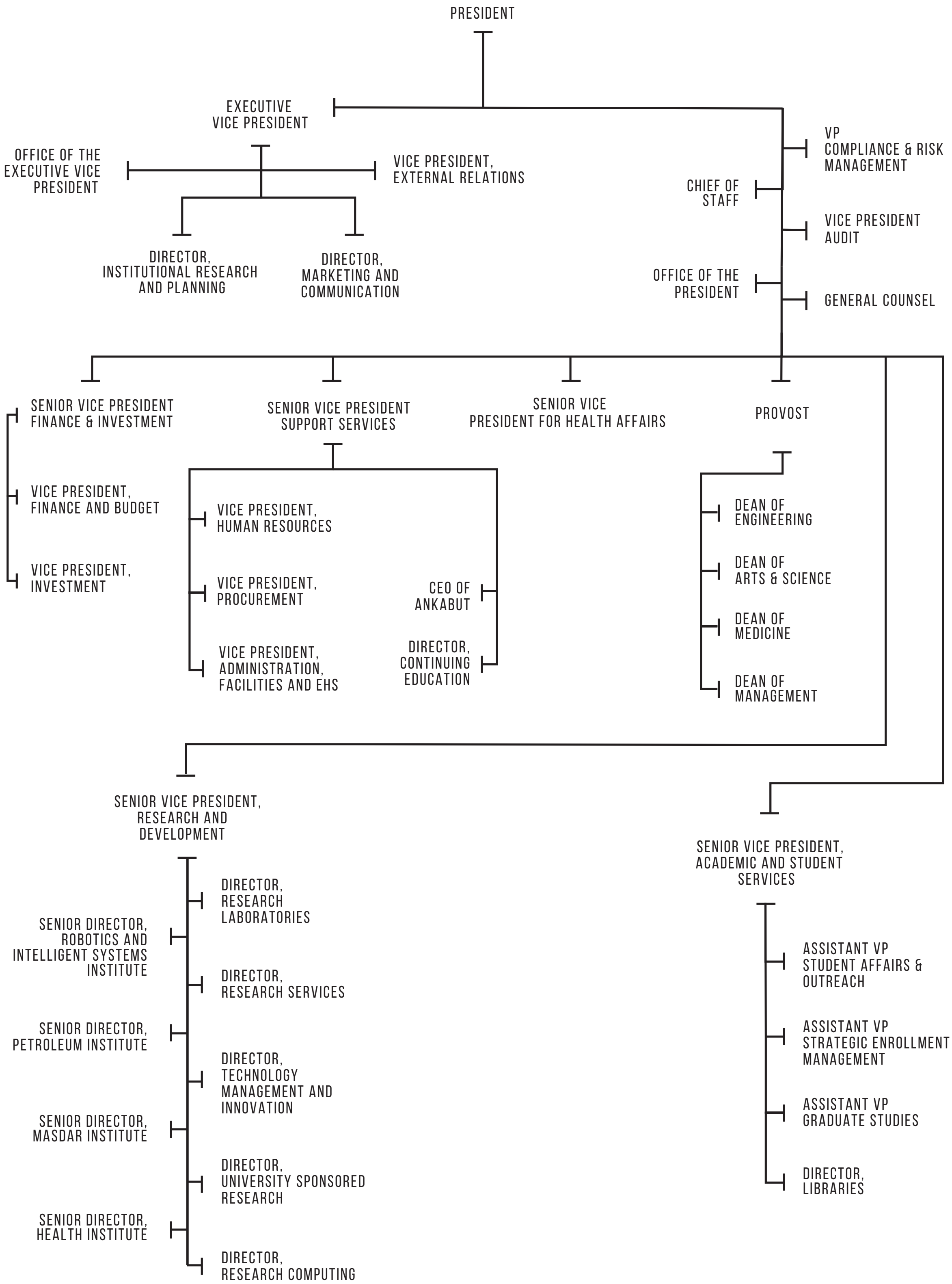
**Office Hours:** 8am–5pm, Monday–Thursday; 7:30am–1pm, Friday (Closed on public holidays)

**Website**
www.ku.ac.ae

**Phone**
00971- 23123333

**Contact**
www.ku.ac.ae/contact

# **KU HIGH LEVEL** POSITIONAL STRUCTURE



# **BOARD OF** TRUSTEES

The Board of Trustees of Khalifa University of Science and Technology consists of prominent individuals with extensive experience in government, academia, and industry.

**MR. JEFF SIMMONS**
Senior Vice President, Technical Planning and Evaluation Occidental Petroleum Corporation

**DR. STEVEN H. WALKER**
Vice President & Chief Technology Officer of Lockheed Martin Corporation

**ENG. HATEM DOWIDAR**
Chief Executive Officer of Etisalat Group

# **CATALOG OF** RECORD

The Khalifa University of Science and Technology Undergraduate Course Catalog is intended for students of the University who are entering the Fall 2022 term, as students in either its Undergraduate Degree Programs or its Preparatory Program.

# THE UNIVERSITY

Khalifa University of Science and Technology boasts three colleges, three research institutes, 20 research centers, and 37 departments covering a broad range of disciplines in science, engineering, and medicine. The University has two purpose-built campuses; one on Abu Dhabi Island, called the Main Campus, where the central administration for the University is located and all general education courses are taught; and a second in Sas Al Nakhl, near the Maqta Bridge.

Khalifa University offers a variety of Bachelor's, Master's and Doctorate programs, with the common feature of having a scientific and technological focus. The core of the institutional mission of each program is to provide high-quality education to the citizens of the UAE and global community at large.
The main goals of Khalifa University are to support development and progress, marshal resources and capabilities to strengthen scientific research activities, and to achieve world-class academic and research excellence locally, regionally and internationally. The university will also contribute to enriching society with well-educated qualified human capital.

## UNIVERSITY VISION AND GOALS

The vision of Khalifa University of Science and Technology is:
To be a catalyst for the growth of Abu Dhabi and the UAE's rapidly developing knowledge economy, the engineering and science education destination of choice, and a global leader among research intensive universities in the 21st century.

### Strategic Priorities

Khalifa University of Science and Technology has identified the following key strategic priorities:

- World-Class Education: prepare future leaders to an internationally recognized standard.
- Influential Research: produce world-class research with local relevance and international impact.
- Catalyst for Economic Development: enrich the national economy through innovation and research commercialization.

### KU Mission

As a world-class, research-intensive institution, KU will:

- Set new standards in education, research and scholarship that will benefit the UAE and the world.
- Drive Abu Dhabi and the UAE as a knowledge destination and engine for socio-economic growth through active translation of research into the nation's economy.
- Seamlessly integrate research and education to produce world leaders and critical thinkers in applied science, engineering, management and medicine.
- Continuously innovate and integrate the global standard in methods of learning and discovery.
- Build a diverse community of service-oriented, ambitious and talented individuals, through an environment that encourages and nurtures creative inquiry, critical thinking, and human values.
- Empower the community with practical and social skills, business acumen and a capability for lifetime learning that will enrich the workforce of the country.

## ACCREDITATION

All of Khalifa University's programs are accredited by the UAE Ministry of Education. A number of our undergraduate programs are also accredited by the international engineering accreditation body ABET:

- BSc. Aerospace Engineering
- BSc. Biomedical Engineering
- BSc. Chemical Engineering
- BSc. Civil Engineering
- BSc. Computer Engineering
- BSc. Electrical Engineering
- BSc. Industrial and Systems Engineering
- BSc. Mechanical Engineering
- BSc. Petroleum Engineering
- BSc. Petroleum Geoscience

## UNIVERSITY FINANCIAL RESOURCES

Khalifa University is a government, independent, non-profit coeducational institution with its own Board of Trustees that is accountable to the Government of Abu Dhabi. Khalifa University has its own legal identity and independence on financial and administrative matters. The Government of the Emirate of Abu Dhabi, with the University having full authority to practice its activities and achieve its objectives, provides the core budget of the University.

## ADMISSION REQUIREMENTS AND FEES

Khalifa University of Science and Technology admits male and female undergraduate and postgraduate students from the UAE and around the world. The admissions standards 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.

## UNDERGRADUATE ADMISSIONS

Undergraduate program admission at Khalifa University of Science and Technology is offered to highly qualified female and male students from the UAE and abroad. All applicants must meet established, clearly communicated minimum requirements to be considered for admission to, and maintain enrolment in, undergraduate studies at the University. The Board of Trustees reserves the right to deviate from published admission requirements.

## UNDERGRADUATE ADMISSIONS REQUIREMENTS

Undergraduate admission to Khalifa University is highly competitive. In order to be considered for admissions, students must meet the following minimum criteria depending on whether they are applying from inside (both UAE Nationals and Expats), or, from outside the UAE (International applicants).

Applicants (UAE Nationals & Expats) coming from High Schools Inside the UAE

- Applicant should have graduated from High School no later than two years prior to the current year.
- Achieve the following minimum EmSAT scores s: Math 1000, Physics 800 (Java, C++, and Python) , Arabic 700, Computer Science 800, 1 EmSAT Elective from Chemistry or Biology 800 , and, English 1250 to be conditionally accepted into the Foundation program. Achieve the following minimum EmSAT scores : Math 1250, Physics 1000 (Java, C++, and Python) , Arabic 700, Computer Science 800, 1 EmSAT Elective from Chemistry or Biology 800 , and, English 1400 to be fully accepted into freshman year.

  **For non-Arabic speakers, the EmSAT Arabic exam is not mandatory**

- Hold a Secondary School Certificate (SSC) with a minimum cumulative average of 75% or its equivalent: Students who do not hold a UAE Secondary School Certificate (SSC), and are therefore applying from private high schools, are to satisfy the equivalency requirements as approved by the UAE Ministry of Education. (Recognized Secondary School Certificates).

## UNDERGRADUATE ADMISSIONS – TYPES

For students applying from inside the UAE, there are two types of admission to Khalifa University. Full admission to the First Year and Conditional admission to the Foundation Year.

**Full Admission**

In addition to the minimum admission criteria listed above (EmSAT and CGPA), to be considered for full-admission, applicants must also satisfy the following:

English language proficiency requirements which may take one of the following forms:

- A TOEFL minimum 79 on the Internet Based Test (iBT), or
- An academic IELTS minimum score of 6.0 (out of 9), or
- An EmSAT English minimum score of 1400
- Note: TOEFL and IELTS scores are valid for two calendar years only and should be taken from an approved Institution. (TOEFL - Test of English as a Foreign Language | IELTS - International English Language Testing System)

In addition to a satisfactory entrance interview

**Conditional Admission**

Applicants who do not meet the requirements for full admission as per above listed requirements, and who have been judged to have the potential to reach these standards, may be offered a conditional admission and required to complete a Foundation Year (Preparatory Program) within a maximum of 12 months.

In addition to the minimum admission criteria, to be considered for conditional admission, applicants must satisfy the following English language proficiency which may take one of the following forms:

- A TOEFL minimum score of 70 on the Internet Based Test (iBT), or
- An academic IELTS minimum score of 5.5 (out of 9),or
- An EmSAT English minimum score of 1250

In addition to a satisfactory entrance interview.
The Preparatory Program is an intensive, full-time program of developmental study in academic and technical English, Mathematics, Physics and Computer Technology required for success in a Khalifa University degree program. Students who successfully complete the program are offered full admission into the degree programs.

Students who are not able to achieve the standard for successful completion of the Preparatory Program within 12 months will have their conditional admission withdrawn, and they will be asked to leave the University.

## International Applicants (coming from high schools outside the UAE)

Students who have completed their high school outside the UAE must provide one of the following certificates to be considered for admission:

**American Curriculum**

- Minimum grade of 3 in all 3 AP courses including Math, Physics & Chemistry
- SAT Math score 700 and above

**British Curriculum (IGCSE)**

- Minimum grade of C in Eight IGCSE: 5 O Subjects including Math, Physics & Chemistry, and, 3 AS/A subjects including Math, Physics, & Chemistry

**IB Curriculum**

- Minimum score of 4 out of 7 in all courses including Math, Physics & Chemistry
- Proof of any one of the below English language proficiency certificates:
- IELTS (Academic) minimum score of 6.0
- TOEFL iBT minimum score of 79

## Satisfactory Entrance Interview

Aall students must participate in a personal interview conducted by a Khalifa University admissions committee.

During the interview, students will be assessed on:

- Ability to communicate in English
- Familiarity with the relevant major of interest
- Commitment to pursue a professional degree program
- Reasons for wanting to attend Khalifa University
- Potential leadership capabilities

## Advanced Standing Credit and Credit by Examination Policies and Procedures

**Policy 5.6.1.2 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 Office of Admissions 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-residence credits) for degree requirement purposes.

**Policy 5.6.1.3 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 Office of Admission and Registration. 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:

1. Credit by Examination testing will normally be offered during the final examinations period.
2. Students may attempt Credit by Examination in a given course only once.
3. No more than 12 credit hours of Credit by Examination may be included in a major program.
4. No more than 6 credit hours of Credit by Examination may be included in a minor program.
5. 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.
6. Students requesting Credit by Examination must satisfy all pre-requisites of the course for which they are being examined.

**Procedures for Advanced Standing Credits**

**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.

All official AP scores should be sent directly to KU registration department by using our college code 7860. 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 |
| Biology | 4/5 | BIOL 101 or BIOL 111 |

**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,<br>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 |
| Biology | 5/6/7 | BIOL 101 or BIOL 111 & BIOL 112 via credit by examination |

**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 | SCORE | RECEIVE CREDIT FOR |
|---|---|---|
| Mathematics | B/A | MATH 111, |
| | B/A | MATH 112 via credit-by-examination |
| Physics | B/A | PHYS 121 via credit by examinations |
| | B/A | PHYS 122 via credit by examinations |
| Chemistry | B/A | CHEM 115 |
| Psychology | B/A | HUMA 140 |
| Sociology | B/A | HUMA 141 |
| Computer Science | | ENGR 112 |
| Biology | | BIOL 101 or BIOL 111 & BIOL 112 via credit by examination |

## UNDERGRADUATE ADMISSIONS – DOCUMENTS

The following documents are required as part of the admissions process:

1. A completed Khalifa University online application form
2. An attested copy of High School certificate.
   - Private school students should submit copies of their grade 10 and 11 certificates and Equivalency
   - British System students should submit certificates of their O level, AS and A levels. If final certificates are yet to be issued, a letter from the school stating predicted grades is required.
3. TOEFL or IELTS certificates (original, plus an extra copy) if any.
4. Passport (two copies)
   - front and back page for UAE Nationals
   - with visa permit for UAE residents
5. A complete copy of Khulasat Al Qaid (UAE National Family Book) for UAE Nationals.
6. Passport size photograph
7. Emirates ID (two copies)

**Important notes:**

- A4 printed documents should be submitted, unless otherwise stated.
- Original documents maybe requested for verification.
- chool's grading scale equivalency should be provided where required.
- All foreign and private school certificates must be equated and attested by the Ministry of Education in the UAE.
- Applications with missing documents will not be accepted.

## UNDERGRADUATE ADMISSIONS - PROCEDURE

To guarantee the quality of the student body,. the following application procedure is applied whereby the application passes through 5 stages:

1. Online Application
2. Application Screening
3. Interview - Documents & Assessments
4. Application Evaluation
5. Final Decision

1. **Online Application**

   UAE National Students who are graduates of the current year, need to apply through the MOE NAPO website and portal.

   Expats coming from high schools inside the UAE, International Students coming from high schools outside the UAE, in addition to graduate from previous years (maximum 2 years before current entry year) and transfer applicants, are to apply through Khalifa University website and portal. .nly complete online applications that include the grades of at least the first term of G12, will be considered
2. **Application Screening**

   All completed applications are screened thoroughly against Khalifa University admission requirements. All rejected applicants are notified.
3. **Interview - Admission documents and assessments**

   All eligible applicants are invited to conduct a personal interview.
4. **Application Evaluation**

   The admissions Office will make recommendations regarding the qualified applicants through an internal process based on the admission assessments results and high school grades. The duration of this process will vary from one applicant to another based on different factors.
5. **Final Decision**

   The Undergraduate Admission Committee will announce the admission decisions in an adequate time prior to the start of the semester. Each accepted applicant will be contacted and sent an official admission offer and contract to sign within a preiod of five working days. Rejected candidates will also be notified.

## SCHOLARSHIPS AND STIPENDS

The University scholarships and stipends are governed by the following rules and conditions:

- University scholarships are available for qualified and eligible UAE National and international students.
- A list of available scholarships and stipends (for UAE National Students), eligibility criteria, and benefits for each category of student are reviewed and updated annually. Students on a university scholarship must abide by the stipulations and contracts signed between the student and the University.
- University scholarships and stipends are provided only for full-time students. If the credit load of a student on a university scholarship drops below the minimum full-time credit load (12 credit hours) in a semester, the scholarship and any stipend will be adjusted as follows:
  - The stipend, if any, will be suspended for the remainder of the semester unless the student is in the final semester of study and requires less than 12 credit hours to graduate, or if the reduced enrollment is determined to be the result of a serious compelling circumstance beyond the student's control.

› Expatriate and international students will be liable for full payment of the tuition fees for that semester. The expatriate/international student may be allowed to drop below the minimum full-time credit load without tuition penalty if the University determines that the reduced enrollment is the result of a serious compelling circumstance beyond the student's control.

- The University reserves the right to change the terms and conditions of its Scholarship and Stipend Programs at any time.
- The University reserves the right to revoke a student's scholarship.
- Students receiving a university scholarship must inform the University of any external scholarships received.
- A student receiving a university stipend is discouraged from seeking additional employment while enrolled in courses at the University. Should the student wish to supplement their stipend with university work-study, permission from the relevant Dean must be obtained.
- In case of violation of the scholarship terms and conditions, a student receiving a university scholarship or stipend may be required to refund part or all of tuition fees covered by the scholarship and stipends paid.

## Scholarships and Stipends for UAE National Students

University scholarships and stipends are available for admitted UAE National students. The financial award consists of, at a minimum:

- A 100% tuition fee waiver for the duration of their study at Khalifa University of Science and Technology;
- A monthly stipend based on the student's CGPA (no stipend is paid to students whose CGPA falls below the set minimum as published in the student handbook);
- Housing fees covering double occupancy for students residing more than 80km from campus;
- Daily and weekend transport fees for those eligible UAE National students who are not receiving their stipend for any reason;
- Other published benefits.

**New UAE National Students (for first semester only)**

| STATUS | SCHOLARSHIP | STIPEND (PER MONTH) |
|---|---|---|
| UAE nationals who are listed from in the top 10 school graduates list issued by the Ministry of Education | 100% of tuition fees | AED 8,000 fees |
| All other UAE nationals | 100% of tuition | AED 4,000 |

**Continuing UAE National Students (for second semester until graduation)**

| STATUS | SCHOLARSHIP | STIPEND (PER MONTH) |
|---|---|---|
| Nationals with CGPA >= 3.8 | 100% of tuition fees | AED 8,000 |
| Nationals with CGPA 3.2 – 3.79 | 100% of tuition fees | AED 6,000 |
| Nationals with CGPA 2.6 – 3.19 | 100% of tuition fees | AED 4,000 |
| Nationals with CGPA 2.0 – 2.59 | 100% of tuition fees | AED 2,000 |
| UAE Nationals with GPA Below 2.0 | 100% of tuition fees | |

## Scholarships for Expatriat and International Students

University scholarships are available for expatriate and international students with outstanding academic performance and personal qualities.

- The scholarship may consist of full or partial tuition assistance.
- Scholarships for expatriate students are provided for the total degree credits of the program in which they are enrolled. Attempted credits that are beyond the total degree credits and credits that do not count towards the degree will be charged at the full rate per credit tuition fee unless the excess credit is the result of university curriculum changes.
- Upon graduation, expatriate students on full scholarship undertake to either join one of the University's graduate programs or to accept employment with the University or any other entity nominated by the University for a period of time which is at least equal to the study period. The decision of whether or not to offer graduate program admission or employment is at the discretion of the University.

### (a) Full Scholarships (President's Scholarship)

A limited number of full scholarships are available for non-national students with outstanding academic performance and personal qualities. These scholarships are very highly competitive.

### President's Scholarship

The President's Scholarship is our most prestigious tuition grant reserved for students on the basis of their academic achievements and excellence. To be considered for the President's Scholarship, students must maintain a cumulative GPA of 3.3 or higher during their studies at Khalifa University.

| STATUS | SCHOLARSHIP COLLEGE OF ENGINEERING | SCHOLARSHIP COLLEGE OF SCIENCE |
|---|---|---|
| International with CGPA >= 3.3 | 100% of tuition fees | 100% of tuition fees |
| International with CGPA 3.0 –3.29 | 75% of tuition fees | 75% of tuition fees |
| International with CGPA 2.0 – 2.99 | 50% of tuition fees | 50% of tuition fees |
| International with CGPA < 2.0 | 0% of the tuition fees | 0% of the tuition fees |

### (b) Partial Scholarships (Khalifa University Scholarship)

A number of partial-scholarships are available for non-national students with excellent academic performance and personal qualities.

### Khalifa University Scholarship

The Khalifa University Scholarship is a general tuition support grant for students with a cumulative GPA of 3.0 or greater. Commenced to be a financial support for hardworking and deserving students, the KU Scholarships continues to incentivize a great number of students to do better.

| STATUS | SCHOLARSHIP COLLEGE OF ENGINEERING | SCHOLARSHIP COLLEGE OF SCIENCE |
|---|---|---|
| International with CGPA >= 3.0 | 100% of tuition fees | 75% of tuition fees |
| International with CGPA 2.5 – 2.99 | 75% of tuition fees | 50% of tuition fees |
| International with CGPA 2.0 – 2.49 | 50% of tuition fees | 25% of tuition fees |
| International with CGPA < 2.0 | 0% of the tuition fees | 0% of the tuition fees |

**(c) Self-pay Scholarships**
Khalifa University offers additional financial support to students without established academic careers of excellence as a means to encourage and incentivize hard work and effort.

**Self-pay Scholarship**
The self-pay scholarship is designed to help students who strive for recognition of their academic vigor after not initially qualifying for a scholarship. Students who are admitted to KU but did not maintain academic excellence and a high GPA before joining can make the most of this scholarship to prove themselves and receives financial reimbursements.

To be considered for the Self-Pay Scholarship, students must maintain a cumulative GPA of 3.8 or higher during their studies at Khalifa University.

| STATUS | SCHOLARSHIP COLLEGE OF ENGINEERING | SCHOLARSHIP COLLEGE OF SCIENCE |
|---|---|---|
| International with CGPA >= 3.8 | 20% of tuition fees | 30% of tuition fees |
| International with CGPA <3.8 | 0% of tuition fees | 0% of tuition fees |

## Scholarships for Children of KU Faculty and Staff

Khalifa University offers full scholarships to qualifying children of KU faculty or staff, who are full-time employees at the time of their children admission to the university, and should continue to be a full-time employee at KU throughout the period of the child's studies to ensure the continuity of the scholarship. Applicants must qualify for full admission into the First Year (Freshman year), as per the university standards. In addition, applicants must not be older than 19 years of age upon the commencement of their undergraduate program.

To retain the Full Scholarship (100%), students must maintain a minimum CGPA of 2.5. Students whose CGPA fall between 2.0 and 2.49 will be required to pay 50% of their tuition fees. Students who do not maintain a minimum CGPA of 2.0, in any given semester, will be required to pay the full tuition fees ( (based on KU Fees and Payment Guide), as per below:

| STATUS | SCHOLARSHIP |
|---|---|
| CGPA 2.5 and Above | 100% of tuition fees |
| CGPA Between 2.0 and 2.49 | 50% Scholarship |
| CGPA below 2.00 | 0% Scholarship |

## Stipend Payment Procedures for UAE Nationals

Stipends are payable only in the semester they are earned. No retroactive stipend payments for prior semesters are allowed.

- To receive a stipend, a student must continue to satisfy the published academic eligibility requirements.
- The student must have a valid bank account in his or her name into which the stipend payment is electronically transferred. It is the student's responsibility to create the bank account and Submit the IBAN details at Khalifa University Intranet Portal.
  - To ensure payment of the stipend, the student Submit the IBAN details at Khalifa University Intranet Portal. by the sixth week of their first semester. Students who fail to provide their bank details by the end of the sixth week of classes will forfeit all stipend payments for that semester.
- To receive a stipend each month, a student must be enrolled in courses when the stipend bank transfer is processed by the University. A student who withdraws from the University prior to the bank transfer date will not receive a stipend for that month.
- Students are not eligible to receive a stipend payment during a Temporary Leave of Absence from the University.

## External Scholarships

External scholarships are governed by the stipulations and contracts signed between the scholarship granting entity, the individual student, and the University.

- For students who are newly sponsored by an external agency or who wish to revert to a Khalifa University scholarship and stipend, the effective date of sponsorship transfer will be the first day of the month following the sponsorship approval.
- Tuition charges for students sponsored by an external agency will be based on the published refund schedule. Invoices will reflect the student's enrollment as of the census date.

## Tuition Fees

Tuition fees for undergraduate students admitted for Fall 2022 are as follows:

| STUDENT LEVEL | SCHOLARSHIP |
|---|---|
| Preparatory | Flat rate of AED 16,000 per chargeable course. |
| Undergraduate | AED 3,333 per credit hour |

Please note that tuition fees are subject to review. Detailed guidance on fees, payment processes and deadlines can be found in the KU Fees, Scholarships and Payment Guide, which is published by the Registrar's Office every semester.

# ACADEMIC REGULATIONS

## DEGREE PROGRAMS OFFERED

The undergraduate degree programs offered by the College of Arts and Sciences are:

- Bachelor of Science (BSc) in Applied Mathematics and Statistics
- Bachelor of Science (BSc) in Cell and Molecular Biology
- Bachelor of Science (BSc) in Chemistry
- Bachelor of Science (BSc) in Earth & Planetary Science.
- Bachelor of Science (BSc) in Petroleum Geosciences
- Bachelor of Science (BSc) in Physics

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

- Bachelor of Science (BSc) in Aerospace Engineering
- Bachelor of Science (BSc) in Biomedical Engineering
- Bachelor of Science (BSc) in Chemical Engineering
- Bachelor of Science (BSc) in Civil Engineering
- Bachelor of Science (BSc) in Computer Engineering (with optional concentration in Software Systems)
- Bachelor of Science (BSc) in Computer Science (with optional concentrations in Artificial Intelligence or Cybersecurity)
- Bachelor of Science (BSc) in Electrical Engineering
- Bachelor of Science (BSc) in Industrial and Systems Engineering
- Bachelor of Science (BSc) in Mechanical Engineering
- Bachelor of Science (BSc) in Petroleum Engineering

The length of the undergraduate engineering programs ranges between 133-139 credits. These credits are divided into 47 credits of University General Education Requirements (GER), 23 credits of College of Engineering Requirements (CER), and 63-69 credits of specific major requirements.

### 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 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 respective Dean determines the equivalent graduation requirements to be applied. The Khalifa University of Science and Technology 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 CGPA of 2.00
- Completion of the last two years in residence at the University. Transfer and exchange students must also meet the additional conditions specified in the Graduate Residency 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.

## GENERAL EDUCATION REQUIREMENTS

In addition to their Major coursework, students are required to take a set of courses to meet University General Education Requirements (GERs). These courses provide a curriculum that aims to help students develop a strong core in mathematics and science, as part of a wide range of knowledge, skills, and behavioral competencies. The General Education Program is designed to prepare students for success with their Science or Engineering degrees and to support their long-term development and progress in their personal and professional lives. The Program has 15 General Education Learning Outcomes (GELOs), divided into 3 categories.

## GENERAL EDUCATION LEARNING OUTCOMES

1. **Breadth of Knowledge**
   a. Discuss issues and topics in the humanities, social sciences, languages and communications, UAE studies, and business, using knowledge and methods learned in courses.
   b. Discuss issues and topics in the physical sciences and mathematics using knowledge and methods learned in courses.
   c. Apply a scientific approach to designing experiments to test hypotheses.
   d. Show knowledge and understanding of Arabic language, Arab culture, and Islamic values.
   e. Exhibit knowledge of key concepts and issues related to sustainability and entrepreneurship.
2. **Range of Technical and Communication Skills**
   a. Read, write, and communicate appropriately for professional and academic purposes.
   b. Exhibit digital literacy and information literacy skills.
   c. Employ appropriate information gathering and data collection methods, in researching particular problems, topics, issues, or features of the world.
   d. Apply a critical approach to argumentation, issues, and methodologies.
   e. Show innovativeness and creativity in finding and solving problems, developing arguments, designing data collection, analyzing, presenting information, and creating value.
3. **Behavioral Competencies**
   a. Learn independently and show the ability to practice lifelong learning.
   b. Work effectively and collaboratively with others and exhibit leadership on particular tasks.
   c. Develop an appreciation of the diversity of the human experience.
   d. Make ethical decisions and behave responsibly, in accordance with cultural and institutional values, norms, and regulations.
   e. Develop and cultivate management of self, self-efficacy, confidence and agency, self-advocacy, purpose, and endurance.

**General Education Requirements (GERs: Total of 15 courses and 48 credits)**

1. **Grand Challenges (1 course, 4 credits):**
   All students take Grand Challenges (GENS 101, 4 credits).
2. **English (3 courses, 6 credits): Students take:**
   a. Academic English I (ENGL 101, 3 credits)
   b. Academic English II (ENGL 102, 3 credits)

3. **Mathematics & Science (5 courses, 20 credits): Students take:**
   a. General Chemistry I (CHEM 115, 4 credits)
   b. Calculus I (MATH 111, 4 credits)
   c. Calculus II (MATH 112, 4 credits)
   d. University Physics I (PHYS 121, 4 credits)
   e. University Physics II (PHYS 122, 4 credits)
4. **Arabic, Islamic and U.A.E Studies (3 courses, 9 credits): Students take:**
   a. an Arabic Language Elective (either HUMA 100 or HUMA 101, 3 credits)
   b. an Islamic Studies Elective (3 credits)
   c. a U.A.E. Studies Elective (3 credits)
5. **Innovation and Entrepreneurship (1 course, 3 credits):**
   All students take Fundamentals of Innovation & Entrepreneurship (BUSS 322, 3 credits).
6. **Business Studies (1 course, 3 credits):**
   Students take either a specific course for their major or a Business Studies (BUSS) course offered by the Dept. of Humanities & Social Sciences.
7. **Humanities or Business Studies Elective (1 course, 3 credits):**
   Students select any Business Studies (BUSS) course or Humanities (HUMA) course offered by the Dept. of Humanities & Social Sciences.
8. **Career Development (1 course, 0 credits):**
   All students take Career Development (SDAS 300).

The majority of General Education courses should be taken in the first two years of study, especially courses such as Academic English I, Academic English II, and the required Mathematics and Science courses. These basic General Education courses are critical to a student's smooth progression into their chosen Major curriculum, due to the gradual development and accumulation of basic knowledge, skills and competencies. This is reflected in course prerequisites, listed in each course syllabus. Additional General Education courses are often taken by students in the later years of study, to supplement and complement the completion of their Major course requirements. A course in Career Development (SDAS 300), to be taken during the third year of study, is a prerequisite for students to do their internship.

## DEGREE MAJORS, MINORS, TRACKS AND CONCENTRATIONS

### Degree Major

A degree major is a structured program of study in an academic or professional discipline which leads to a Bachelor's degree. 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 of Science and Technology 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 Course Catalog. Students are required to follow the major requirements that are current at the time the student's choice of major is effective.

### Declaring a Major/Change of Major

- Students should make their initial choice of major after registering minimum of 12 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.

### Double Major

Students wishing to complete a second major concurrently with his or her primary major must complete the double major request from, the application is available with the Registration Office.
To be granted permission for a second major, the application should be approved by the scholarship office, the academic advisor, the appropriate department heads and Dean.

Students must be academically well qualified and have a minimum CGPA of 3.3, so as to not delay graduation. In addition, students must apply for a second major by the time they have completed 45 credits hours, including at least 12 credits of courses from the department with a declared major. The student's application must include a proposed study plan for both majors. A minimum of additional 30 credits on the requirement of one major are required for a double major.

To graduate with a double major, the student must meet departmental requirements for each major.
The student must maintain a CGPA of 3.0 to remain registered for the double major. If the student CGPA drops below 3.0, he/she will be withdrawn from the new major. The student will have the right to appeal.

### Accelerated Master of Science Programs

The Accelerated Master of Science Programs enable exceptional senior undergraduate students to start earning credits towards their master's while pursuing their undergraduate education. Through the Accelerated MSc program option, highly motivated students with the help of their academic advisors can plan to finish their undergraduate and master's degrees in one of the engineering disciplines within a minimum period of five-years.  The accelerated program is intended to allow undergraduate students register for maximum of two master level course, where these courses can count to satisfy the technical elective requirement for the undergraduate level. It is required that an undergraduate CGPA of at least 3.5 is maintained and grades of B or better are received in the completed dual-counted graduate courses.

To be able to apply to the Accelerated Master of Science Programs, students must be on senior standing and having a minimum CGPA 3.5.

Students wishing to apply for the Accelerated Master of Science Programs must complete the application form, which is available with the Registration Office.

To be granted permission for the Accelerated Master of Science Programs, the application should be approved by the scholarship office, the academic advisor, the department head the Associate Dean of Undergraduate Studies and finally the Associate Dean of Graduate Studies.

## Degree 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 12 and no more than 18 credits, with at least 12 credits in upper level coursework (300-400 level). No more than six 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.

## Degree Concentration

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

## 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. Tracks are normally used to help students focus their selection of advanced elective courses within their selected major. The track will not be noted on the student transcript or the Bachelor's degree certificate.

## Variation to Academic Program

In exceptional circumstances, a student may petition the Department Chair of the major/minor program 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 of Academic Program form and/or the Prerequisite waiver Form (if required) 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 form.

In preparing the form, students must 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.

# GRADUATING

## GUIDELINES FOR GRADUATING WITHIN EXPECTED TIME

The Khalifa University of Science and Technology 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 students' 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 transferrable 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 their desired degree program requires and should make sure they fulfill on 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. Students should also 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 GER, COE, major, and any other requirements.
- Students should limit elective credits to the number the program allows.
- If a student is considering changing their major or does 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 plan 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.

### Time Limit on Duration of Study and Re-admission

All degree requirements must be completed within six (6) years of first registration as a matriculated student, exclusive of any approved leave including national service. The duration of study does not include time spent in a foundation program as a conditionally admitted student. As specified in the withdrawal policy (see ACA 3700 Withdrawal, Discontinuing and Resuming Studies), a student in good academic standing is allowed a total of no more than two semesters of Temporary Leave of Absence.

A student who is away from the university, for any reason, for more than two consecutive semesters must submit a re-application for admission to the Admissions Office prior to the semester for which registration is sought.

- Students who are re-admitted are required to comply with the Catalog of Record for the semester of re-admission.

### Internships

All students are required to complete a full-time internship experience to be eligible to graduate. 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. Students earn credit for the 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 provide names and contact information of organizations with which they would like to intern. Complete information about internship requirements can be found in the Internship Handbook. Students in the College of Engineering are required to complete sixteen weeks of internship placement for two credits, this can be taken over two summer semesters, or in one regular (Fall/Spring) semester given that the student has completed all the required courses as per his/her degree plan.

Students in the College of Arts and Sciences are required to complete eight weeks of internship placement for one credit, this can be taken in one summer semester, or in one regular (Fall/Spring) semester given that the student has completed all the required courses as per his/her degree plan.


Electrothermal
Electrothermal
Electrothermal
250ml 24/29
250ml 24/29

# **STUDENT** REGISTRATION

## ORIENTATION PROGRAM

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

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

## REGISTRATION DEADLINES

Khalifa University of Science and Technology 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 the 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 (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.)

# ACADEMIC ADVISING

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

Academic advising is an integral aspect of academic progress and a shared responsibility between the student and academic advisor. Every student at the Khalifa University of Science and Technology from the time of their enrollment to graduation are assigned at least one academic advisor.

The student and advisor(s) must meet at least once a semester to ensure satisfactory and timely progress towards graduation. All students are provided an Academic Advising Guide document, which details the responsibilities and procedures. Advisors are assigned by the Academic Department and maintained through the Registrar's Office.

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. With the benefit of academic advisors, University students acquire the knowledge needed to create and fulfill their 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.

## CHANGE OF ACADEMIC ADVISOR

A student may change advisor within the same department upon approval by the department chair (or designees). The department chair will notify the Registrar's Office of the approved change of advisor.

## FACULTY OFFICE HOURS

Faculty office hours are allocated for students' 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 a student 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, and consequently students are required to follow the requirements of the approved plan that was 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 of Variation to Academic Program for additional information.

# **MANAGING** COURSES

## DROPPING/ADDING COURSES

Students may add, drop or change a course section at the beginning of a semester during the official add/drop period. Courses dropped during the official add/drop period will not appear on a student's official transcript.

## 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 a 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.

## 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.

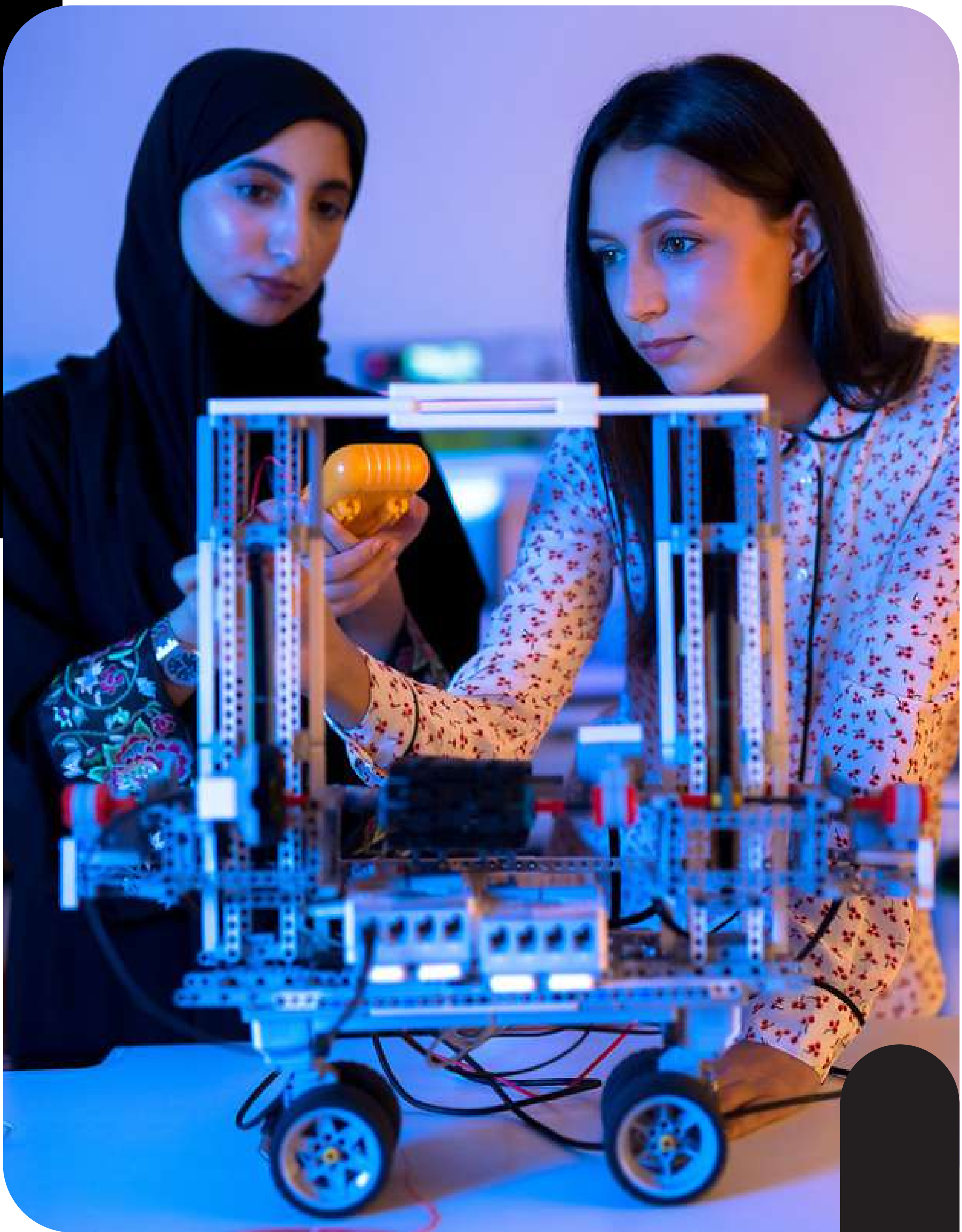
Auditors are required to follow the same registration procedures as persons taking the course for credit. Auditors do not receive grades or credits. Participation in class discussion and written work is permitted at the discretion of the instructor. A fee per credit hour may be charged. The status of 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.

Tuition fees for a course Audit is normally not covered by the student scholarship. The Auditors are required to pay the fees of the course as per the fee rate published in the KU Fee and Payment Guide.

## 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.

# WITHDRAWAL, DISCONTINUING AND RESUMING STUDIES



The Khalifa University of Science and Technology recognizes that personal circumstances may require that a student withdraw from a course or degree program either temporarily or permanently, and provides advice and guidance for doing so.

## NATIONAL SERVICE LEAVE

Leave for national service is automatically granted. The student must return to the University in the semester immediately following the completion of national service.

## COURSE WITHDRAWAL

Students are permitted to withdraw from degree courses during the official published withdrawal period. A grade of “W” will be assigned on the student’s transcript. The grade of W will not affect a student’s Grade Point Average (GPA).

Students withdrawing from any course should discuss the decision with their instructor, academic advisor, and with a student counselor. Students should be aware that withdrawal from a course may have an impact on their scholarship terms and timely progress toward graduation.

All students are expected to maintain full-time status by carrying a minimum load of 12 credit hours per semester. A student who fails to complete 12 credit hours in a semester is issued an academic progress warning and may be required to meet with a counselor.

A student who withdraws from a course after the deadline for withdrawal has passed will be assigned a grade of WF (withdraw failing). The grade of WF is equivalent to an F (0.0 quality points), and is used in the calculation of the GPA (see ACA 3350 Grading System, GPA, and Course Repetition). Upon appeal, this grade may be changed to a WP.

## TEMPORARY LEAVE OF ABSENCE AND RESUMING STUDIES

Under exceptional circumstances, students may apply for a Temporary Leave of Absence for a maximum of two semesters during their degree studies. Students should be aware that withdrawing will have an impact on their scholarship terms and timely progress toward graduation.

Generally, a student must be in good academic standing. A student in good academic standing is normally allowed no more than two semesters leave of absence during their degree studies. The student must complete a Leave of Absence Request form and specify the reason for the leave. The Leave of Absence must be approved by the Dean of Academic Services. Students sponsored by non-KU agencies may not take leave of absence without their sponsor’s approval.

To resume studies after a Temporary Leave of Absence, a student must contact the Registrar’s Office to request reactivation.

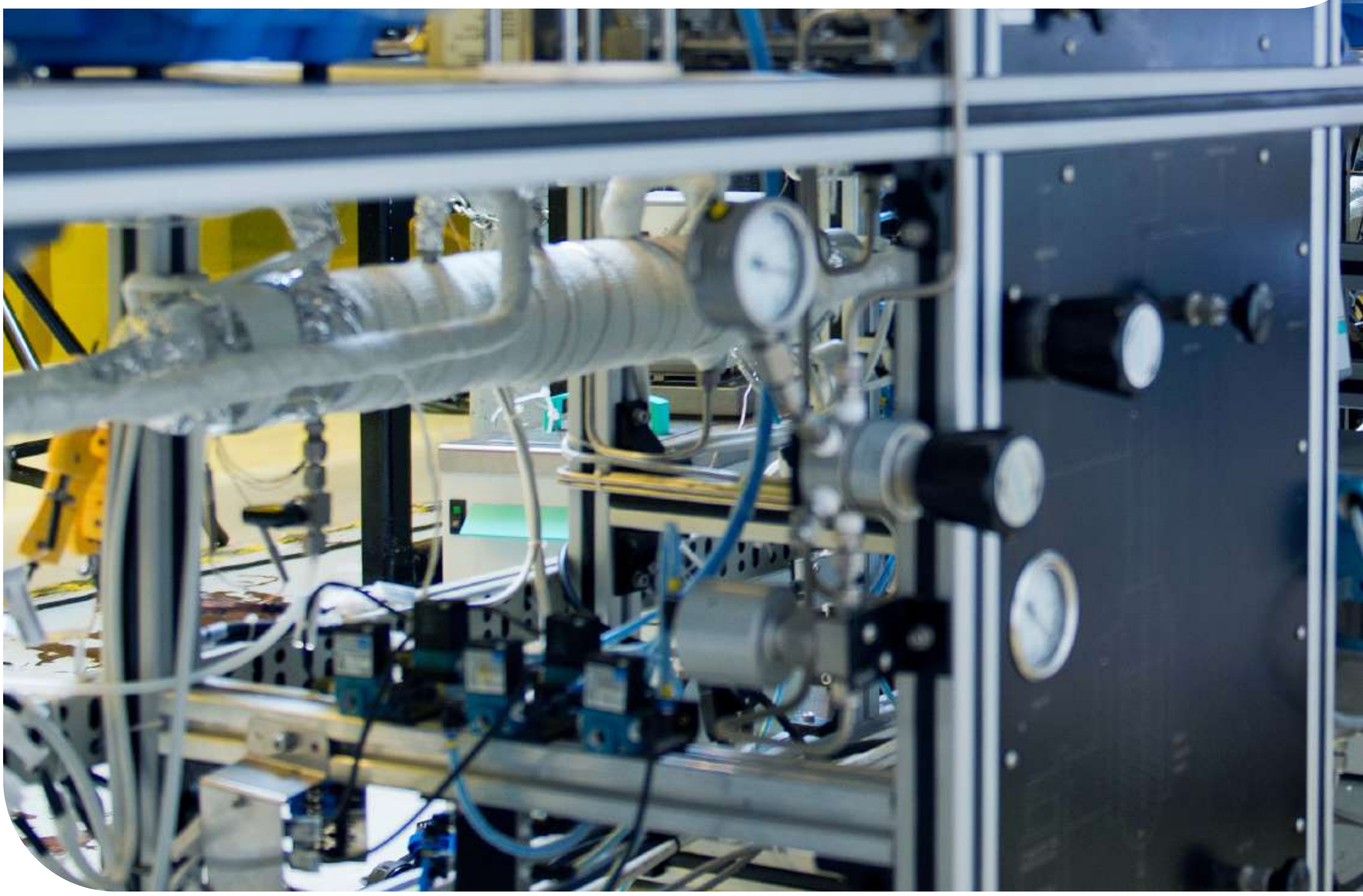
A student who does not return from a Temporary Leave of Absence by the date specified in the leave request is dismissed from the university.

## PERMANENT WITHDRAWAL FROM THE UNIVERSITY

A student may voluntarily withdraw from the University in accordance with withdrawal clearance procedures. Students who voluntarily withdraw are subject to the terms and conditions of their scholarship agreement or undertaking.

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 by filing a completed "Permanent Withdrawal Request" form at the Registrar's Office. A withdrawal is effective on the date the form is received by the Registrar's Office.
No record of enrollment in courses will appear on the transcript of a student who withdraws from all degree courses during the official add/drop period. A student who withdraws from the university before the deadline for course withdrawal, but after the official add/drop period, will receive a grade of W for all courses in progress. Students withdrawing after the deadline and before the last day of classes will receive a WF in each course. The student has the right to appeal a grade of WF as per the provisions of STL 5450 Student Grievances and Appeals. In cases of a successful appeal, a grade of WP will be assigned.
Any student who leaves the university before the close of a semester without withdrawing officially will receive a failing grade of F in each course for which the student was registered.



# **ACADEMIC** YEAR

The academic year at the Khalifa University of Science and Technology 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 for 75-90 minutes per day, five days per week. Due to 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.

# ACADEMIC CREDIT SYSTEM

The unit of measurement of academic work at the Khalifa University of Science and Technology 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.

## LANGUAGE OF INSTRUCTION AND EXAMINATION

English is the official language of the Khalifa University of Science and Technology. All courses at the University are taught and examined in English apart from non-English content courses such as Arabic language.

## TOTAL DEGREE CREDITS AND SEMESTER LOAD

Students are required to make steady progress towards their degree requirements within the maximum allowable time. The total degree credits required to complete the University's undergraduate degree programs will vary but in no case will they be less than 120 semester hours.
The appropriate course load for an undergraduate is dependent on two factors: scholastic ability, as reflected by the student's academic history, and available study time. Successful academic achievement usually requires two to three hours of outside study for each hour spent in class. For example, enrollment in 16 credit hours would require about 32-48 hours of outside preparation per week.

A credit load of 15-18 credit hours constitutes a normal full semester program for an undergraduate student. A student must normally complete 15-18 credit hours per semester to finish a Bachelor's degree in four years.

The maximum load in a semester is 19 credit hours. The maximum credit load in a summer session is 6 credit hours.

Enrollment in more than 19 credit hours, to a maximum of 21 hours in a semester, requires advance written approval of the relevant Dean (or designee.) Enrollment in more than 6 credit hours to an absolute maximum of 7 in a summer session requires advance written approval of the relevant Dean (or designee.)

## COURSE TITLE, CODE, CREDIT VALUE AND DESCRIPTION

Each course offered at the University has a unique code, title and 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 three or 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 | Numeric part of the code | Course title | Lecture hours per week<br>Laboratory hours per week<br>Overall credit value |

## STUDENT CLASSIFICATION, FULL AND PART-TIME STATUS

Undergraduate students admitted to a Bachelor's degree program are classified based on earned semester credit hours:

| EARNED CREDIT HOURS | CLASSIFICATION |
|---|---|
| 0-29 | Freshman |
| 30-59 | Sophomore |
| 60-89 | Junior |
| 90+ | Senior |

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

## GRADUATION RESIDENCY REQUIREMENTS

Students must successfully achieve the following to complete the requirements for a bachelor's degree:

- Complete all coursework in a degree program sequence as published in the student's academic catalog of record within six years of first enrollment at Khalifa University of Science and Technology (KU) as a degree student;
- Under certain circumstances, a course substitution may be allowed. If approved, the "Course Substitution" Form is submitted to the Registrar's Office in order to update the student's degree audit in the Student Information System. All substitutions must be approved by the student's degree program (department chair) and the dean of the relevant college (or designee).
- Have a minimum cumulative grade point average of 2.00 for all academic work completed in residence (excluding foundation program courses);
- A minimum of 50 percent of the academic credit applied toward graduation must be earned from courses taken at KU (See ACA 3270 Transfer Credits and Advanced Standing);
- Have a minimum of 30 credit hours in 300 and 400 level courses at KU;
- Recommendation by the faculty and approval of the Board of Trustees.
- Students should register for a normal credit load as appropriate, keeping in mind that exceptions to the maximum allowable credit load will require approval of the dean (or designee).
- Students should consult with their academic advisor for information on specific credit hour requirements. Continuous consultation with the academic advisor is essential, as it will also enable the student to complete the required degree credits within four years.

# **GRADES AND GRADE** POINT AVERAGES

## POLICY AND GRADING SCALES

Grades are an important component of the learning assessment process (refer to ACA 3300 Assessment of Student Learning). It is the responsibility of the course instructor to inform each class at the beginning of the semester or session of the nature of the course assessment and corresponding grades assigned. Each course instructor should include a grading metric in the course syllabus. The following grades and guidelines are used at the KU:

For undergraduate programs:

| LETTER GRADE | GRADE POINT | DESCRIPTION |
|---|---|---|
| A | 4 | Excellent |
| A- | 3.7 | Very Good |
| B+ | 3.3 | |
| B | 3 | Good |
| B- | 2.7 | |
| C+ | 2.3 | Satisfactory |
| C | 2 | |
| C- | 1.7 | Less Than Satisfactory |
| D | 1 | Poor |
| F | 0 | Fail |
| WF | 0 | Withdrew Failing |

Additional letter grades are used to denote special cases. These letter grades do not have corresponding grade points, and hence are not used in calculating a student's grade point average.

| LETTER | DESCRIPTION |
|---|---|
| W | Withdrew between end of late registration and deadline for course withdrawal. |
| WP | Withdrew Passing after the deadline for course withdrawal through the last day of classes. A WP grade must be approved by the dean (or designee). |
| WA | Administratively withdrawn due to absences. |
| S | Satisfactory in a Pass/Fail course. |
| U | Unsatisfactory (denotes failing in a Pass/Fail course) |
| I | Incomplete* (See Below) |
| IP | In Progress (May be assigned prior to a final grade in a multi-course sequence.) |
| AUD | Audit |
| EX | Student Exempt from a Course (No credit given.) |
| TR | Transfer (Credit counted.) |
| N | No Grade Submitted |
| XF | Failure Due to Academic Dishonesty (This grade can only be assigned after an academic dishonesty hearing. A student may petition to change this grade to F.) |

## GRADE POINT AVERAGE (GPA)

The grade point average is the ratio of the total number of quality points earned to the total number of credit hours attempted. Both semester GPA (SGPA) and CGPA (CGPA) appear on the transcript.

## INCOMPLETE GRADES

The incomplete grade is an exceptional 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 university regulations, was unable to meet the full requirements of the course.

- Approval by the college dean (or designee) must be secured by the instructor before a grade of "I" may be assigned or changed.
- An incomplete grade assigned in a course must be removed and the grade change submitted by no later than the end of the first week of classes in the term immediately following. Failure to remove the "I" grade by this deadline will result in the "I" grade changing to "F".
- It is the student's responsibility to meet with the faculty member and request arrangements for the completion of the missing required coursework.
- Once course requirements are completed a request for grade change must be made by the instructor as stipulated in para 5.3.

## REPETITION OF COURSES

A student should meet with his/her advisor and appropriate KU departments before repeating a course, as it may affect the student's academic standing and scholarship. A repeated course must be taken when it is regularly offered and cannot be taken in independent or individual format. Any questions regarding these procedures should be addressed to the Registrar's Office. A student may repeat a course subject to the following:

- A student may repeat a course for which the student received a letter grade of C- or lower;
- A student is allowed to repeat degree courses for a maximum of seven times during the student's undergraduate studies at the university;
- Degree credit for a course is only given 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 grade point average;
- Students may not repeat a course by taking it in transfer at another university;
- A student who wishes to take a course for a third time must obtain 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 (refer to ACA 3600 Academic Standing and Honors).

## GRADE CHANGES AND APPEALS

Final course grades, officially reported by the instructor at the end of an academic semester or summer term, are recorded by the Registrar's Office. A request to change a grade may be initiated, in writing, by the instructor of the course or, following a student submitted Grade Appeal form, by the Student Appeals Committee.

A student may appeal an officially recorded grade through submission of a "Grade Appeal" form to the Registrar's Office no later than the first day of classes of the next regular semester. A grade appeal will be processed as per the provisions in STL 5450 Student Grievances and Appeals.


XBOX 360

# ATTENDANCE

The Khalifa University of Science and Technology students are required to attend classes regularly to progress academically. All faculty members are required to maintain accurate and up-to-date records of student attendance.

## INSTITUTIONAL SANCTIONS

The following shall apply when a student has been absent, either excused or unexcused, for more than 20% of scheduled class meetings in which s/he is currently enrolled (including excused absences).

- If the 20% limit is reached on or before the last day to withdraw from classes, as specified in the academic calendar, then the Student Information System will automatically assign a letter grade of WA (Withdrawn Administratively).
- In all other cases a letter grade of WF (Withdrawn after Deadline) will be assigned.
- All appeals should be referred to the Student Appeals Committee which will provide a recommendation to the chief academic officer whose decision shall be final. Students applying for an appeal must provide all necessary documentation within three days of the grade (WA or WF) notification.

## EXCUSED ABSENCE

Excused absences: Official approval from Student Success is the only means of excusing a student's absence. The following provisions apply:

- It is the student's responsibility to apply for an absence to be excused. Once the application is approved, Student Success shall inform the instructor.
- Medical certificates, personal correspondence and other documentation may not be accepted by instructors as excusing a student's absence. Instead, these should be provided by the student to Student Success who are the final arbiter in matters regarding the collection, dissemination and review of all required documentation subject to the provisions of ACA 3850 Confidentiality and Privacy of Student Records shall apply.
- The decision by Student Success to grant or decline a student's application to excuse his/her absence is final subject to the provisions regarding appeals in 5.2.2.3 above.
- When possible, students should seek prior approval for an excused absence.
- In the case of students representing KU on official business (KU-related travel, conferences, school recruiting, presentations, fieldtrips, etc.) the following provisions shall apply:

  Approval must be obtained prior to the absence from student's department chair who shall then inform Student Success and the instructor(s) of the course(s) from which the student will be absent.

  All other provisions shall apply.

  - Application to excuse an absence post facto must be made to Student Success within five (5) working days of the last day of the period of absence for which application to excuse is made.
  - Where an excused absence causes a student to miss an assessment then the student's grade for the assessment shall be calculated in accordance with the course syllabus. Unexcused absences that cause a student to miss an assessment will result in that student receiving a grade of zero (0) for the missed assessment with a concomitant effect upon the student's final grade. Refer to ACA 3370 Examinations, ACA 3350 Grading Systems, GPA and Course Repetition, ACA 3200 Graduation Requirements and Academic Progress (Undergraduate).

## 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.

# EVALUATION AND EXAMINATIONS

## ASSESSMENT OF STUDENT LEARNING

Achievement levels of intended learning outcomes shall be evaluated through a variety of assessment instruments in a process of frequent assessment that includes regular and timely feedback to students regarding their performance.

Course policies regarding the submission, grading, return and weighting of all assessment instruments must be clearly communicated in the course syllabus, which is to be shared with students on the first day of class.

## EXAMINATIONS

One or more major examinations may be administered for a course to assess achievement of learning outcomes. All examinations at the Khalifa University of Science and Technology must follow clear and established guidelines to ensure examination integrity and compliance with best practices.

Major examinations shall be included in the course syllabus and any changes communicated to students in advance. Final examinations are scheduled through the Registrar's Office.

## 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 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.

## ACADEMIC STANDING

The Khalifa University of Science and Technology actively monitors each student's academic standing and communicates the information on a periodic basis. Academic standing is based on the student's CGPA and indicates if a student is meeting the University's standard for expected academic performance. Academic excellence, rigorous scholarship, demonstrated attainment of learning outcomes and timely progress towards graduation are critical components and measures of student intellectual development and academic success.

## ACADEMIC HONORS

The President's List is reserved for students with the very highest levels of achievement who:

- During the preceding semester earned a semester grade point average of 3.80 or higher while completing a minimum of 12 credit hours that includes no incomplete grades or repeated courses;
- Are not on academic probation or subject to any disciplinary action.

The President's List acknowledgement will be posted on the student's transcript.

The Dean's List is reserved for students who demonstrate a level of achievement significantly above the norm who:

- During the preceding semester earned a semester grade point average of 3.50-3.79 while completing a minimum of 12 credit hours that includes no incomplete grades or repeated courses;
- Are not on academic probation or subject to any disciplinary action.

The Dean's List acknowledgement will be posted on the student's transcript.

## ACADEMIC GOOD STANDING

Students are in good academic standing as long as they maintain a CGPA of 2.00 or higher.

## ACADEMIC PROBATION

A student whose CGPA falls below 2.00 is placed on Academic Probation for the next regular semester and a note is made on the student's transcript. The following provisions apply for a student on Academic Probation:

- A full-time student on probation is only allowed to register for a maximum of 13 credit hours per regular semester;
- While on probation, a student may not take any course on a Pass/Fail basis;
- A student who is placed on probation may be required to enroll in developmental courses or workshops.

If, at the end of the semester, the student has attained a CGPA of 2.00 or above, he/she shall return to good standing.

If, at the end of the semester, the student's CGPA remains below 2.0, he/she will remain on probation for the following regular semester.

## ACADEMIC DISMISSAL

A student in the second consecutive regular semester of probation who, at the end of that semester, fails to attain a CGPA of 2.00 shall be academically dismissed from the University.

# STUDENT RIGHTS AND RESPONSIBILITIES

## ACADEMIC INTEGRITY

The Khalifa University of Science and Technology is committed to the principles of truth and academic honesty. It is the responsibility of all University community members – students, faculty, staff and administration alike – to promote academic integrity through active deterrence and reporting of violations.

## STUDENT ACADEMIC RIGHTS

Every enrolled student has the right to access and receive quality education.

- KU is obliged to provide students with information on available funds and financial aid.
- KU is obliged to uphold and preserve its students' rights to exercise principles of academic freedom.
- KU is obliged to advise on and provide sufficient course information to permit students to make informed course selections.
- KU is obliged to make each course outline available to students including (but not limited to):
  - A description of the topics to be considered in the course;
  - Objectives and learning outcomes;
  - 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.
- Instructors are obliged to clearly communicate the learning outcomes and assessment tools to students.
- Instructors are obliged to provide a fair and reasonable evaluation of a student's performance in a course, with evaluation measures reflecting the content of the course.
- The students have the right to a fair and impartial assessment of their performance.
- Subject to reasonable administrative arrangements and provided that a request is made by a student within a reasonable time after the notification of a decision, students have the right to appeal an academic decision.

## STUDENT RESPONSIBILITIES

Khalifa University of Science and Technology 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 of Science and Technology 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."

- More specifically, a student is responsible for:
  - Abiding by all academic policies and procedures, and adhering to the academic integrity policy (including work ethics, attendance, etc.);
  - Conforming to all non-academic administrative rules and regulations (including those related to health, safety and environment);
  - Conducting oneself in accordance with the Student Code of Conduct.
- All students are obliged to abide by the following rules of general conduct:
- Respect the norms of UAE society and behave in a way that does not offend cultural sensitivities (see STL 5410 Student Code of Conduct).
- Observe decency in conduct and behavior, whether the student is on campus or off campus. (see STL 5410 Student Code of Conduct).
- Adhere to the appearance appropriate to university students. Give special attention to clothing and cleanliness. Ensure that clothes do not conflict with public morals (see STL 5430 Student Dress Code).

- Abide by all academic policies and procedures and conform to all non-academic administrative rules and regulations.
- Complete his/her academic program. This includes being familiar with KU catalogs, maintaining good academic standing, and meeting all other degree requirements.
- Abide by KU attendance policy (see ACA 3550 Student Attendance).
- Maintain communication with KU and keep accurate student information including current address, home address, telephone number and e-mail address etc.
- Keep their ID card with them at all times and present it on demand to university personnel.
- Participate in campus and community life in a manner that will reflect credit upon the student and the university.
- Be punctual in attending lectures, labs, workshops and events.
- Be an active listener while in any educational setting and avoid any disruption.
- Maintain the cleanliness and tidiness of KU facilities.
- Refrain from using, circulating or displaying pamphlets, leaflets or posters in KU premises without prior approval.
- Smoke only in designated smoking areas in KU.
- Assume responsibility of all resources such as apparatus, equipment, computer, books and other provided materials.
- Refrain from using any university computer for games or other purposes not related to the educational programs.
- Park only in the designated areas. Students are not allowed to use the parking area designated for faculty and staff.
- Be fully responsible for personal property. KU shall bear no responsibility for any lost or missing items.
- Consume food only in designated dining facilities. Food, tableware and utensils cannot be removed without permission.
- Refrain from engaging in spreading rumors or making false accusations.
- In case of a fire alarm, follow the instructions of the safety and security staff and leave KU premises as quickly as possible.
- Respect payment deadlines.
- Irrespective of religion or nationality, behave and dress in a modest manner. Harassment or intimidation of students will not be tolerated and students should report any such cases to the Student Services Office.

## CONFIDENTIALITY AND PRIVACY OF STUDENT RECORDS

Khalifa University of Science and Technology (KU) creates and maintains a variety of records for prospective, current and former students. Documents submitted by students become the property of the university including, but not limited to application / enrollment forms, school certificates, academic or other transcripts and English language test scores.

- Current and former students, their guardians and/or sponsors have access to the student's academic records upon written request to the Registrar's Office and provision of valid identification in accordance with the stipulations herein.
- University faculty and staff are permitted to access a student's academic record only when necessary to the performance of their assigned duties and responsibilities.

Current and former students, their guardians and/or sponsors have access to the student's academic records upon written request to the Registrar's Office and provision of valid identification in accordance with the Confidentiality and Privacy of Student Records policy.

Other parties may be given limited access to student academic records as follows:

- Organizations, their employees, agents and/or representatives authorized to act on the University's behalf or providing a service or function for or on behalf of the University may have access such as may reasonably be considered necessary to the service or function;
- Government and other authorized officials including accrediting bodies;
- To comply with a judicial order;
- Other institutions to which a student is transferring;
- Organizations conducting educational studies, on the condition that no personally identifiable information is released, or is released only in aggregate form;
- University employees, agents or representatives investigating a suspected security breach or conduct violation;
- Emergency personnel where there is a health or safety concern.

A student, guardian, or sponsor has the right to request changes to the content of the student's education record if the content is considered to be inaccurate, misleading, or in violation of the student's privacy or other rights. Such a request should be submitted in writing to the Registrar's Office.

## 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. The Khalifa University of Science and Technology 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

Representing another's words or ideas as one's own or failing to give appropriate credit to outside sources of information in any academic assignment, exercise, examination, project, presentation, report, etc.

### Forms of Plagiarism

1. Word-for-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, is considered a form of plagiarism. 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.

2. An unacknowledged paraphrasing of the structure and language of another person's work is a form of plagiarism. 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.
3. Writing a paper based solely on the ideas of another person is a form of plagiarism. 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:
   1. Using published work without referencing (the most common);
   2. Copying coursework;
   3. Collaborating with any other person when the work is supposed to be individual;
   4. Taking another person's computer file/program;
   5. Submitting another person's work as one's own;
   6. The use of unacknowledged material published on the web;
   7. Purchase of model assignments from whatever source;
   8. Copying another student's results.

### Avoiding Plagiarism

To avoid plagiarism, a student must give credit whenever he or she uses:
1. Another person's idea, opinion, or theory;
2. Any facts, statistics, graphs, drawings, any pieces of information that are not common knowledge;
3. Quotations of another person's actual spoken or written words; or
4. 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*

Using or attempting to use unauthorized materials and/or assistance in any academic assignment, exercise, examination, project, presentation, report, etc. This includes the possession of a mobile phone or any other unauthorized electronic devices during a test or an examination.

### 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

Falsifying or inventing research, citations, or any information on any academic assignment, exercise, examination, project, presentation, report, etc.

### Falsification of Results

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

### Falsifying Signatures

Forging monograms, imprimaturs and other forms of authorization or identification – whether hand-written, electronic or otherwise – on official forms or documents, attendance lists or any academic assignment, exercise, examination, project, presentation, report, etc.

### 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, the progress of another student's work related to a course is considered sabotage and is viewed as 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

1. If an instructor suspects that a student has committed a major violation, s/he must inform the student by e-mail about the details of the allegation within three (3) working days from when the alleged violation was identified If the instructor determines that no major academic violation has occurred, the matter is dropped.
2. If the instructor determines that a major violation has occurred, s/he shall notify the student, the instructor's department chair, and the relevant college dean (or designee) in writing, detailing the incident in question and policy violation(s) under consideration and including the available evidence.

3. The student's case file will be referred by the instructor's department chair through the relevant college dean (or designee) to the AIC within five (5) working days, confirming that points 1 to 4 of this procedure were followed.
4. Upon submission of the case to the AIC,
   - The AIC will hold a meeting t, if necessary, with the student and/or instructor for the purpose of examining the evidence and questioning any witnesses or relevant parties.
   - The student shall have the right to be assisted by an advocate. The advocacy role may be assigned to an academic advisor or counselor. External attorneys are not permitted to be involved in any grievance or appeal case.
5. The committee may consult the university legal assessors or an expert (e.g., medical, psychological, etc.) for advice regarding any evidentiary issue.
6. Based on the evidence, if the AIC decides that the student has committed an academic violation, they will recommend an appropriate sanction. The AIC may recommend any sanction in accordance with para 5.6 of this document.
7. The AIC submits a full report, including the recommended sanction, to the provost (or designee) for a final decision. Such decision will be communicated to the Registrar's Office. Where the provost (or designee) determines to impose a sanction other than that recommended by the AIC, written justification shall be provided to the AIC.
8. The Registrar's Office will communicate the final decision to the student, the instructor, the department chair, and the relevant college dean (or designee).

## INVESTIGATION AND PENALTIES BY THE HEARING COMMITTEE

The offence is referred to a Hearing Committee in the following cases:

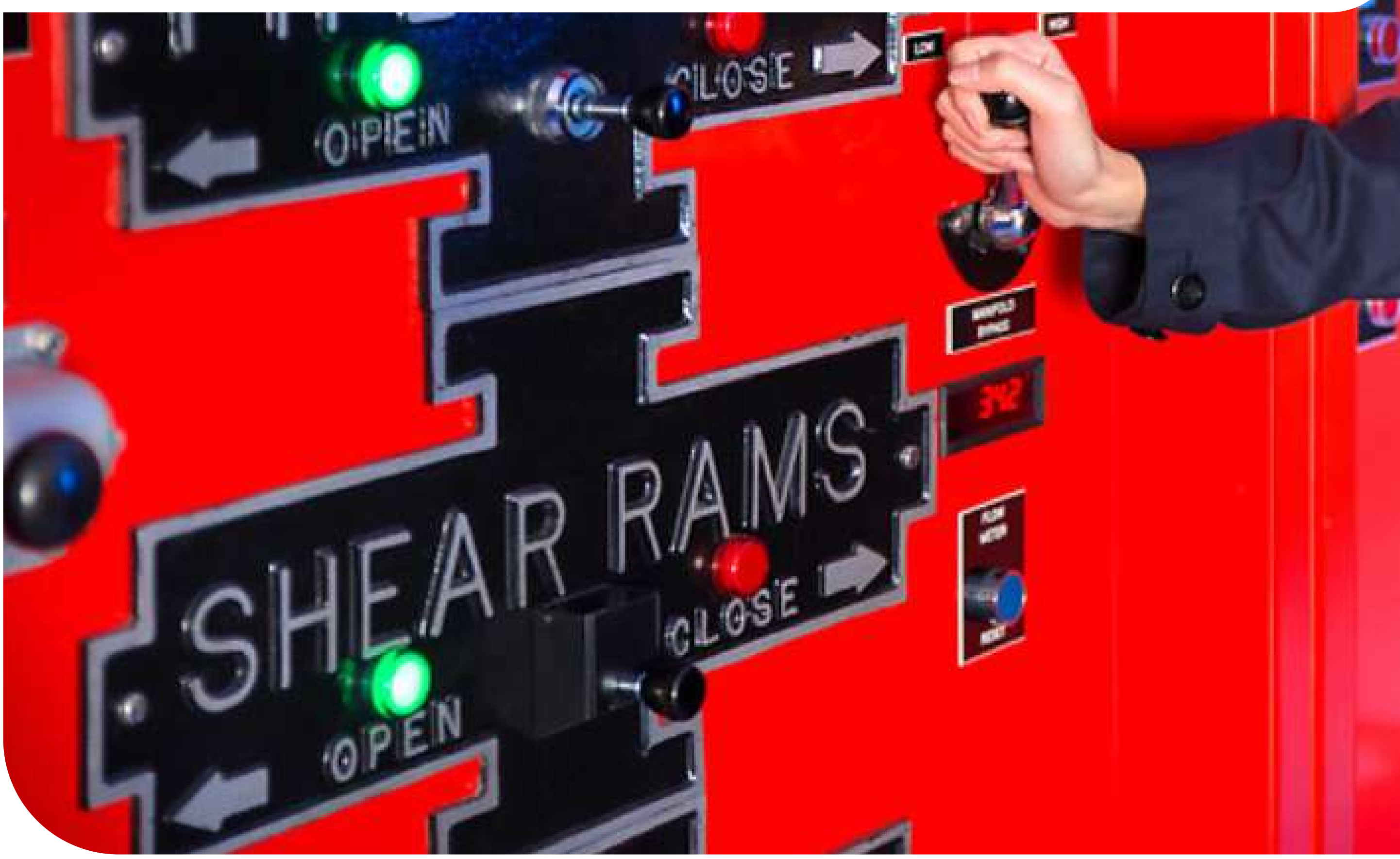
a. If the case represents a student's first offense and the student either did not admit guilt or wishes to appeal the sanction imposed by the instructor;
b. If the case represents a student's first offense and the student admitted guilt but the instructor decided that the offence is serious and warrants 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.

1. 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.
2. 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.
3. 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.
4. The meeting shall be private to protect the confidentiality of the proceeding.
5. 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.

6. 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;
7. At the onset of the hearing, the Chair confirms that the referred student(s) understands his/her rights.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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:
      i. Counseling the student and issuing him/her a formal written warning;
      ii. 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;
      iii. 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);
      iv. Failing the student in the relevant course;
      v. Failing the student in all courses for the semester during which the academic misconduct has occurred;
      vi. 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.
      vii. 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.

viii. 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

13. In cases of penalties resulting in immediate suspension or expulsion, the student shall physically leave University-owned or controlled property within 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.
14. The chair of the committee will notify the student of the committee's decision in writing within five business days. The student will also be informed in writing of the right to file a final written appeal to the Provost within five 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.
15. 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.
16. 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.



# **CAMPUS FACILITIES** AND SERVICES

## LABORATORIES AND WORKSHOPS

Khalifa University conducts periodic Environment, Health and Safety (EHS) briefings, and online training, which are mandatory for students to work in labs/workshops. Students are responsible for understanding the EHS materials and instructions presented at these briefings/training and for acting in accordance with them.

## EHS PROCEDURES FOR LAB AND WORKSHOP FACILITIES

In university colleges, students are expected to manipulate instruments, equipment, and materials that are potentially hazardous. For this reason, students are required to attend the **EHS inductions and orientations**, and to read the EHS manuals associated with all lab and workshop activities. Students will not be allowed to participate in the lab or workshop activities unless they have demonstrated a clear understanding of the safety procedures involved.

Students shall get the lab instructor's approval before starting the experiments in labs /workshops. Students may not work alone in a lab or workshop in case of a due to chances of an accident or medical emergency. Inattention or disruptive behavior will not be tolerated in any lab or workshop activity. Repeated cases will be referred for disciplinary action. Equipment, tools, and materials must be handled in a manner that is safe for the student as well as for other students and the instructor and only if authorized to do so. Students have a responsibility to report any infringements which they witness. Further information is available in the EHS manuals.

## BUILDING ACCESS AFTER HOURS

Students may be granted building access during non-operational hours. The responsible University employee will complete the online request and submit it to the responsible Department Head.
The form must contain the names of each student being granted access and the termination date for this access. Student access will be automatically terminated at the end of each semester. The responsible Department Head and employee must approve the form. The facilities Management/Security department will reprogram the electronic lock within three days of the receipt of the request or issue a key as applicable.

## HEALTH SERVICES

Khalifa University employs male and female nurses to provide First Aid services and emergency care at its Main and SAN campuses (SAN Campus 24/7). The nurse is on full-time duty to care for both male and female students who require emergency treatment while on campus. The nurse also gives advice on a healthy lifestyle and other related health issues. Students are required to complete a Medical Record Form giving details of medical history and specific instructions for emergency situations. Students should inform the nurse of any medical ailments or ongoing treatment. Minor ailments will be treated at the First Aid clinic in private treatment rooms. In cases of accident or emergency, a nurse is on call to attend to the patient. Except in life-threatening situations, the patient will not be moved, until an authorized person arrives and assesses the injury. Guardians will be notified as quickly as possible and instructions on the student's Medical Record Form adhered to where possible.

## EMERGENCY SERVICES

Emergency services are provided by the campus Security Department, which operates 24/7. These services can be requested by calling (02-312 3999) or contacting the Security Department. Emergency phones are located throughout campus for your safety and convenience. Please refer to the University's Emergency Plan for additional information.

## PRAYER ROOMS

Khalifa University provides purpose built rooms for prayers. This includes separate areas for `Wudhu', washing and cleaning for both men and women. Please refer to the campus map.

## STUDENT LOUNGES

Separate lounge areas are provided for male and female students.

## SPORT FACILITIES

A state-of-the-art sports and fitness facilities are located in the Main Campus, Building D next to the Student Hub. The facilities are gender-specific and available to all Khalifa University students with a valid student ID card.

At Masdar City Campus, the Gymnasium is located on the first floor of our Multi-Use Hall and offers both male and female work-out areas.

At Sas Al Nakhl Campus, exercise rooms are available in the Student Center and Arzanah Building on the third floor.

Children under the age of 16 are not permitted to use equipment in the gym. This age limit is in line with campus recreational facilities in other universities internationally, as the equipment is designed for use by individuals with fully developed bodies. Additional gym usage policies are posted in the gym and students are urged to familiarize themselves with the rules and regulations of the gym.

## FOOD OUTLETS AND RETAILS

Khalifa University campuses have a broad range of food and drink outlets operated by external providers. The University aims to ensure a range of good quality food and drink that offers convenience, customization, choice, value for money, and an environment that meets the demographic, lifestyle, belief and cultural diversity of the University. The experience that our staff, students, and visitors have from eating and drinking on campus, and the interactions that they have with us, should be positive and have a positive impact on their view of the University.

The main dining area is located in the Student Hub at Khalifa University's Main Campus offers students a comfortable area to relax between classes, get homework done, or have a lunch or and coffee with friends. There are a wide variety of restaurant and food options in Khalifa University's Main Campus:

**MAIN RESTAURANT** - located in the Student Hub building on the ground floor. Lunch is served from 11:30am to 4:30pm.

**COSTA RESTAURANT** - located beside the R Building. Serves coffee, tea, soda and cakes, and sandwiches.

**STARBUCKS** – located in the Student Hub Building, ground floor, and serve hot and cold coffee, sandwiches, salads, and desserts.

**DOCTOR SHAWARMA** – located in Student Hub food court. Serves shawarma sandwiches, manakish, juices, and snacks.

**HOUSE OF TEA** – located in Student Hub food court. Serves hot and cold drinks (karak tea, haleeb ginger) and sandwiches.

**BASIL** – located in Student Hub food court. Serves burger sandwiches, side dishes and juices.

Vending machines are located throughout campus in the following locations: directly outside the R Building, L Building, G Building on the 1st floor.

At the Sas Al Nakhl Campus, the Student Center (male students) is located in Satah building; it consists of a dining facility that serves three meals a day. A similar outlet is open to the female students in Arzanah building serving two meals a day. Smaller cafeterias are open for the Sas Al Nakhl Campus community in the Bu Hasa and Habshan buildings. All of these outlets serve an a la carte menu and breakfast and lunch buffets.

At Masdar City Campus, a general cafeteria that caters to the needs of the staff and students is available on campus, along with campus restaurants and coffee shops, including Caribou café, Sumo Sushi, Barbacoa Mexican Restaurant, Jim's Kitchen, Skinny Genie and Pappa Roti Café, In addition, students are provided with basic facilities in their residential units for self-preparation of simple meals.

## TELECOMMUNICATION CUSTOMER SERVICES (ETISALAT)

Khalifa University has opened an Etisalat kiosk in the Student Hub hall, operating from 8am to 5pm Sunday through Thursday, and offering partial services from 9am 4pm on Saturdays. Etisalat, as one of the Middle East's leading telecommunications, has the right to sell all agreed products and services and any special offers of Etisalat in the Kiosk including:

- New Connections (Prepaid & Postpaid SIM Cards, Internet, Landlines, TV Bundled Packages).
- Smart Devices (iPhone, Samsung, tablets, etc.)
- Replacement of SIM Cards
- Bill Payment

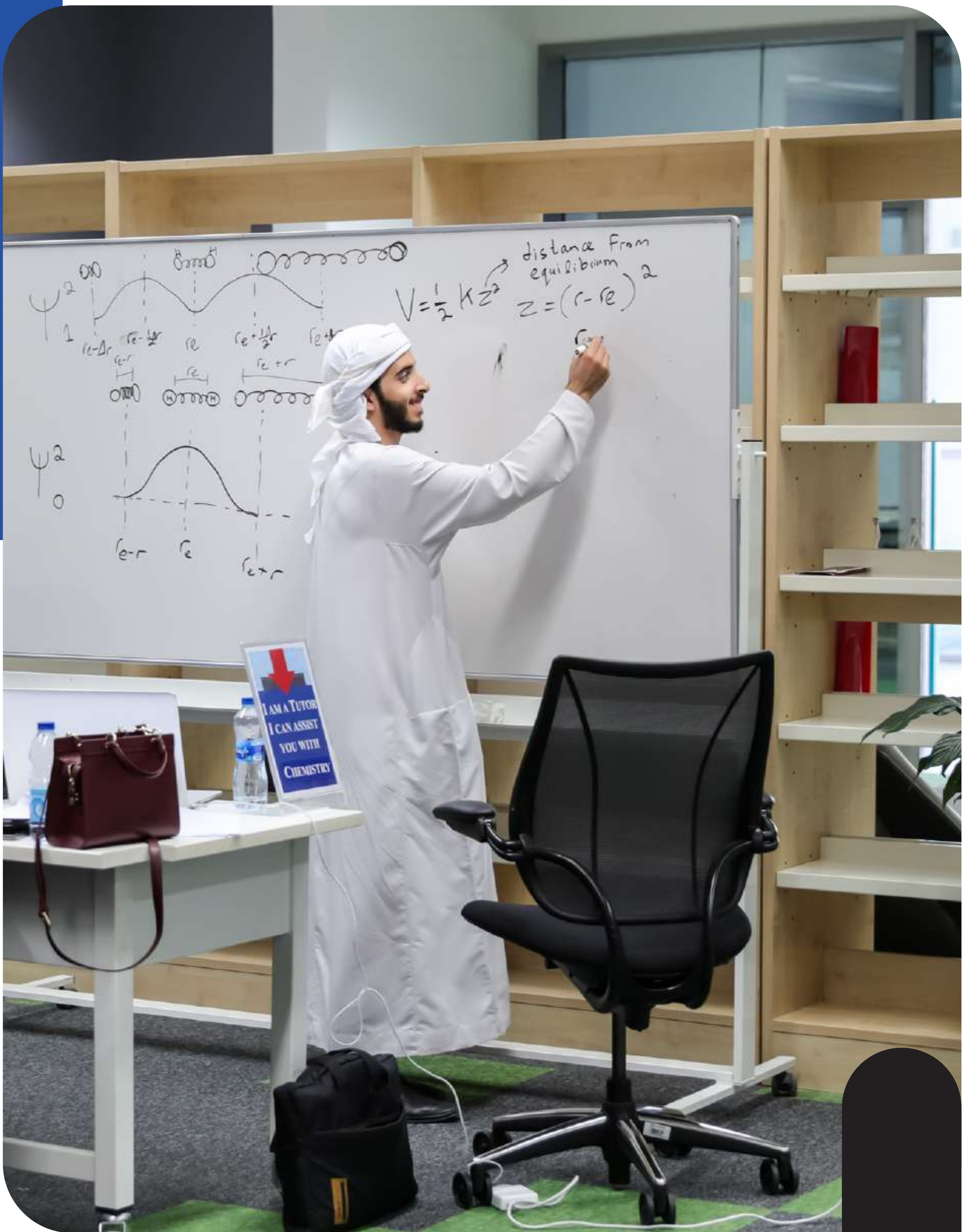
## BANKING SERVICES

At the Main Campus, there are a number of ATM facilities provided for students, faculty, and staff. ATMs are located on G building and Student Hub link bridge. There are also a number of ATMs at the Masdar City Campus. At the Sas Al Nakhl Campus ATMs are located at the gate to Arzanah, at the Habshan building lobby, and at Ruwais building lobby.

## RESIDENCE VISA AND GOVERNMENT AFFAIRS

International Student enrolled at Khalifa University should have their own visas. However, students whose studies maybe interrupted due to visa problems should make their situation known to the Registrar's Office. In some cases, the University may be able to provide assistance.

# **STUDENT SERVICES**
# OFFICE



The Student Services Office (SSO) is the office that fosters the intellectual, social, ethical, and personal development of students, preparing them to become engaged and constructive members of a diverse, dynamic, and global society in and out of the University. The SSO advocates students' needs, facilitates student involvement, and encourages students to accept responsibilities of membership in a campus community to explore personal interests through clubs, associations and focus groups. Additionally, there is strong emphasis on various health and fitness programs, as well as recreational and educational activities. Students are encouraged and supported in becoming involved in and undertaking the responsibilities of helping to organize major events and celebrations such as the National Day, Film Festival, KU Bazaar and Global Day. Student Services support students to lead events and activities such as the New Student Orientation Day, Career Fair, and non-academic recognition award ceremonies.

In addition, these departments facilitate student uptake of the external opportunities available to them such as the Youth Ambassadors Program, or external competitions and support students' participation in external conferences and events. Operating within the framework of total student development, the Department is committed to promoting a caring, cooperative campus environment that values diversity and reflects an appreciation of the dignity of all people.

## STUDENT LIFE

Student Services are committed to enriching the University campus life by offering students a chance to take initiatives and assume leadership roles through student clubs and the Student Council. Students are closely involved in organizing extracurricular activities, major and minor events.

## TRANSPORTATION SERVICES

The Transportation services are provided to students living in Khalifa University accommodation and students living in Abu Dhabi suburbs. Daily, weekly (to and from their home emirates) and shuttle buses between the campuses are part of this service. The transportation service supports university students' external events, activities and field trips inside and outside Abu Dhabi. The weekly transportation fees are set according to the University payment guidelines.

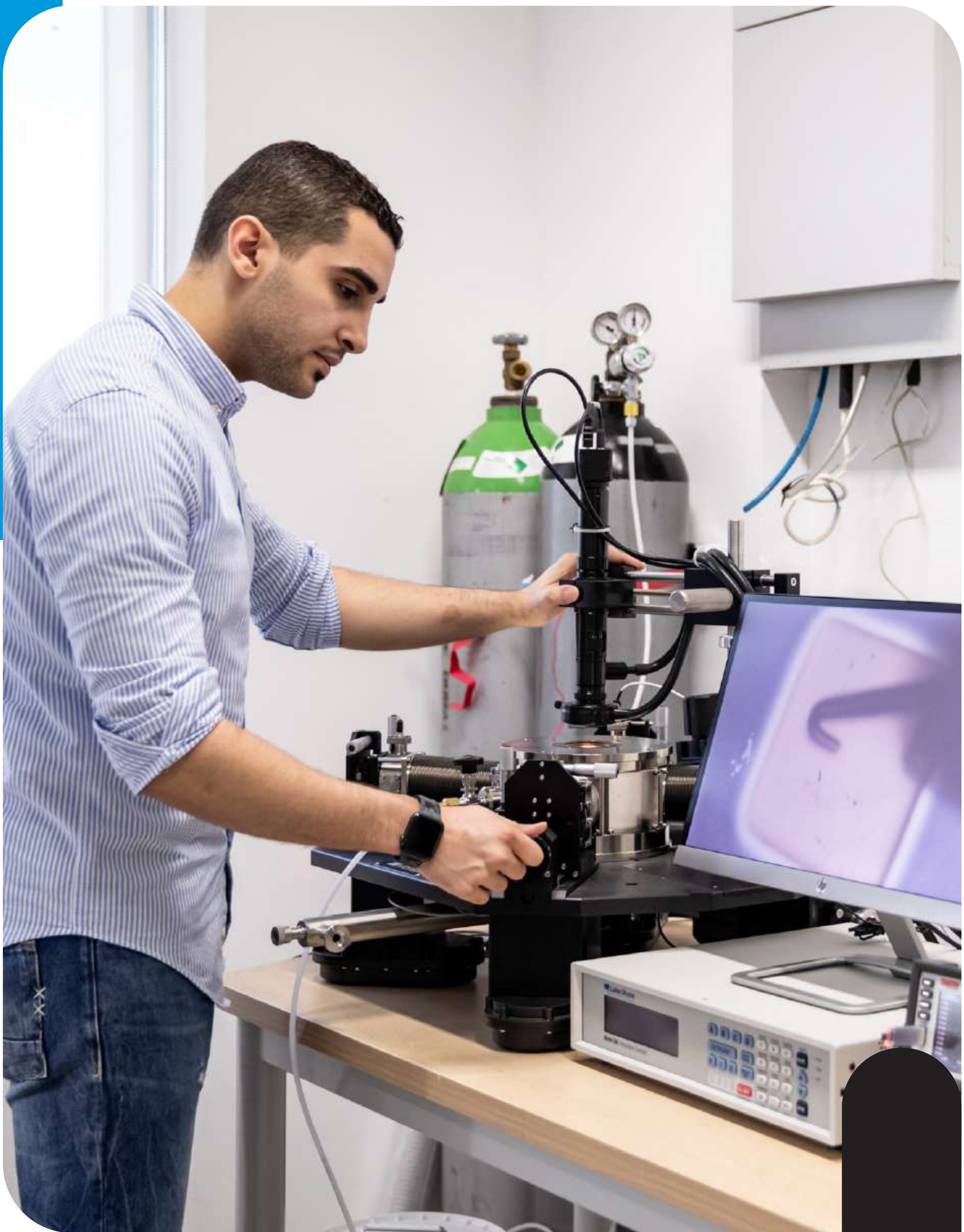
## STUDENT RESIDENCES

University Residences offer an environment in which students from different parts of the country have the chance to meet and learn from one another. All housing facilities are managed by on-site staff and security team.

The University offers two types of residence quarters for its students: (a) male-only; (b) female-only. Students are expected to be respectful and considerate of all different cultures, customs, and traditions. Based on availability and demand, student housing is subject to priority allocation. Priorities and costs are subject to change. Daily transportation is provided to and from the campuses.

For further information, students are encouraged to refer to the undergraduate and graduate Residence Guidebooks.

# **CENTER FOR TEACHING** AND LEARNING



The Center for Teaching and Learning (CTL) supports Science, Technology, Engineering, and Mathematics (STEM) education through professional development, research, and innovation. The center aims to lead the teaching community in nurturing their practices and promoting meaningful student experiences across disciplines, including educational technology tools. The center's primary goal is to promote teaching as a scholarly practice aligned with KU priorities. The CTL strives to empower students to become independent thinkers, lifelong learners, and future leaders by providing them with the necessary tools to develop their academic and personal skills. CTL offers students the following learning experiences:

- Peer tutoring and faculty-led tutoring in the CTL Learning Centers.
- Lead Peer Mentoring Program
- A Leading with Passion and Knowledge Certificate Course
- Public Speaking, Problem Solving, and Critical Thinking workshops
- Grit and Growth Mindset workshops
- Entrepreneurship & Innovation Bootcamps
- Promoting the use of Blackboard (LMS) and tools (e-portfolio)

CTL sponsors an annual Experiential Learning (ExL) Symposium, which offers students an opportunity to reflect on, share their experiential learning and assess challenges and successes that inspire their peers. To learn more about it, please visit the https://www.ku.ac.ae/virtual-experiential-learning-symposium and the CTL page on the KU Portal or email us at ctl@ku.ac.ae.

## CAREER DEVELOPMENT

The Khalifa University of Science and Technology assists students in career planning and obtaining appropriate employment through provision of career services activities that follow best practices. The University is responsible for delivery of professional services that meet the needs of its stakeholders including current students, alumni and employers. Career Services are available to students beginning with their first enrollment.

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.

To prepare students for internships and employability the following career related workshops are offered, but not limited to:

- Workshops on resume writing and cover letter development
- Workshops on interview skills and etiquette
- Career Fairs providing effective opportunities to network with hiring employers
- Internship preparation workshops: orienting students on the internship process

## EXTERNAL SCHOLARSHIPS

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

.

## STUDENT SUCCESS OFFICE

Student Success Office offers a University Success Program that includes the following topics: developing effective study habits; discovering personal learning styles; understanding the importance of managing time; exploring personal values and interests. The Student Success Office provides academic support for students in different ways, such as academic advising, peer tutoring and leadership 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 University student body.

## COMMUNITY SERVICES

Student Success Office offers Community Service required for all undergraduate students. Students have to carry out a minimum of 20 hours of Community Service per academic year, for a total of 80 hours (or 100 hours if a preparatory year is included) of Community Service/ Service Learning to graduate. Students will not be able to graduate from the Khalifa University of Science and Technology 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 of the Community Service Program is to contribute to the region through student's involvement

## COUNSELING SERVICES

The Student Success Office also provides an essential service to students through the available counseling services. Counseling services at the Khalifa University of Science and Technology 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 overwhelmed. The University counseling team help students develop the skills necessary to overcome any challenges they may face while studying at the University. They are devoted to aiding 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 to fulfill their dreams and reach their full potential. Counselors are available to support students with social issues, life adjustments and offer encouragement. 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 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 to high level of confidentiality.

In addition to the above, the Student Success Office is responsible for approving students' excused absences and official business absences per the established policy and procedures.

## STUDENT ACTIVITIES AND EVENTS

### Campus life

Purposeful and planned student activities at the Khalifa University of Science and Technology provide a friendly atmosphere for a multicultural and co-educational student body. The aim is to create a vibrant environment around co-curricular activities that extend beyond the classroom.

Khalifa University of Science and Technology students are encouraged to organize and lead many events and activities. These activities and programs include: a talent day, UAE National day celebrations, Film Festival, Student Leadership Day and intramural competitions.

The on-campus facilities to support these co-curricular activities include student lounges and activity rooms (male and female), kitchens, cafés and wireless internet access areas. The university encourages the establishment of a variety of student organizations and clubs reflecting various student interests.

**Some of the student current clubs at the Khalifa University of Science and Technology**

- Hope
- Arabic
- Spanish
- Debate
- Programming
- Anime
- Music
- Media
- Games Dev
- Sport
- Photography
- Story writing
- Happiness
- Han
- Art
- Nippon
- Literature
- Green crescent
- Gastronomy
- Emirati
- Pioneers
- Theater and talent
- Sustainability

### *Professional Organizations*

The current available professional organizations are listed below.

**AIAA Student Chapter**

The objectives of the University's American Institute of Aeronautics and Astronautics (AIAA) student 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 University's AIAA 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 the Khalifa University of Science and Technology. 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 Chapter**

The mission of the University's American Society of Civil Engineers (ASCE) student chapter 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. It participates in community service projects, ensures entries in national and international competitions, helps students participate in the ASCE Student Conferences, and sends potential members to 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 civil Engineering professionals and learn from them.

**ASME Student Chapter**

The University's student chapter of the American Society of Mechanical Engineering (ASME) serves 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.

The group participates in events like the Student Professional Development Conference (SPDC) held in Lebanon, and the Robocop and Human Powered Vehicle Competitions. It seeks to offer its members online courses and workshops that develop engineering and communication skills as well as social events to encourage other students to join.

**IEEE Student Chapter**

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association for the advancing of technology. The University's IEEE student chapter aims to prepare students of the Khalifa University of Science and Technology to face challenges in 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 chapter vision is a continuous, successful and productive student branch that holds new and innovative activities in both the scientific and social environments. Its mission is to be the definite article that merges all disciplines and activities into one big integrated multidisciplinary team of innovation and productivity. Registration in the chapter is open for all majors of engineering.

**IIE Student Chapter**

The objectives of the University's Institute of Industrial Engineers (IIE) student 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. Any University student who is enrolled as a fulltime student at the undergraduate or graduate level in industrial and systems engineering or another field that will enhance professional competence is eligible for membership in the chapter.

The goals of the IIE student chapter are to:

- nvite 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 and Middle East and North Africa, to network with future colleagues from other universities.

## Student Governance

The Khalifa University of Science and Technology promotes the active participation of students in the governance of the university. Every student on campus, undergraduate or graduate, is eligible to serve on a student council, university committee or departmental advisory board, as applicable.

## Student Council

The purpose of the University Student Council is to provide the student body with a common platform that promotes 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 Student 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 UAE 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 the 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.

## STUDENT CONDUCT REGULATIONS

### Student Rights

Every Khalifa University of Science and Technology (KU) student enjoys all rights and freedoms afforded 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, gender or special needs.
In general, a student has the right to:

- Attend classes and work in laboratories in accordance with the related academic policies and procedures;
- Participate in athletic and recreational activities as per the associated guidelines;
- Partake in student governance within the subscribed policies and procedures;
- Receive fair treatment and due process in case of an investigation or appeal;

Every student has a right to safeguard of his or her dignity. This right includes protection by KU against vindictive conduct displayed by a representative of the university acting in an official capacity.

KU respects a student's right to privacy of personal information in regard to student records, counseling records, and personal information (see ACA 3850 Confidentiality and Privacy of Student Records).

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.

A student has the right to appeal an academic or financial decision or ruling, or a sanction resulting from a code of conduct violation.

A student has a right to file a grievance regarding a perceived injustice without fear of negative repercussions.

KU has an obligation to ensure that administrative decisions are made, or actions taken, with fair regard for the known and legitimate interests of students.

KU has an obligation to maintain safe and suitable conditions of learning and study.

KU has an obligation to ensure that adequate measures are taken to protect the security of students on university property.

KU will not apply retroactive changes to university regulations to the detriment of any student.

## SPECIAL NEEDS ACCOMMODATIONS

- Entry into a specific academic program is dependent upon the student's ability, with reasonable accommodations, to achieve the learning outcomes of that program.
- Khalifa University of Science and Technology (KU) provides assistance and reasonable accommodations to students with special needs. The services provided include information on accessibility, identification of possible accommodations, and liaison with faculty and staff in establishing reasonable accommodations (e.g., equipment, testing modification, note-taking, etc.).
- Khalifa University ensures confidentiality of information related to the special needs cases.
- A student suspected of having a special need should be brought to the attention of the Office of Student Success (OSS) who will assess, plan and coordinate the follow up for referral or recommendations.

## NON-ACADEMIC STUDENT CONDUCT

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. Nonacademic 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 the 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 University Student Handbook and website details University policies and procedures regarding student conduct regulations, hearings and sanctions.

## DRESS CODE

All employees and students are required to adhere to the University dress code when on campus or representing the University off-campus.

## STUDENT CODE OF CONDUCT

Every member of the Khalifa University of Science and Technology (KU) community is required to follow the principles of decency, modesty and propriety in their behavioral conduct and dress code in line with the spirit of the national cultural norms and religious traditions of the United Arab Emirates at all times, both on and off campus. To this end, all students must comply with the conventions and regulations of university life established to maintain order, protect individuals and property, and fulfill the university's mission and purpose.

## STUDENT GRIEVANCES AND APPEALS

The Khalifa University of Science and Technology aims to provide a fair, equitable and productive learning environment for all its students that include a variety of means by which student grievances are brought to consideration and subsequent resolution in a timely manner.

A student has the right to appeal or file a grievance against academic or financial decisions or rulings, or a sanction resulting from a code of conduct violation. Students must follow the established procedures and adhere to time limits for filing a grievance or appeal. The University will issue an official written response.

## PREPARATORY PROGRAM

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

The aims of the Preparatory Program are to ensure that students have a sound foundation in Chemistry, Mathematics, and Physics and that their English language proficiency is sufficient to allow them to pursue undergraduate 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.

The program is designed so that students typically complete the requirements in one semester. 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 at Khalifa University. Regular assessments are conducted to identify student progress and to offer remedial support where necessary. Assessments take the form of traditional-style examinations, assignments and 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 Program courses with a grade of C or higher, and achieving an EmSAT 1400 in English or Band 6 in an external IELTS (or equivalent).

## CURRICULUM

Students are enrolled in appropriate English, Mathematics, Chemistry, and Physics courses based on their EmSAT scores (or equivalent).

### English Language Courses

| | | |
|---|---|---|
| ENGL 002 | Preparatory English II | 14 cr. |
| ENGL 003 | IELTS Exam Skills | 14 cr. |

### STEM Course

| | | |
|---|---|---|
| STEM 002 | STEM II | 12 cr. |

### Academic Success Course

| | | |
|---|---|---|
| SDAS 001 | Academic Success 1 | 1 cr. |

## COURSE DESCRIPTIONS

**ENGL002 Preparatory English II (14-0-14)**

Prerequisite: Initial placement with IELTS 5.5, IBT TOEFL 70-78 or EmSAT 1250.

In this course, students will develop the required English language proficiency for entry into freshman year. During the course, students will read a variety of texts to help improve their reading skills. They will also listen to different types of conversations and lectures to develop listening and note-taking skills. In addition to the various types of input to which students will be exposed, they will be required to produce written texts of various genres and complete oral presentations. This course will also provide students with specific training on how to adequately meet the task demands required in the IELTS exam.

**ENGL003 Preparatory English III (14-0-14)**

Prerequisite: Successful completion of ENGL002 and <IELTS 6 or <TOEFL iBT 79 or <EmSAT 1400

ENGL003 provides students with the language skills, enhanced knowledge of common topics, and test-taking strategies required to achieve the necessary requirements for transfer into freshman year courses. The course is designed for students who have passed the ENGL002 course, but have yet to reach the required English proficiency exam score.

### STEM COURSE

This course is an introduction to university mathematics and sciences. This is a developmental pre-freshman level course involving mathematics, physics, and chemistry and their integration and application to engineering. The course is offered to prepare students for their freshman year courses. The course delivers content using recent technology and hands-on techniques with an emphasis on self-study, context-rich problem solving, and study skills for university students.

**STEM002 STEM II**

Prerequisite: Students are placed into STEM002 if they satisfy minimum university admission criteria.

**Mathematics Component (5-0-5)**

This course is a developmental pre-calculus level course involving algebraic-rational expressions, circles and lines, inverse functions, polynomials, rational functions, exponential and logarithmic functions, trigonometric functions and trigonometric identities and their application. The course delivers content using a hands-on hybrid flipped model with an emphasis on independent and self-study, context-rich problem solving, and study skills for university students.

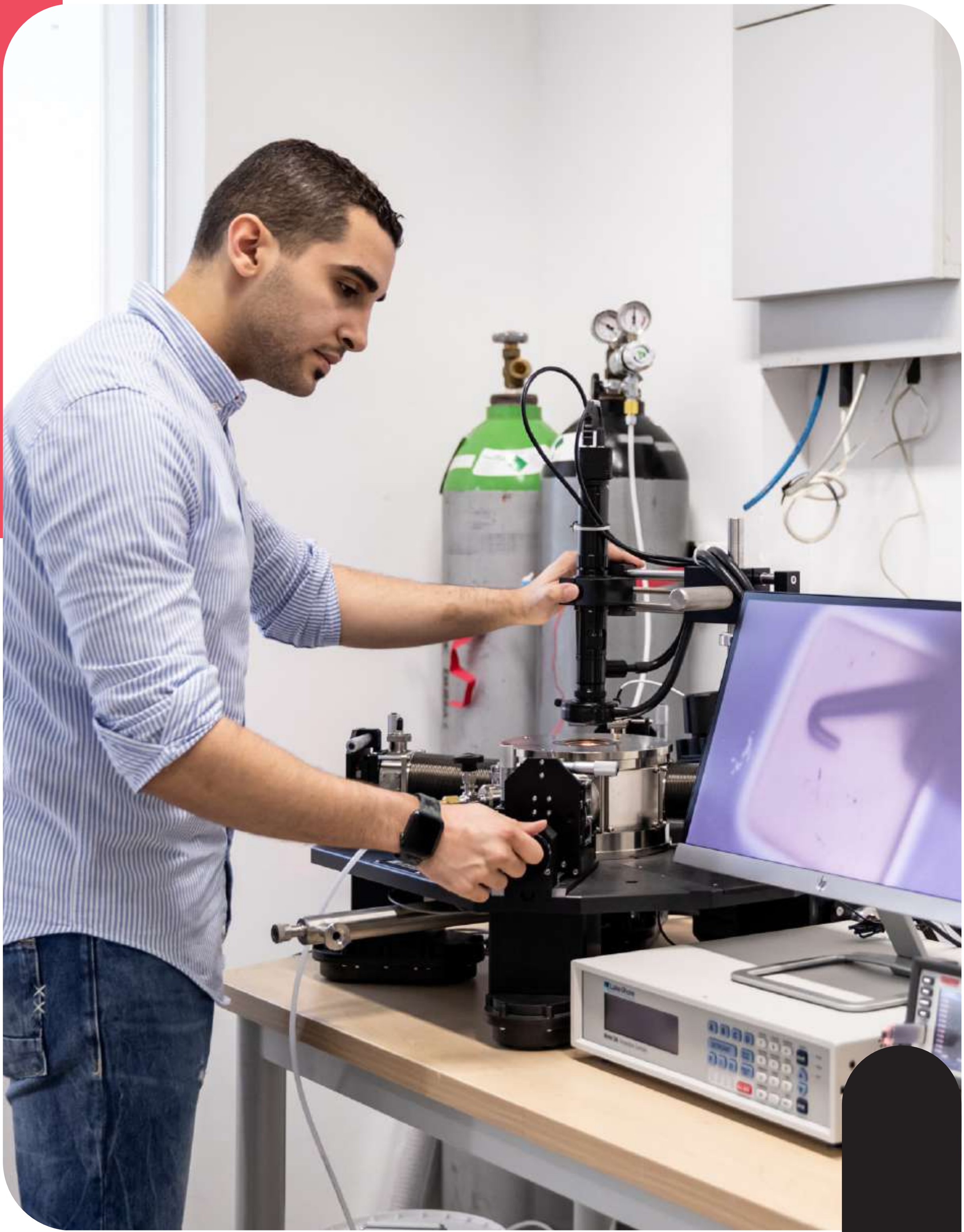
**Physics Component (2-2-4)**

This course is an introduction to university physics. This is a developmental pre-calculus level course involving algebra, geometry, trigonometry, and physics (mechanics) with an emphasis on their integration and application to engineering. The course is offered to prepare students for their level one, freshman year, courses. The course delivers content using recent technology and hands-on techniques with an emphasis on self-study, context-rich problem solving, and study skills for university students. The laboratory part of the course is designed to provide an introduction to experimental techniques in the laboratory, focused on experiments on forces, motion, and energy.

**Chemistry Component (2-1-3)**
This course provides students with the entry requirements in chemistry in preparation for their freshman year studies. Topics include chemical measurements, properties of matter, chemical reactions, stoichiometry, acidic and basic solutions, in addition to chemistry-related environmental issues. This course focuses on developing numerical problem solving skills using the basic tools of quantitative chemistry. The laboratory component develops the students' practical skills in handling basic chemical measurements and reactions.

**SDAS001 Academic Success 1**
This course delivers a blended learning experience designed to help students apply positive behavioral principles to their present and future studies. Students will develop the academic skills necessary to use university resources, critically assess their personal study habits, time management, and take responsibility for their own academic habits.

# COLLEGE OF ARTS AND SCIENCES



The College of Arts and Sciences is responsible for conducting leading-edge research, and delivering effective, student-focused teaching in fundamental science and humanities disciplines. Our activities include teaching to meet the accreditation requirements of the academic programs offered by the College of Engineering, as well as delivering existing and future BSc, MSc and PhD programs to meet the needs of the Emirate of Abu Dhabi, the UAE and the GCC region for workforce skills in the STEM disciplines.

## COLLEGE MISSION

Our mission is to deliver research-led teaching in fundamental science and humanities disciplines to educate tomorrow's generation of scientists and engineers as human capital for a knowledge economy. We encourage fundamental research in all disciplines, which will inform our curriculum and maintain currency and relevance.

## COLLEGE VISION

Our vision is to lead research excellence in Science and Humanities thus underpinning Khalifa University of Science and Technology's research strategy, a strategy which also maps on to the UAE's key research priorities. We will nurture and develop human capital at all levels, train tomorrow's scientists and engineers to the highest international standards and establish our University as a research-intensive centre of educational excellence for the region and the world.

## COLLEGE UNDERGRADUATE DEGREE PROGRAMS

The undergraduate degree programs offered by the College of Arts and Sciences are:

- Bachelor of Science (BSc) in Applied Mathematics and Statistics
- Bachelor of Science (BSc) in Cell and Molecular Biology
- Bachelor of Science (BSc) in Chemistry
- Bachelor of Science (BSc) in Petroleum Geosciences
- Bachelor of Science (BSc) in Earth and Planetary Sciences
- Bachelor of Science (BSc) in Physics

The length of these undergraduate programs ranges between 120 and 140 credits. These credits are divided into 48 credits of University General Education Requirements (GERs) and between 73 to 93 credits for specific Major Requirements.

## COLLEGE UNDERGRADUATE MINORS

Currently, there are three minors offered by the College of Arts and Sciences. Additional minor degrees are planned and will be offered by the College in the near future. The currently available minor degrees are:

- Minor in Digital Media and Composition
- Minor in General Business Studies
- Minor in Mathematics

## DEPARTMENT OF CHEMISTRY

### Introduction

Chemistry is the study of the composition and properties of matter, and how and why it undergoes change. Its study is central to the development of new medicines, to the secure supply of food and water and to the manufacture of innovative new materials for the 21st century.

The department is dedicated to supporting excellence in chemical education and research to meet the strategic needs of Abu Dhabi, the UAE and the international community.
We are committed to teaching and developing the next generation of scientists through a strong, innovative teaching program that equips students with skills that are useful whatever their choice of career. All our students have the opportunity to take part in cutting-edge projects which are part of the substantial research activity undertaken by Faculty members in chemistry. Research is conducted across diverse fields including both fundamental and applied topics covering materials, the environment, energy, and human health. Much of this is multidisciplinary and is conducted in collaboration with colleagues in other departments at Khalifa and around the world.

## BACHELOR OF SCIENCE IN CHEMISTRY

Chemists continue to make an enormous contribution to society, for example:  development of batteries for portable electronic devices; discovery of drugs and medicines for treating disease; polymers for drug delivery, medical implants and aerospace, flavors and preservatives used in food or water purification and many others. A world of opportunities and huge range of careers awaits students who major in chemistry.

The BSc in Chemistry program gives students a broad education in chemistry and supporting subjects in the early stages to provide a holistic set of skills (e.g. computational, analytical, numerical and synthetic), knowledge and methodologies for observing the physical world. Chemistry students can pursue their interests in more specialized sub-disciplines of chemistry or prepare for medical school. Four tracks, designed to serve the UAE's needs, are currently available:

- The **Environmental Chemistry** track promotes sustainable development through environmental monitoring and assessment, green chemistry and renewable energies.
- The **Materials Chemistry** track considers modern applications of downstream petroleum-based industries such as polymers and plastics and also novel nanomaterials such as carbon and metal oxide materials.
- The **Forensic Chemistry** track will support the analytical and investigative skills linked with industrial and medical applications as well as criminology in the police force and other investigative agencies.
- The **Medicinal Chemistry** track will support students who wish to proceed to medical school or the medical industries through additional study of biomedical applications of chemistry.

Upon successful completion of the degree, Chemistry graduates can pursue further studies (MSc or PhD) or careers in business, industry and academia, locally or internationally. Typical employment fields within the UAE and the Gulf region encompass quality control, analytical and technical roles, education, consultancy, as well as research and development. Such employment exists within industrial and government laboratories, university and industrial research centers, environmental protection agencies, chemical manufacturing plants and forensic chemistry laboratories (e.g. criminology and clinical science). Many students study for higher degrees, in particular, undertaking research towards a doctorate. Some Chemistry graduates go on to medical school for training and future employment in a medical field.

Chemists develop and synthesize life-saving tests and drugs within the pharmaceutical, biotechnology and life sciences sectors and although these are nascent industries within the UAE, the BSc in Chemistry program paves the way for training a new generation of graduates who can play a leading role in developing these crucial sectors of the UAE economy.

**Program Educational Objectives**

The BSc in Chemistry program aims to produce graduates who will:

- Possess substantial technical skills and theoretical knowledge of chemistry, and will be able to apply these appropriately in a variety of professional or academic contexts.
- Be competent in a broad range of technical and non-technical transferable skills, which are needed to have successful careers and assume leadership roles in industry, business and the government sector.
- Be prepared to pursue advanced studies in a range of disciplines, including but not limited to those allied to chemistry.

**Program Learning Outcomes**

Students graduating with a BSc in Chemistry will:

- Have specialized knowledge of the major sub-disciplines within chemistry, and the capacity to apply that knowledge in a professional context.
- Have a broad understanding of the sciences, mathematics and other disciplines relevant to chemistry and be able to integrate that knowledge to solve problems.
- Be able to efficiently search for, retrieve and critically evaluate technical literature and data.
- Be able to design and implement laboratory or computational experiments, analyse the resulting data, and apply appropriate safety measures.
- Be able to use the scientific method, apply critical thinking and reason analytically to solve chemical problems and conduct research.
- Be able to communicate effectively in oral or written form, to a range of scientific and non-scientific audiences.

- Be able to work productively in multidisciplinary teams to solve problems, debate different points of view, and exercise self-reflection following professional norms.
- Demonstrate an understanding of the societal and economic importance of chemistry, and the significance of ethical and environmental concerns for acting responsibly among chemists.

**Degree Requirements**

The normal length of the BSc program is 127 credits. To be recommended for graduation with a BSc in Chemistry, 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 (GERs, 48 credits), as well as the Chemistry Core (62 credits), Technical Elective Requirements (10-11 credits) and free electives (6 credits) .

| | | |
|---|---|---|
| CHEM 116 | General Chemistry II | 4 cr. |
| CHEM 200 | Quantitative Methods in Physical Sciences | 4 cr. |
| CHEM206 | Chemical Safety and Research Skills | 3 cr. |
| CHEM 221 | Organic Chemistry I | 4 cr. |
| CHEM 322 | Organic Chemistry II | 4 cr. |
| CHEM 231 | Physical Chemistry I | 4 cr. |
| CHEM 332 | Physical Chemistry II | 4 cr. |
| CHEM 251 | Inorganic Chemistry I | 4 cr. |
| CHEM 352 | Inorganic Chemistry II | 4 cr. |
| CHEM 330 | Introduction to Computational Chemistry | 4 cr. |
| CHEM 311 | Biochemistry I | 4 cr. |
| CHEM 241 | Introduction to Analytical Chemistry | 4 cr. |
| CHEM 342 | Spectroscopic and Separation Methods in Analytical Chemistry | 4 cr. |
| CHEM 343 | Advanced Instrumental Analysis Techniques in Chemistry | 4 cr. |
| CHEM 399 | Internship | 1 cr. |
| CHEM 497 | Senior Research Project I | 3 cr. |
| CHEM 498 | Senior Research Project II | 3 cr. |

**Chemistry Technical Elective Requirements (10-11 credits)**

The BSc Chemistry program has four tracks: (i) Environmental Chemistry, (ii) Forensic Chemistry, (iii) Materials Chemistry or (iv) Medicinal Chemistry.

For the Environmental Chemistry, Forensic Chemistry and Materials Chemistry tracks, students are expected to complete 12 credits of Technical Elective requirements. There are no restrictions on the combination of Free Elective courses students may take in Years 2 and 3 of the program for these tracks.

The Medicinal Chemistry track may be used to satisfy KU's Pre-Med requirements if appropriate Maths/Science/Engineering Free elective courses are taken in Years 2 and 3. Students interested in pursuing an MD degree MUST register for both BIOL 111 (3 cr.) in place of the Maths/Science/Engineering Free Elective in the Spring semester of Year 2 AND BIOL 112 (4 cr.) in place of the Maths/Science/Engineering Free Elective in the Spring semester of Year 3. The Technical Elective course requirements for the Medicinal Chemistry track has a load of 11 credits comprising: CHEM 312 (3 cr.), CHEM 423 (4 cr.) and CHEM 424 (4cr.). Students who do not take BIOL 111 and BIOL 112 in Years 2 and may still opt for the Medicinal Chemistry track and its associated technical elective courses in Year 4.

A complete list of the technical elective courses in the programs is given in the following table.

| | | |
|---|---|---|
| BIOL 312 | Biochemistry II | 3 cr. |
| CHEM 423 | Introduction to Medicinal Chemistry | 3 cr. |
| CHEM 424 | Synthesis of Medicinal Compounds | 4 cr. |
| CHEM 461 | Environmental Chemistry | 3 cr. |
| CHEM 462 | Pollution Science and Control | 4 cr. |
| CHEM 463 | Methods for Environmental Trace Analysis | 4 cr. |
| CHEM 471 | Fundamentals of Forensic Science | 3 cr. |
| CHEM 472 | Forensic Chemistry and Evidence Analysis | 4 cr. |
| CHEM 473 | Fundamentals of Forensic Toxicology | 4cr. |
| CHEM 481 | Materials Chemistry | 3 cr. |
| CHEM 482 | Nanochemistry | 4 cr. |
| CHEM 483 | Polymer Chemistry | 4 cr. |
| CHEM 391* | Independent Study I | 1-3 cr. |
| CHEM 491* | Independent Study II | 1-3 cr. |
| CHEM 495* | Special Topics in Chemistry | 3 cr. |

*At most four credits of the technical electives may be satisfied from a different track after departmental approval. In special cases, a student will be allowed to satisfy at most four credits of technical electives via alternative advanced chemistry free elective topics, subject to departmental approval.

**Chemistry BSc Tracks**

Chemistry students select one of four available tracks. These tracks are provided as a guide for the selection of courses and do not appear as a separate transcript record. The following courses are approved by the Chemistry Department for each track.

**Environmental Chemistry Track (11 credits)**

| | | |
|---|---|---|
| CHEM 461 | Environmental Chemistry | 3 cr. |
| CHEM 462 | Pollution Science and Control | 4 cr. |
| CHEM 463 | Methods for Environmental Trace Analysis | 4 cr. |

**Materials Chemistry Track (11 credits)**

| | | |
|---|---|---|
| CHEM 481 | Materials Chemistry | 3 cr. |
| CHEM 482 | Nanochemistry | 4 cr. |
| CHEM 483 | Polymer Chemistry | 4 cr. |

**Forensic Chemistry Track (11 credits)**

| | | |
|---|---|---|
| CHEM 471 | Fundamentals of Forensic Science | 3 cr. |
| CHEM 472 | Forensic Chemistry and Evidence Analysis | 4 cr. |
| CHEM 473 | Fundamentals of Forensic Toxicology | 4 cr. |

**Medicinal Chemistry Track (10 credits)**

| | | |
|---|---|---|
| BILO 312 | Biochemistry II | 3 cr. |
| CHEM 423 | Introduction to Medicinal Chemistry | 4 cr. |
| CHEM 424 | Synthesis of Medicinal Compounds | 4 cr. |

Typical Course Sequence for a **BSc degree in Chemistry** – FALL ENTRY

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | ENGL 102 Academic English II | 3 cr. |
| | MATH 111 Calculus I | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| | GENS 101 Grand Challenges | 4 cr. | CHEM 116 General Chemistry II | 4 cr. |
| | Semester Credits | 15 cr. | Semester Credits | 15 cr. |
| S | HUMA XXX Arabic Language Elective | 3 cr. | | |
| YEAR 2 | CHEM 200 Quantitative Methods in Physical Sciences | 4 cr. | Maths/Science/Engineering Free Elective | 3 cr. |
| | CHEM 206 Chemical Safety and Research Skills | 3 cr. | CHEM 221 Organic Chemistry I | 4 cr. |
| | CHEM 251 Inorganic Chemistry I | 4 cr. | CHEM 231 Physical Chemistry I | 4 cr. |
| | PHYS 122 University Physics II | 4 cr. | CHEM 241 Intro. to Analytical Chemistry | 4 cr. |
| | Semester Credits | 15 cr. | Semester Credits | 15 cr. |
| S | BUSS XXX or HUMA XXX<br>Business Studies or Humanities Elective | 3 cr. | | |
| YEAR 3 | CHEM 330 Introduction to Computational Chemistry | 4 cr. | Maths/Science/Engineering Free Elective | 3 cr. |
| | CHEM 322 Organic Chemistry II | 4 cr. | CHEM 311 Biochemistry | 4 cr. |
| | CHEM 332 Physical Chemistry II | 4 cr. | CHEM 343 Advanced Instrumental Analysis Techniques in Chemistry | 4 cr. |
| | CHEM 342 Modern Techniques for Chemical Analysis | 4 cr. | CHEM 352 Inorganic Chemistry II | 4 cr. |
| | | | SDAS 300 Career Development | 0 cr. |
| | Semester Credits | 16 cr. | Semester Credits | 15 cr. |
| S | CHEM 399 Chemistry Internship | 1 cr. | | |
| YEAR 4 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr. | BUSS XXX Business Studies Elective | 3 cr. |
| | HUMA XXX UAE Studies Elective | 3 cr. | CHEM 498 Senior Research Project II | 3 cr. |
| | HUMA XXX Islamic Studies Elective | 3 cr. | Technical Elective | 4 cr. |
| | CHEM 497 Senior Research Project I | 3 cr. | Technical Elective | 4 cr. |
| | Technical Elective | 3 cr. | | |
| | Semester Credits | 15 cr. | Semester Credits | 14 cr. |
| | | | Total Program Credits | 127 cr. |

S SUMMER

Typical Course Sequence for a **BSc degree in Chemistry** – SPRING ENTRY

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| SEMESTER 1 | | | ENGL 101 Academic English I | 3 cr. |
| | | | MATH 111 Calculus I | 4 cr. |
| | | | CHEM 115 General Chemistry I | 4 cr. |
| | | | GENS 101 Grand Challenges | 4 cr. |
| | | | Semester Credits | 15 cr. |
| S | HUMA XXX Arabic Language Elective | 3 cr. | | |
| SEMESTER 2-3 | ENGL 102 Academic English II | 3 cr. | CHEM 221 Organic Chemistry I | 4 cr. |
| | PHYS 121 University Physics I | 4 cr. | CHEM 231 Physical Chemistry I | 4 cr. |
| | MATH 112 Calculus II | 4 cr. | CHEM 241 Intro. to Analytical Chemistry | 4 cr. |
| | CHEM 116 General Chemistry II | 4 cr. | PHYS 122 University Physics II | 4 cr. |
| | Semester Credits | 15 cr. | Semester Credits | 16 cr. |
| | BUSS XXX or HUMA XXX<br>Business Studies or Humanities Elective | 3 cr. | | |
| SEMESTER 4-5 | CHEM 200 Quantitative Methods in Physical Sciences | 4 cr. | Maths/Science/Engineering Free Elective | 3 cr. |
| | CHEM 206 Chemical Safety and Research Skills | 3 cr. | CHEM 311 Biochemistry | 4 cr. |
| | CHEM 251 Inorganic Chemistry I | 4 cr. | CHEM 343 Advanced Instrumental Analysis Techniques in Chemistry | 4 cr. |
| | CHEM 342 Modern Techniques for Chemical Analysis | 4 cr. | CHEM 352 Inorganic Chemistry II | 4 cr. |
| | | | SDAS 300 Career Development | 0 cr. |
| | Semester Credits | 15 cr. | Semester Credits | 15 cr. |
| SEMESTER 6-7 | CHEM 330 Introduction to Computational Chemistry | 4 cr. | Maths/Science/Engineering Free Elective | 3 cr. |
| | CHEM 322 Organic Chemistry II | 4 cr. | CHEM 497 Senior Research Project I | 3 cr. |
| | CHEM 332 Physical Chemistry II | 4 cr. | Technical Elective | 4 cr. |
| | Technical Elective | 3 cr. | Technical Elective | 4 cr. |
| | Semester Credits | 15 cr. | Semester Credits | 14 cr. |
| S | CHEM 399 Chemistry Internship | 1 cr. | | |
| SEMESTER 8 | CHEM 498 Senior Research Project II | 3 cr. | | |
| | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr. | | |
| | HUMA XXX UAE Studies Elective | 3 cr. | | |
| | HUMA XXX Islamic Studies Elective | 3 cr. | | |
| | BUSS XXX Business Studies Elective | 3 cr. | | |
| | Semester Credits | 15 cr. | Total Program Credits | 127 cr. |

S SUMMER

## DEPARTMENT OF BIOLOGY

### Introduction

The Department of Biology at Khalifa University has the mandate of promoting Excellence in Teaching and Research in various life science fields at Khalifa University, thus catering to the strategic mission of the university, Abu Dhabi Emirate and UAE. The department is composed of highly qualified and internationally trained faculty members excelling in research and teaching in different aspects of biological sciences.

The department will host the BSc in Cell and Molecular Biology degree program, which will graduate highly qualified pre-med students for Khalifa University's MD program, in the College of Medicine and Health Sciences. In addition, the department will offer advanced MD students to carry out their senior year clinical research activities. Furthermore, it aims to be a strategic partner and interdisciplinary bridge between the College of Engineering and the College of Arts and Sciences to enable excellence in life science research, and be the premiere center for Applied Biotechnology research and contribute to other key research activities at KU. The department will also offer collaborative opportunities (faculty and resources) to carry out innovative Genomics/Proteomics research and work closely with Khalifa University's Biotech Center, Biomedical Engineering department, and the College of Medicine and Health Sciences.

### Vision

The Department of Biology at Khalifa University will provide students with an excellent educational and research experience and graduate students with skill sets to serve their communities and a thirst and passion for studying medical sciences.

### Mission

The Department of Biology is dedicated to using the latest pedagogical and research technologies to train students to be critical thinkers, independent, innovative and experts in the field of life and medical sciences. The department provides excellent facilities and resources to allow its faculty and students to be international leaders in medical and life science research.

## BACHELOR OF SCIENCE IN CELL AND MOLECULAR BIOLOGY

The BSc in Cell and Molecular Biology (CAMB) program contributes to Khalifa University's desire to become a center of excellence in science, engineering, and medicine within the region and beyond. This is aligned with the UAE's strategic plans, which aim to shift the reliance on the oil-based economy to a knowledge-based one by focusing on science, engineering, and health sciences.

The program aims to offer comprehensive theoretical and practical knowledge of Cell and Molecular Biology to students interested in pursuing careers in life sciences or medicine. It will graduate students who are critical thinkers with the ability to use their scientific knowledge to solve problems in life sciences and to effectively communicate them various stakeholders.

### Program Educational Objectives

Two to three years after completing the program, the graduates will:

1. Exhibit substantial knowledge of various aspects of Cell and Molecular Biology including Chemistry, Mathematics, and Physics.
2. Demonstrate strong abilities for problem solving, teamwork and effective communication.
3. Be competent in various professional and transferable skills to have a successful career in industry, graduate school, or medical school.
4. Use their training and skills for the well-being of their societies

### Program Learning Outcomes

Upon completion of the program, students will be able to:

1. Demonstrate knowledge of major concepts, theoretical principles and experimental findings in cell and molecular biology and related topics.
2. Conduct laboratory experiments and analyze results.
3. Retrieve and use life science information from scientific literature.
4. Solve practical and theoretical problems in life sciences and demonstrate critical thinking skills.
5. Communicate effectively both orally and in writing.
6. Work effectively independently and in teams.
7. Conform to safety, ethical and professional standards adopted in life sciences.

### Degree Requirements

The BSc in Cell and Molecular Biology program requires students to complete 124 credit hours, ideally in 8 semesters (and 1 summer). The 124 credits are divided into 48 credit hours of University General Education requirements (GER), 2 credit hours of free electives and 74 credit hours of specific major requirements, as follows: Chemistry/Mathematics requirements (19 CH) + Biology Core requirements (49 CH) + Electives (6 CH).

### Chemistry/Mathematics Requirements (19 credits)

The BSc in Cell and Molecular Biology program requires the following Chemistry/Mathematics courses, in addition to the GERs:

| | | |
|---|---|---|
| CHEM 116 | General Chemistry II | 4 cr. |
| CHEM 211 | Organic Chemistry | 4 cr. |
| CHEM 241 | Introduction to Analytical Chemistry | 4 cr. |
| CHEM 311 | Biochemistry I | 4 cr. |
| MATH 252 | Introduction to Applied Statistics | 3 cr. |

**Biology Core Requirements (49 credits)**

| | | |
|---|---|---|
| BIOL 111 | Biology I | 3 cr. |
| BIOL 112 | Biology II | 4 cr. |
| BIOL 211 | General Genetics | 4 cr. |
| BIOL 221 | Applied Microbiology | 4 cr. |
| BIOL 301 | Cell Biology | 3 cr. |
| BIOL 312 | Biochemistry II | 3 cr. |
| BIOL 331 | Physiology | 3 cr. |
| BIOL 335 | Developmental Biology | 3 cr. |
| BIOL 411 | Immunology | 3 cr. |
| BIOL 430 | Bioinformatics | 4 cr. |
| BMED 341 | Molecular Cell Biology | 4 cr. |
| BMED 342 | Molecular Genetics, Technologies & Tools | 4 cr. |
| BIOL 399 | Internship | 1 cr. |
| BIOL 497 | Senior Research Project I | 3 cr. |
| BIOL 498 | Senior Research Project II | 3 cr. |

**Elective Requirements (6 credits)**
Every student must select 6 credits of electives from the list below:

| | | |
|---|---|---|
| HUMA 277 | Introduction to Logical Reasoning | 3 cr. |
| HUMA 140 | Introduction to Psychology | 3 cr. |
| HUMA 141 | Introduction to Sociology/ Free Elective | 3 cr. |

Typical Course Sequence for a **BSc degree in Cell and Molecular Biology**

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | GENS 101 Grand Challenges | 4 cr. | ENGL 102 Academic English II | 3 cr. |
| | ENGL 101 Academic English I | 3 cr. | MATH 112 Calculus II | 4 cr. |
| | MATH 111 Calculus I | 4 cr. | BIOL 111 General Biology I | 3 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | CHEM 116 General Chemistry II | 4 cr. |
| S | | | | |
| YEAR 2 | BIOL211 General Genetics | 4 cr. | PHYS 122 University Physics II | 4 cr. |
| | CHEM 211 Organic Chemistry | 4 cr. | CHEM 311 Biochemistry I | 4 cr. |
| | BIOL 112 General Biology II | 4 cr. | Chem 241 Intr. Analytical Chemistry (Only offered in the Spring term) | 4 cr. |
| | PHYS 121 University Physics I | 4 cr. | HUMA 140 Intro. to Psychology | 3 cr. |
| S | | | | |
| YEAR 3 | BIOL 312 Biochemistry II | 3 cr. | BIOL 221 Applied Microbiology | 4 cr. |
| | HUMA101 Arabic Language | 3 cr. | BIOL 331 Physiology | 3 cr. |
| | HUMA 141 Intro. to Sociology | 3 cr. | HUMA 277 Intro. to Logical Reasoning | 3 cr. |
| | BIOL 301 Cell Biology | 3 cr. | Math 252 Intr. Applied Statistics (only offered in the Spring Term) | 3 cr. |
| | BMED 341 Molecular Cell Biology (only offered in the Fall term) | 4 cr. | BMED 342 Molecular Genetics Tech. Tools (only offered in the Spring Term) | 4 cr. |
| | SDAS 300 Career Development | 0 cr. | | |
| S | BIOL 399 Internship | | | 1 cr. |
| YEAR 4 | Free Elective | 2 cr. | BIOL 498 Senior Research Project II | 3 cr. |
| | BIOL 497 Senior Research Project I | 3 cr. | BIOL 411 Immunology | 3 cr. |
| | BIOL 335 Developmental Biology | 3 cr. | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr. |
| | HUMA 105 UAE Studies Elective | 3 cr. | BIOL 430 Bioinformatics | 4 cr. |
| | HUMA 102 Islamic Studies | 3 cr. | BUSS 150 Intr. Economics | 3 cr. |
| | | | | 124 cr. |

S SUMMER

## DEPARTMENT OF EARTH SCIENCES

**Introduction**

Earth Science is the science of studying geologic systems and processes, including other bodies in the solar system, as well as environment and resources of Earth and other planets. Earth Science is the platform where other Natural Science disciplines meet. It includes the research of Earth's structure, minerals, soil, atmosphere, as well as water and energy resources. Earth scientists explore how Earth's natural systems currently operate, how they have operated in the recent and ancient past, and how we expect they may behave in the future.

Earth Science has a high societal significance and is relevant to us all, every day.
The Department of Earth Sciences offers students a modern educational program leading to a BSc in Earth, Planetary and Environmental sciences. Our Graduate Program offers students the opportunity to pursue MSc and PhD degrees in the topics mentioned above. We provide high-quality education in different fields of Earth Sciences to prepare students for a wide range of socially and ethically responsible professional careers.

In their final year, students can choose amongst three main tracks, Petroleum Geosciences, Planetary Sciences, and Environmental and Atmospheric sciences. All our students will take part in innovative projects, which are part of our Faculty member's wide-ranging research activities.

Graduates will be able to apply their knowledge of Geology, Paleontology, Geochemistry, Atmospheric sciences, and Geophysics to formulate solutions to various geoscience problems, and can contribute effectively to the UAE's geologic, economic and space sectors. They will further have demonstrated an awareness of the social, ethical, and professional responsibilities in the exploration and exploitation of energy and natural resources, and an understanding of major regional and global social and environmental issues.

The Department of Earth Sciences at Khalifa University is an internationally recognized center of excellence in education and research and is among the leading geoscience centers of education and research in the Middle East. Graduates can join both the local and international petroleum and space industry or may find career opportunities in governmental and non-governmental institutions. PhD graduates can also choose to pursue academic careers with universities in the UAE and abroad.

## BACHELOR OF SCIENCE IN EARTH AND PLANETARY SCIENCES

A degree in Earth and Planetary Sciences will prepare students to pursue careers in a broad range of geo- and planetary science disciplines with direct environmental and societal applications. By selecting different tracks (petroleum geosciences, planetary sciences, and atmospheric and environmental sciences) graduates can be enrolled in positions in governmental organizations, private consulting firms, non-governmental organizations and/or academic institutions. Specifically, the Earth and Planetary Sciences program addresses the need of the UAE society to improve both the employability of UAE nationals and the necessity for skilled graduates to manage the environment and natural resources and contribute to the economical and technical development of the country. Knowledge of planetary science is introduced through the study of planetary geology, remote sensing, astrobiology, astronomy, and astrophysics, providing the skill set necessary for graduates to participate in the development of the UAE space sector. On the other hand, a solid background in atmospheric and environmental sciences is gained through a large number of courses on Geochemistry and Environmental Chemistry, Climate Science, Astrobiology, Earth's Climate History, Oceanography, and Hydrology. A specialization in petroleum geosciences is acquired through a number of specific courses like, Reflection Seismology, Petrophysics and Logging, Seismic Reflection Interpretation, Reservoir Characterization, Reservoir Geophysics, Rock Mechanics and Reservoirs, and Petroleum Geology and Petroleum Systems.

### Program Educational Objectives

The BSc in Earth and Planetary Sciences aims to produce graduates who will be able to:

- Function ethically and with integrity such that society and industry benefit from their work as Earth and Planetary Scientists;
- Continue personal and professional growth through self-education;
- Meet, or exceed, expectations of employers in attaining technical and personal competencies; and
- Contribute to the development and use of new knowledge and technologies to explore the Earth and our Solar System.

### Program Learning Outcomes

Upon completion of the BSc in Earth and Planetary Sciences, graduates will be able to:

- Apply knowledge of mathematics, chemistry, physics, geology, and geophysics to the study of the Earth and planets in order to understand the processes that are active in the Earth's interior, oceans, and atmosphere, as well as the interiors and atmospheres of other planets.
- Demonstrate an ability to collect, analyze, and interpret geological, geophysical, and planetary science data using a variety of techniques, to test hypotheses and make scientifically sound interpretations from results.
- Function effectively on multi-disciplinary teams.
- Apply the principles of professional, ethical, and responsible conduct as earth scientists.
- Demonstrate an ability to communicate in oral and written forms in English appropriate to the professional career in a wide range of fields in Earth and Planetary science.
- Demonstrate the recognition of the need for, and an ability to engage in, continual lifelong education.

**Program Facilities**

The Earth Sciences Department laboratories are located in the Bu Hasa and Ruwais buildings on the Sas Al Nakhl (SAN) Campus. The laboratories include geology and geophysics laboratories, dedicated core-layout areas, laboratories for sample and equipment preparation, and dedicated geosciences computer laboratories equipped with a wide range of industry-standard geoscience software, a scanning electron microscopy laboratory, petrographic microscopy laboratory and geophysical equipment storage and testing laboratory. The laboratories support the teaching and research needs of the department.

**Professional Chapters and Clubs**

The American Association of Petroleum Geologists (AAPG) student chapter in the Petroleum Geosciences Program is the first AAPG Chapter established in the UAE. The AAPG student chapter provides a variety of programs and opportunities for students to have contact with the professional geosciences' community, to have access to unique learning and leadership opportunities, to receive member benefits and to be eligible for grants.

The Petroleum Geosciences Student Society aims to help and support students as they prepare to start their careers within the Petroleum Geosciences. As well as supporting the next generation of geoscientists, the society also provides a range of social activities for geosciences students at the University. Recent activities included guest seminars and lectures, field trips, social evenings and sporting events.

The student chapter's affiliation with the Society of Exploration Geophysicists (SEG) and the European Association of Geoscientists and Engineers (EAGE) provides a means of contact with the geosciences profession both inside and outside of academia. Active participation in the student chapters provides students with an opportunity to develop leadership and management skills. Actively running an organization and networking with professionals develop a sense of professionalism.

**Degree Requirements**

To be recommended for the degree of BSc in Earth and Planetary Sciences, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the Basic Sciences (13 credit hours including Introduction to Biology), the University General Education Requirements (48 credit hours), the Discipline Specific Courses (52 credit hours), and Technical Electives requirements (17 credit hours). The normal length of the undergraduate BSc in Earth and Planetary Sciences is 130 credit hours.

**Chemistry/Mathematics/Science Requirements (13 credits)**

The BSc in Earth and Planetary Sciences program require the following Chemistry, Mathematics, Science courses, in addition to the General Education Requirements:

| | | |
|---|---|---|
| BIOL 111 | Introduction to Biology | 3 cr. |
| CHEM 116 | General Chemistry II | 4 cr. |
| MATH 231 | Calculus III | 3 cr. |
| MATH 206 | Differential Equations | 3 cr. |

**Earth and Planetary Sciences Core Requirements (52 credits)**
For the BSc in Earth and Planetary Sciences degree, students must complete the following common Core Requirement courses:

| | | |
|---|---|---|
| EPSS 200 | Earth System Science | 3 cr. |
| EPSS 210 | Earth Materials | 3 cr. |
| PGEG 222 | The Evolving earth | 4 cr. |
| EPSS 230 | Geological Maps | 3 cr. |
| EPSS 300 | MATLAB for Earth Scientists | 3 cr. |
| EPSS 305 | Sedimentology | 4 cr. |
| EPSS 310 | Remote Sensing and Geomatics | 4 cr. |
| EPSS 321 | Structural Geology | 4 cr. |
| EPSS 323 | Solid Earth Geophysics | 4 cr. |
| EPSS 331 | Igneous and Metamorphic Petrology | 3 cr. |
| EPSS 397 | Field Geology | 4 cr. |
| EPSS 400 | Planetary Sciences | 4 cr. |
| EPSS 412 | Environmental Geology | 3 cr. |
| PGEG 497 | Senior Research Project I | 3 cr. |
| PGEG 498 | Senior Research Project II | 3 cr. |

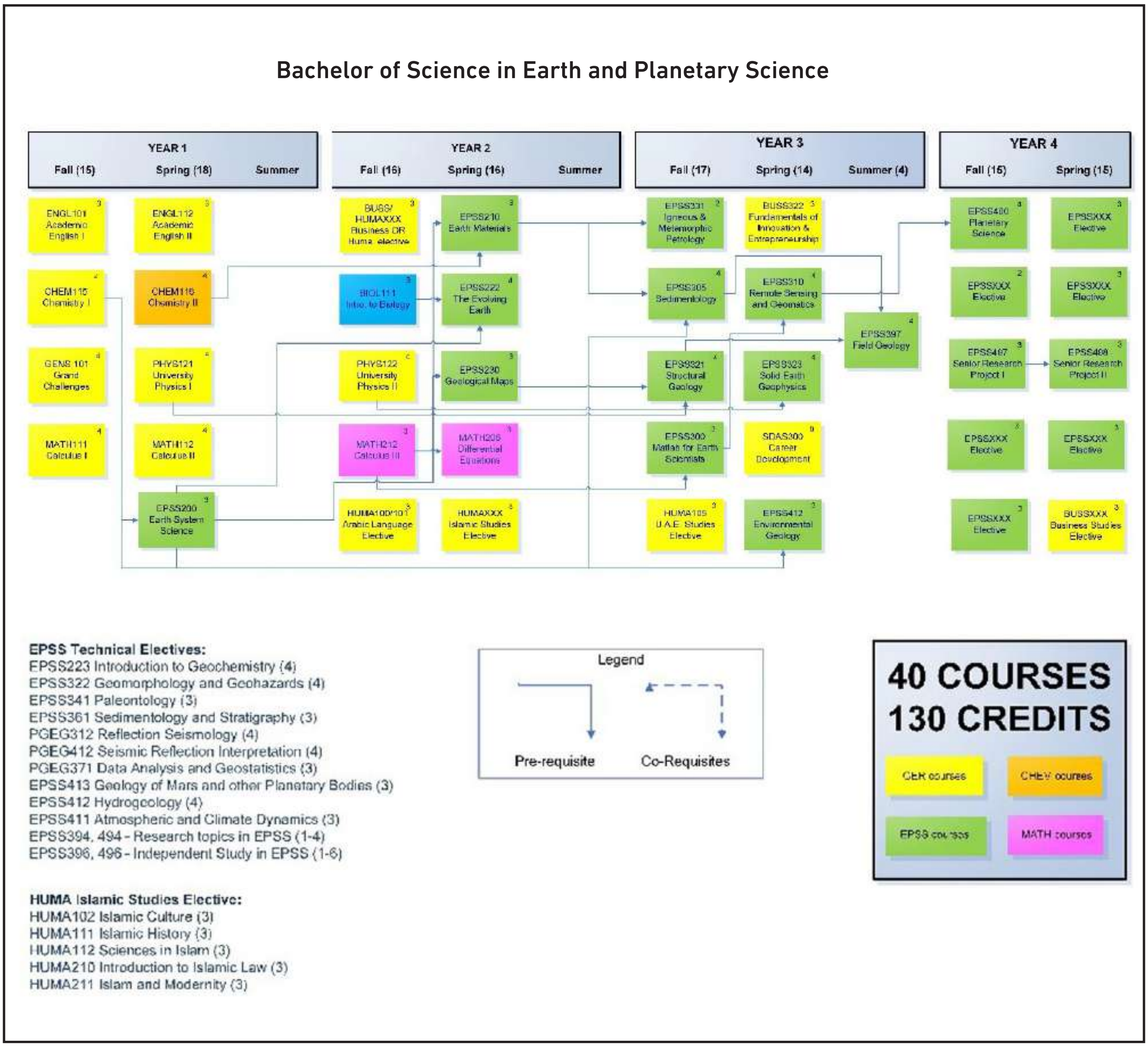
**Petroleum Geosciences Free Electives (17 credits)**
All students must complete at least 17 credits of free electives, which are intended to provide students with flexibility to support their career paths and individual interests. They will support the development of technical expertise within the student's disciplines, as well as, undergraduate research and independent study opportunities. They can also be used for an additional Humanities and Social Sciences course or any other course offered by the Department chosen among the non-required courses of the curriculum.

Typical Course Sequence for a **BSc in Earth and Planetary Sciences**
The table below shows the study plan for the BSc in Earth and Planetary Sciences.

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | ENGL 102 Academic English II | 3 cr. |
| | MATH 111 Calculus I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| | GENS 101 Grand Challenged | 4 cr. | CHEM 116 General Chemistry II | 4 cr. |
| | | | EPSS 200 Earth System Science | 3 cr. |
| S | | | | |
| YEAR 2 | BIOL 111 Biology I | 3 cr. | MATH 206 Differential Equations | 3 cr. |
| | PHYS 122 University Physics II | 4 cr. | HUMA XXX Islamic Studies Elective | 3 cr. |
| | MATH 121 Calculus III | 3 cr. | EPSS 230 Geological Maps | 3 cr. |
| | HUMA 100/101 Arabic Language Elective | 3 cr. | EPSS 210 Earth Materials | 3 cr. |
| | BUSS/HUMA XXX Buss. or Huma. Elective | 3 cr. | EPSS 222 The Evolving Earth | 4 cr. |
| S | | | | |
| YEAR 3 | HUMA 105 U.A.E. Studies Elective | 3 cr. | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr. |
| | EPSS 305 Sedimentology | 4 cr. | EPSS 310 Remote Sensing and Geomatics | 4 cr. |
| | EPSS 321 Structural Geology | 4 cr. | EPSS 412 Environmental Geology | 3 cr. |
| | EPSS 331 Igneous & Metamorphic Petrol. | 3 cr. | EPSS 323 Solid Earth Geophysics | 4 cr. |
| | EPSS 300 MATLAB for Earth Scientists | 3 cr. | SDAS 300 Career Development | 0 cr. |
| S | EPSS 397 Field Geology | | | 4 cr. |
| YEAR 4 | EPSS 400 Planetary Science | 4 cr. | EPSS XXX Elective | 3 cr. |
| | EPSS XXX Elective | 2 cr. | EPSS XXX Elective | 3 cr. |
| | EPSS XXX Elective | 3 cr. | EPSS XXX Elective | 3 cr. |
| | EPSS XXX Elective | 3 cr. | EPSS XXX Elective | 3 cr. |
| | EPSS 497 Senior Research Project I | 3 cr. | EPSS 498 Senior Research Project II | 3 cr. |
| | | | | 130 cr. |

S SUMMER

The flow chart for the BSc in Earth and Planetary Sciences degree is shown below.




## Optional Earth and Planetary Sciences Technical Tracks

Sets of recommended elective courses are provided to help students who have specific interests and/or employment goals. These tracks are provided as a guide for the selection of courses and do not show up as a separate transcript record. The Earth and Planetary Sciences degree offers three tracks: Petroleum Geosciences, Planetary Geosciences, and Environmental and Atmospheric Sciences. Selection of electives courses must be agreed with the academic adviser at the beginning of the sophomore year and approved by the department.

Note, a student is also free to choose any out-of-track technical elective from all electives offered by the Earth Sciences Department or other out-of-program electives if offered by the concerned department and in line with the program objectives.

### 1. Track Petroleum Geosciences

Petroleum Geosciences track provides a high-quality education in petroleum geology and geophysics, and prepares students for careers in the petroleum industry and other geosciences sectors.

| **Electives** |
|---|
| EPSS312 Reflection Seismology (4 cr.) |
| EPSS401 Petrophysics & Logging (4 cr.) |
| EPSS413 Seismic Reflection Interpretation (4 cr.) |
| EPSS461 Reservoir Characterization (4 cr.) |
| EPSS410 Reservoir Geophysics (3 cr.) |
| EPSS381 Rock Mechanics and Reservoirs (3 cr.) |
| EPSS293/393/394 Special Topics in Petroleum Geosciences (1-3 cr.) |
| EPSS294/394/494 Research Topics in Petroleum Geosciences (1-3 cr.) |

### 2. Track Planetary Science

This new track offers the students the necessary tools to build a career in space exploration or related academia. While the track focuses on surface (geological) aspects of planetary science, it also offer a wider perspective through variable electives, and the ability to acquire courses from other departments in Khalifa University, to diversify research interests and broaden the student's skill set,

| **Core course** |
|---|
| EPSS400 Planetary Science (4 cr.) |

| **Electives** |
|---|
| PHYS203: Introduction to Astronomy (4 cr.) |
| PHYS211: Computational Physics (4 cr.) |
| EPSSXX Geology of Mars (3 cr.) |
| EPSSXX GIS for planetary scientists (3 cr.) |
| EPSSXX Planetary atmospheres (3 cr.) |
| EPSSXX Special topics in planetary science (3 cr.) |
| EPSSXX Remote Sensing of solar system bodies (3 cr.) |
| EPSSXX Ice in the solar system (2 cr.) |
| EPSSXX Volcanism and tectonics in the solar system (2 cr.) |
| EPSSXX Small bodies in the solar system (2 cr.) |
| EPSSXX Astrobiology (2 cr.) |
| EPSS293/393/493 Special topics in planetary science (1-3 cr.) |
| EPSS294/394/494 Research Topics in planetary science (1-3 cr.) |

**3. Track Environmental and Atmospheric Sciences**

This track offers courses focused on Earth Systems, exploring the interaction between the oceans, atmosphere and environment to understand our dynamic planet. The courses are designed to enable students to understand the fundamental science underlying Earth processes including atmospheric phenomena, climatic and environmental change, as well as natural hazards while exploring the role and impact of humans within these processes. It also provides students with a comprehensive overview of our Earth Systems as well as the methods and techniques used to study, analyze and predict past, present, and future changes to our planet.

| **Core courses** |
|---|
| EPSS 4XX Remote Sensing & Geomatics (3 cr.) |
| EPSS 451 Environmental Geology (3 cr.) |

| **Electives** |
|---|
| EPSS 3XX Climate and Environmental Change Science and Policy (3 cr.) |
| EPSS 3XX Meterology (3 cr.) |
| EPSS 412 Hydrogeology (3 cr.) |
| EPSS 4XX Geomorphology & Geohazards (4 cr.) |
| EPSS 411 Atmospheric, Ocean and Climate Dynamics (3 cr.) |
| EPSS 4XX Engineering solutions to climate and environmental change (2 cr.) |

| **Additional Out of Program Technical Electives** |
|---|
| LTCM 345 Science Journalism (3 cr.) |
| CHEM 311 Biochemistry I (3 cr.) |
| CHEM 461 Environmental Chemistry (3 cr.) |
| CHEM 342 Modern Techniques for Chemical Analysis (3 cr.) |
| CHEM 463 Methods for Environmental Trace Analysis 3 cr.) |
| CHEM 462 Pollution Science and Control - Management, Technology and Regulations (3 cr.) |

## DEPARTMENT OF ENGLISH

**Introduction**

The mission of the Department of English at Khalifa University is to broaden and deepen knowledge about English as a medium of inquiry and communication in second-language contexts, especially within the sciences, technology, engineering, and medicine.

Instructionally, the Department's mission is to provide a broad range of courses designed to build the literacy and communicative skills of graduate and undergraduate students in English, as well as offer an increasingly diverse range of courses in literature, communications, rhetoric, and digital composition, all with a STEM focus.

The English program is a General Education requirement for all undergraduate students at Khalifa University.  To satisfy the GE requirement, students must take:

| | | |
|---|---|---|
| ENGL 101 | Academic English I | 3 cr. |
| ENGL 102 | Academic English II | 3 cr. |

### Minor in Digital Media and Composition

The Minor in Digital Media and Composition enables students in the sciences and engineering with both the technical skills and critical awareness to communicate effectively in digital media environments. The minor has two focus areas: 1) digital composition; and 2) media literacy. All courses are reading and writing intensive.

Courses focusing on digital composition will introduce and then develop competence in the design of a range of formats, including webpages, video, 3D modeling and animation, and podcasting, using standard professional tools (e.g., Adobe Creative Cloud, Adobe Spark) and open-source equivalents (e.g., Shotcut, Audacity, Blender).

Courses focusing on media literacy will address ethical issues in social media, digital marketing, and advertising, and consider the implications of technological innovation in human society individually, locally, and globally. A problem-solving approach will be used throughout.

**Program Educational Objectives**

The Minor in Digital Media and Composition will produce graduates who are able to:

- Design and create texts in a broad range of formats (e.g., webpages, podcasts, videos) and modes (narrative, informational, persuasive) that are accurate, technically sound, and professional in appearance;
- Evaluate the informational, ethical, and aesthetic quality of a wide range of digital texts on the Internet;
- Communicate effectively about technology for commercial and social purposes;
- Use spoken and written English to communicate through media with advanced proficiency;
- Develop an integrated use of science and technology, human and social awareness, and digital composition

**Program Learning Outcomes**

Learning Outcomes for the Minor are divided into two areas of focus:

Composition Focus

- Demonstrate knowledge of principles of digital composition in relation to aesthetics, functionality, audience, and writing
- Demonstrate uses of professional-level software in composition and communications research
- Write professional-quality English texts for use in a variety of digital formats
- Produce professional-quality spoken/video recordings for use in a variety of formats
- Media Literacy Focus
- Model ethical and appropriate standards of behavior in socially mediated environments
- Evaluate digital media for ethical standards in messaging, for potential audience engagement, and for informational accuracy
- Describe relationships among business, technology, and communications in the development of successful projects
- Evaluate the relationship between technology and human culture and society
- Demonstrate intercultural awareness in evaluating and creating digital content

## Degree Requirements

The Minor in Digital Media and Composition requires a total of eighteen (18) credit hours. The program consists of two core courses of six (6) credits plus four elective courses of twelve (12) credits.
Typical course sequence is six (6) credits per academic year beginning no later than year 2.

**Core Requirements for the Minor in Digital Media and Composition**

Students must take the following core courses for a total of 6 credit hours:

| | | |
|---|---|---|
| LTCM 224 | Digital Composition | 3 cr. |
| LTCM 225 | Media Literacy | 3 cr. |

**Electives for the Minor in Digital Media and Composition**

Students choose a minimum of 4 elective courses (12 credit hours); two with a Composition Focus and two with a Media Literacy Focus):

Composition Focus:

| | | |
|---|---|---|
| LTCM 300 | Composition for Digital Marketing | 3 cr. |
| LTCM 311 | Technical Communications | 3 cr. |
| LTCM 325 | Travel Writing | 3 cr. |
| LTCM 328 | Digital Public Speaking | 3 cr. |
| LTCM 337 | Visual Communications | 3 cr. |
| LTCM 345 | Science Journalism | 3 cr. |

Media Literacy Focus:

| | | |
|---|---|---|
| LTCM 330 | Thinking through Technology | 3 cr. |
| LTCM 332 | Communications Ethics | 3 cr. |
| LTCM 335 | Games and Narrative | 3 cr. |
| LTCM 340 | Language and Intercultural Communications | 3 cr. |
| LTCM 370 | Studying Global Media | 3 cr. |

## Additional Literature and Composition (LTCM) Electives

In addition to the previously listed required ENGL courses and the courses associated with the Minor in Digital Media and Composition, the department offers the following electives that students may select:

| | | |
|---|---|---|
| LTCM 150 | Academic Reading | 3 cr. |
| LTCM 213 | Short Stories from around the World | 3 cr. |
| LTCM 221 | Intercultural Communication | 3 cr. |
| LTCM 240 | Introduction to Linguistics | 3 cr. |
| LTCM 260 | Writing about Innovation | 3 cr. |
| LTCM 280 | Studying Human Language | 3 cr. |

## DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

**Introduction**

The Department of Humanities and Social Sciences is an academic unit within the College of Arts and Sciences. The Department offers a Minor in General Business Studies and it provides courses which support all undergraduate degree programs across the University. Every student must take a minimum of 18 credits from the Department to satisfy the University General Education Requirements (GERs). These include courses in Arabic, Islamic Studies, U.A.E. Studies, Innovation and Entrepreneurship, Business Studies, and Humanities Electives. To satisfy the GER, students must take:

**1. One of the following Arabic Language courses.**

| | | |
|---|---|---|
| HUMA 100 | Arabic Language for Non-Native Speakers | 3 cr. |
| HUMA 101 | Arabic Language | 3 cr. |

**2. One of the following Islamic Studies courses.**

| | | |
|---|---|---|
| HUMA 102 | Islamic Culture | 3 cr. |
| HUMA 103 | Islamic Culture & Civilization | 3 cr. |
| HUMA 111 | Islamic History | 3 cr. |
| HUMA 112 | Sciences in Islam | 3 cr. |
| HUMA 210 | Introduction to Islamic Law | 3 cr. |
| HUMA 211 | Islam and Modernity | 3 cr. |
| HUMA 395 | Islam and the Discourse of the Enlightenment | 3 cr. |

**3. One of the following U.A.E. Studies courses (options expected to increase).**

| | | |
|---|---|---|
| HUMA 105 | Emirates Society | 3 cr. |

**4. The following Innovation and Entrepreneurship course.**

| | | |
|---|---|---|
| BUSS 322 | Fundamentals of Innovation and Entrepreneurship | 3 cr. |

**5. One 3 credit-hour Business course (specified by the student's Major or as an Elective).**

**6. One additional 3 credit-hour Elective chosen from the entire range of Humanities (HUMA) or Business Studies (BUSS) course offerings.**

**Humanities and Social Sciences Elective Courses**

In addition to the HUMA courses previously listed, the department offers a range of courses that may be selected by students.

| | | |
|---|---|---|
| HUMA 264 | Arabic Language II | 3 cr. |
| HUMA 106 | Gulf Region Economic and Social Outlook | 3 cr. |
| HUMA 110 | Middle East Studies | 3 cr. |
| HUMA 140 | Introduction to Psychology | 3 cr. |
| HUMA 141 | Introduction to Sociology | 3 cr. |
| HUMA 156 | Human Behavior and Well-Being | 3 cr. |
| HUMA 214 | Environment and Society | 3 cr. |
| HUMA 215 | World Religions | 3 cr. |
| HUMA 265 | Sufism in Islam | 3 cr. |
| HUMA 268 | World Civilization form 1500 | 3 cr. |
| HUMA 277 | Introduction to Logical Reasoning | 3 cr. |
| HUMA 291 | Leadership by Design | 3 cr. |
| HUMA 295 | The History and Politics of Middle Eastern Oil | 3 cr. |
| HUMA 295 | Special Topics in Humanities and Social Sciences | 3 cr. |
| HUMA 296 | Directed Study | 1 cr. – 3 cr. |

**Language Courses**

| | | |
|---|---|---|
| CHNA 101 | Elementary Chinese I | 3 cr. |
| JAPN 101 | Elementary Japanese I | 3 cr. |
| JAPN 102 | Elementary Japanese II | 3 cr. |
| KORA 101 | Elementary Korean I | 3 cr. |
| KORA 102 | Elementary Korean II | 3 cr. |
| SPAN 101 | Elementary Spanish I | 3 cr. |
| SPAN 102 | Elementary Spanish II | 3 cr. |

## Minor in General Business Studies

The Minor in General Business enables students to grasp the elements of managing a business, by focusing on key areas of accounting, finance, economics, leadership, management and entrepreneurship.
Courses in accounting and finance provide an overview of fundamental concepts in tracking and accounting for business transactions. The student will learn how the transactions are used to generate financial statements to provide information to stakeholders.

The economic component gives insight into the working of an economy and the effects that this has on industry and on countries. The management component provides guidance in how to operate a sustainable business and maximize profitability. Bloomberg Concepts is an integral part of this curriculum.

**Program Educational Objectives**

The Minor in General Business Studies aims to produce graduates who are able to:

- Develop and analyze business transactions, develop journals, trial balances, and postings to key financial statements
- Develop and analyze key financial statements using various analytic techniques and interpreting data to produce relevant information for stakeholders.
- Interpret costing methods to determine best product or process costing choices to maximize business efficiency and cost savings.
- Compare and Contrast micro and macro-economic trends in industry and country to predict growth and recession events with the aid of Bloomberg Terminals
- Identify market trends through certification in Bloomberg Market Concepts, Portfolio Management, and Terminal Management.
- Combine various skills in leadership, funding, employee relations, entrepreneurship to have the ability to manage a company or team.

**Program Learning Outcomes**

Upon completion of the Minor in General Business Studies, graduates will be able to:

- Apply learned concepts to produce, analyze and interpret financial statements
- Model product and process costing systems to increase productivity and reduce costs
- Interpret and analyze trends to determine economy and industry performance, at macro and micro levels respectively
- Demonstrate knowledge and analytical skills needed to develop and manage sustainable businesses and teams

- Identify and analyze key personal and organizational factors, in order to establish healthy employee relations, and productive business environments
- Identify and apply key communication and leadership skills, in order to establish positive human relationships and a productive business environment.

**Degree Requirements**

The Minor in General Business Studies requires a total of 18 credit hours. These consist of courses in accounting, finance, economics, and management. The typical course sequence is six credits per academic year to begin no later than the second year of study.

**Core Requirements for the General Business Studies Minor**

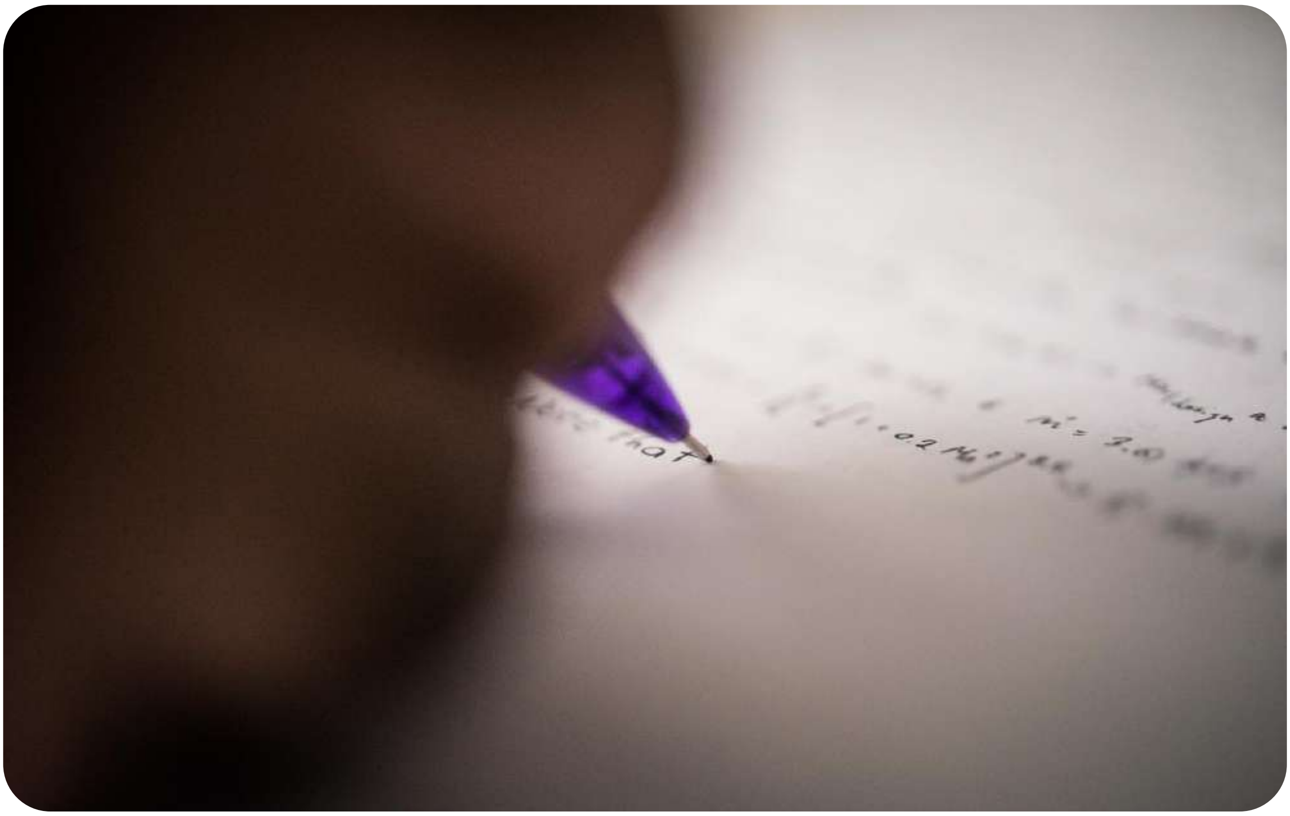
Students must take the following four core courses for a total of 12 credit hours:

| | | |
|---|---|---|
| BUSS 150 | Introduction to Economics | 3 cr. |
| BUSS 201 | Fundamentals of Accounting & Finance | 3 cr. |
| BUSS 301 | Corporate Leadership & Human Resource Management | 3 cr. |
| BUSS 322 | Fundamentals of Innovation & Entrepreneurship | 3 cr. |

**Free Electives for the General Business Studies Minor**

Students must take at least two of the following courses for a total of 6 credit hours:

| | | |
|---|---|---|
| BUSS 202 | Business Communications | 3 cr. |
| BUSS 203 | Environmental Economics | 3 cr. |
| BUSS 204 | Introduction to Organizational Management | 3 cr. |
| BUSS 205 | Business Forecasting | 3 cr. |
| BUSS 344 | Managerial Finance | 3 cr. |
| BUSS 374 | Managerial Accounting | 3 cr. |
| BUSS 361 | Business & Sustainability | 3 cr. |
| BUSS 456 | Investment & Portfolio Management | 3 cr. |
| BUSS 339 | Econometrics | 3 cr. |
| BUSS 350 | Economics | 3 cr. |
| BUSS 381 | Macroeconomics – UAE Economy | 3 cr. |



## DEPARTMENT OF MATHEMATICS

**Introduction**

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

## BACHELOR OF SCIENCE IN APPLIED MATHEMATICS AND STATISTICS

The BSc in Applied Mathematics and 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 Educational Objectives**
- Graduates will meet the expectations of employers of applied mathematicians and statisticians.
- Qualified graduates will pursue advanced study if they so desire.

**Program Learning Outcomes**
Students graduating with a BSc in Applied Mathematics and Statistics will have achieved the following set of knowledge and performance based skills, and affective competencies:
- An ability to apply knowledge of mathematics, statistics and computing.
- An ability to design statistical experiments, as well as to analyze and interpret data.
- An ability to read, understand and construct mathematical and statistical proofs.
- An ability to function on a multi-disciplinary team as a member or leader.
- An ability to formulate, and to solve, mathematical models of real-world problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the strengths and limitations of mathematical and statistical models, and their solutions, in a global and societal context.
- A recognition of the need for, and an ability to engage in, life-long learning.
- A knowledge of contemporary issues.
- An ability to select, and use, appropriate software packages and/or computer programming to solve mathematical models.
- Familiarity with, and use of, sources of current research and an understanding of how new knowledge is generated.

**Program Facilities**
- All lectures are conducted in a traditional classroom setting using both the whiteboard and PowerPoint software.
- The laboratory classes are conducted in Computer Laboratories equipped with state of the art mathematical and statistical software packages.

**Professional Chapters and Clubs**
Students are encouraged to take up Undergraduate Membership of one, or more, of the professional mathematical societies such as the Institute of Mathematics and its Applications (IMA), the Society for Industrial and Applied Mathematics (SIAM), the Mathematical Association of America (MAA) or the American Mathematical Society (AMS). There is also an active on-campus student Math Club that organizes student-focused seminars and competitions.

Our students have participated in a number of local and regional conferences, the annual UAE Math Day in particular, and have presented the results of their research conducted in collaboration with department faculty.

**Degree Requirements**
To be recommended for the degree of BSc in Applied Mathematics and Statistics, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (including specification of both Business courses for the GER, 48), additional Mathematics and Computing courses (7 credits), and an Applied Mathematics and Statistics Core (57 credits), Science/Engineering elective (6 credits), Technical Electives (15 credits) and free elective (1 credit) requirements.

The normal length of the BSc in Applied Mathematics and Statistics program is 134 credits, comprising 48 credits of University General Education Requirements and 86 credits of specific Major requirements.

**Applied Mathematics and Statistics Requirements**

**Business Course Requirements**

For the BSc in Applied Mathematics and Statistics, the two GER Business Studies courses are:

| | | |
|---|---|---|
| BUSS 201 | Fundamentals of Accounting | 3 cr. |
| BUSS 322 | Fundamentals of Innovation and Entrepreneurship | 3 cr. |

**Additional Mathematics and Computing Requirements (7 credits)**

Students must take the following two courses:

| | | |
|---|---|---|
| MATH 101 | Fundamentals of Mathematical Reasoning | 3 cr. |
| ENGR 113 | Introduction to Computing using Matlab | 3 cr. |

**Science/Engineering Electives (6 credits)**

Students may select courses from the following list to satisfy their Science/Engineering Elective requirements for the BSc in Applied Mathematics and Statistics; additional courses may be approved by the department as Science/Engineering electives.

| | | |
|---|---|---|
| BIOL 111 | General Biology I | 3 cr. |
| BIOL 112 | General Biology II | 4 cr. |
| BMED 202 | Biomedical Engineering Fundamentals | 4 cr. |
| BMED 211 | Human Anatomy | 4 cr. |
| BMED 321 | Mechanics for Biomedical Engineers | 4 cr. |
| CHEM 116 | General Chemistry II | 4 cr. |
| CHEM 211 | Organic Chemistry | 4 cr. |
| ECCE 230 | Object-Oriented Programming | 4 cr. |
| ISYE 200 | Engineering Economic Analysis | 3 cr. |
| ISYE 331 | Stochastic Processes | 3 cr. |
| ISYE 341 | Simulation Modeling and Analysis | 4 cr. |
| ISYE 351 | Production and Operations Management | 3 cr. |
| ISYE 430 | Supply Chain and Logistics | 4 cr. |
| ISYE 431 | Time Series Forecasting | 3 cr. |
| ISYE 441 | Advanced Simulation | 3 cr. |

| | | |
|---|---|---|
| ISYE 451 | Operations Research II | 3 cr. |
| ISYE 480 | Financial Engineering | 3 cr. |
| MEEN 200 | Statics | 3 cr. |
| MEEN 201 | Engineering Dynamics | 3 cr. |
| MEEN 240 | Thermodynamics | 3 cr. |
| MEEN 335 | Fluid Mechanics | 4 cr. |

**Free Electives (1 credit)**

Students may select a total of 1 credit from any courses offered at Khalifa University.

**Applied Mathematics and Statistics Core Requirements (57 credits)**

| | | |
|---|---|---|
| MATH 231 | Calculus III | 3 cr. |
| MATH 204 | Linear Algebra | 3 cr. |
| MATH 206 | Differential Equations | 3 cr. |
| ISYE 251 | Operations Research I | 4 cr. |
| MATH 214 | Mathematical and Statistical Software | 3 cr. |
| MATH 244 | Probability | 3 cr. |
| MATH 245 | Mathematical Statistics | 3 cr. |
| MATH 352 | Complex Functions | 3 cr. |
| MATH 324 | Real Analysis I | 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. |
| SDAS 300 | Career Development | 0 cr. |
| MATH 399 | Internship | 1 cr. |
| MATH 412 | Optimization | 3 cr. |
| MATH 419 | Numerical Analysis II | 3 cr. |
| MATH 497 | Senior Research Project I | 3 cr. |
| MATH 498 | Senior Research Project II | 3 cr. |

**Applied Mathematics and Statistics Technical Electives (15 credits)**

To satisfy the BSc in Applied Mathematics and Statistics Technical Elective requirement, students must take courses from the following list. Students may be allowed to choose technical electives from the Financial Mathematics concentration or the Mathematical Biology concentration with department approval.

| | | |
|---|---|---|
| MATH 320 | Mathematical Foundations of General Relativity | 3 cr. |
| MATH 410 | Introduction to Topology | 3 cr. |
| 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 and Analysis | 3 cr. |
| MATH 417 | Measure and Probability Theory | 3 cr. |

**Applied Mathematics and Statistics - Financial Mathematics (Concentration)**

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

The Financial Mathematics concentration requires the student to select BUSS 150 Introduction to Economics as a Business Elective, and ISYE 480 Financial Engineering from the list of Science/Engineering Electives and replace all technical electives with five courses from the following list.

| | | |
|---|---|---|
| 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. |
| MATH 426 | Finance in Discrete Time | 4 cr. |

**Applied Mathematics and Statistics – Mathematical Biology (Concentration)**

Students may select a Mathematical Biology Concentration before selecting their Science/Engineering Electives. A concentration at Khalifa University of Science and Technology leads to a specialized award or degree and will be specified on the diploma and the student's academic record.

The Mathematical Biology Concentration requires the student to select BIOL 111 General Biology I and BMED 202 Biomedical Engineering Fundamentals from the list of Science/Engineering Electives and replace all technical electives with the following five 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 Course Sequence for the **BSc in Applied Mathematics and Statistics**

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | ENGL 102 Academic English II | 3 cr. |
| YEAR 1 | MATH 111 Calculus I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| YEAR 1 | CHEM 115 General Chemistry I | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| YEAR 1 | MATH 101 Fundamentals of Mathematical Reasoning | 3 cr. | ENGR 113 Introduction to Computing using Matlab | 4 cr. |
| YEAR 1 | GENS 101 Grand Challenges | 4 cr. | HUMA XXX Arabic Language Elective | 3 cr. |
| S | HUMA XXX UAE Studies Elective | 3 cr. | | |
| YEAR 2 | MATH 231 Calculus III | 3 cr. | MATH 324 Real Analysis I | 4 cr. |
| YEAR 2 | MATH 204 Linear Algebra | 3 cr. | MATH 206 Differential Equations | 3 cr. |
| YEAR 2 | MATH 244 Probability | 3 cr. | MATH 245 Mathematical Statistics | 3 cr. |
| YEAR 2 | PHYS 122 University Physics II | 4 cr. | BUSS 201 Fundamentals of Accounting and Finance | 3 cr. |
| YEAR 2 | BUSS XXX or HUMA XXX Business Studies or Humanities Elective | 3 cr. | MATH 214 Mathematical and Statistical Software | 3 cr. |
| S | HUMA XXX Islamic Studies Elective | 3 cr. | | |
| YEAR 3 | MATH 352 Complex Functions | 3 cr. | MATH 316 Partial Differential Equations | 3 cr. |
| YEAR 3 | MATH 315 Advanced Linear Algebra | 3 cr. | MATH 317 Nonparametric Statistics | 3 cr. |
| YEAR 3 | MATH 318 Multivariate Statistics | 3 cr. | MATH 319 Numerical Analysis I | 3 cr. |
| YEAR 3 | ISYE 251 Operations Research I | 4 cr. | Science/Engineering Elective | 3 cr. |
| YEAR 3 | | | Science/Engineering Elective | 3 cr. |
| YEAR 3 | Free Elective | 1 cr. | SDAS 300 Career Development | 0 cr. |
| S | MATH 399 Internship | 1 cr. | | |
| YEAR 4 | BUSS 322 Fundamentals of Innovation and Entrepreneurship | 3 cr. | Technical Elective | 3 cr. |
| YEAR 4 | MATH 419 Numerical Analysis II | 3 cr. | Technical Elective | 3 cr. |
| YEAR 4 | MATH 412 Optimization | 3 cr. | Technical Elective | 3 cr. |
| YEAR 4 | Technical Elective | 3 cr. | Technical Elective | 3 cr. |
| YEAR 4 | MATH 497 Senior Research Project I | 3 cr. | MATH 498 Senior Research Project II | 3 cr. |

S SUMMER

Typical Course Sequence for the **BSc in Applied Mathematics and Statistics**

Concentration in Financial Mathematics

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | ENGL 102 Academic English II | 3 cr. |
| | MATH 111 Calculus I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| | MATH 101 Fundamentals of Mathematical Reasoning | 3 cr. | ENGR 113 Introduction to Computing using Matlab | 4 cr. |
| | GENS 101 Grand Challenges | 4 cr. | HUMA XXX Arabic Language Elective | 3 cr. |
| S | HUMA XXX UAE Studies Elective | 3 cr. | | |
| YEAR 2 | MATH 231 Calculus III | 3 cr. | MATH 324 Real Analysis I | 4 cr. |
| | MATH 204 Linear Algebra | 3 cr. | MATH 206 Differential Equations | 3 cr. |
| | MATH 244 Probability | 3 cr. | MATH 245 Mathematical Statistics | 3 cr. |
| | PHYS 122 University Physics II | 4 cr. | BUSS 201 Fundamentals of Accounting and Finance | 3 cr. |
| | BUSS XXX or HUMA XXX Business Studies or Humanities Elective | 3 cr. | MATH 214 Mathematical and Statistical Software | 3 cr. |
| S | HUMA XXX Islamic Studies Elective | 3 cr. | | |
| YEAR 3 | MATH 352 Complex Functions | 3 cr. | MATH 316 Partial Differential Equations | 3 cr. |
| | MATH 315 Advanced Linear Algebra | 3 cr. | MATH 317 Nonparametric Statistics | 3 cr. |
| | MATH 318 Multivariate Statistics | 3 cr. | MATH 319 Numerical Analysis I | 3 cr. |
| | ISYE 251 Operations Research I | 4 cr. | ISYE 480 Financial Engineering | 3 cr. |
| | | 3 cr. | Free Elective | 1 cr. |
| | BUSS 150 Introduction to Economics | 1 cr. | SDAS 300 Career Development | 0 cr. |
| S | MATH 399 Internship | 3 cr. | | |
| YEAR 4 | BUSS 322 Fundamentals of Innovation and Entrepreneurship | 3 cr. | Technical Elective | 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. |
| | MATH 497 Senior Research Project I | | MATH 498 Senior Research Project II | 3 cr. |

Typical Course Sequence for the **BSc in Applied Mathematics and Statistics**

Concentration in Mathematical Biology

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | ENGL 102 Academic English II | 3 cr. |
| | MATH 111 Calculus I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| | MATH 101 Fundamentals of Mathematical Reasoning | 3 cr. | ENGR 113 Introduction to Computing using Matlab | 4 cr. |
| | GENS 101 Grand Challenges | 4 cr. | HUMA XXX Arabic Language Elective | 3 cr. |
| S | HUMA XXX UAE Studies Elective | 3 cr. | | |
| YEAR 2 | MATH 231 Calculus III | 3 cr. | MATH 324 Real Analysis I | 4 cr. |
| | MATH 204 Linear Algebra | 3 cr. | MATH 206 Differential Equations | 3 cr. |
| | MATH 244 Probability | 3 cr. | MATH 245 Mathematical Statistics | 3 cr. |
| | PHYS 122 University Physics II | 4 cr. | BUSS 201 Fundamentals of Accounting and Finance | 3 cr. |
| | BUSS XXX or HUMA XXX Business Studies or Humanities Elective | 3 cr. | MATH 214 Mathematical and Statistical Software | 3 cr. |
| S | HUMA XXX Islamic Studies Elective | 3 cr. | | |
| YEAR 3 | MATH 352 Complex Functions | 3 cr. | MATH 316 Partial Differential Equations | 3 cr. |
| | MATH 315 Advanced Linear Algebra | 3 cr. | MATH 317 Nonparametric Statistics | 3 cr. |
| | MATH 318 Multivariate Statistics | 3 cr. | MATH 319 Numerical Analysis I | 3 cr. |
| | ISYE 251 Operations Research I | 4 cr. | BMED 202 Biomedical Engineering Fundamentals | 4 cr. |
| | BIOL 111 General Biology I | 3 cr. | SDAS 300 Career Development | 0 cr. |
| S | MATH 399 Internship | 1 cr. | | |
| YEAR 4 | BUSS 322 Fundamentals of Innovation and Entrepreneurship | 3 cr. | Technical Elective | 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. |
| | MATH 497 Senior Research Project I | 3 cr. | MATH 498 Senior Research Project II | 3 cr. |

**Minor in Mathematics**

The Minor in Mathematics provides science and engineering students with a significant mathematical background and a broad perspective on the discipline via a coherent survey of mathematics at the undergraduate level. Students gain a deep understanding of rigorous mathematical thinking, including the ability to produce and judge the validity of mathematical arguments. Some courses focus on problem solving techniques and others have an intensive proof-writing component to help students develop specific technical and critical thinking skills. Students who complete the minor become familiarized with several areas of mathematics such as analysis, linear algebra, probability and statistics, and abstract algebra.

**Student Learning Outcomes**

Students graduating with the Minor in Mathematics will achieve the following set of knowledge and performance based skills. They will be able to:

a. apply knowledge of mathematics, statistics, and computing.
b. implement algorithms and analyze and interpret results.
c. understand and construct mathematical and statistical proofs.
d. formulate and solve mathematical models of real-world problems.

**Degree Requirements**

1. The program requires at least 18 credit hours: four (4) core courses plus two (2) elective courses.
2. The Minor in Mathematics is NOT open to the students in the Mathematics (AMS) major.
3. A minimum grade of "C" must be achieved in each of the courses that count towards the award of the Minor in Mathematics.
4. A student may double-count a maximum of two courses to satisfy the requirements of both his/her respective major and the Minor in Mathematics.

**Core Requirements**

Students are required to take the following four core courses that will count for a total of 12 credits.

**All three (3) of the following courses (9 credits):**

| COURSE CODE | COURSE TITLE | CREDIT |
|---|---|---|
| MATH 101 | Fundamentals of Mathematical Reasoning | 3 cr. |
| MATH 214 | Mathematical and Statistical Software<br>Prerequisite: ENGR 113, MATH 204, MATH 242 or MATH 243 or MATH 244 | 3 cr. |
| MATH 315 | Advanced Linear Algebra<br>Prerequisite: MATH 204 | 3 cr. |

**One (1) of the following two (2) courses (3 credits):**

| COURSE CODE | COURSE TITLE | CREDIT |
|---|---|---|
| MATH 231 | Calculus III<br>Prerequisite: MATH 112 | 3 cr. |
| MATH 232 | Engineering Mathematics<br>Prerequisite: MATH 112 | 3 cr. |

**Elective Requirements:**
Students are required to take at least two elective courses. One of the electives must be selected from the Electives Group A listed below. The second required elective can be selected from any of the 300- or 400-level courses offered by the Mathematics department.

**Electives Group A**

| COURSE CODE | COURSE TITLE | CREDIT |
|---|---|---|
| MATH 245 | Mathematical Statistics<br>Prerequisite: MATH 242 or MATH 243 or MATH 244 | 3 cr. |
| MATH 317 | Nonparametric Statistics<br>Prerequisite: MATH 214, MATH 245 | 3 cr. |
| MATH 318 | Multivariate Statistics<br>Prerequisite: MATH 214, MATH 231, MATH 245 | 3 cr. |
| MATH 319 | Numerical Analysis I<br>Prerequisites: MATH 204, MATH 206, MATH 214 | 3 cr. |
| MATH 320 | Mathematical Foundations of General Relativity<br>Prerequisites: MATH 204, MATH 206, MATH 231 | 3 cr. |
| MATH 333 | Applied Engineering Mathematics<br>Prerequisite: ENGR 112, MATH 204, MATH 206 | 3 cr. |
| MATH 352 | Complex Functions<br>Prerequisite: MATH 231 | 3 cr. |
| MATH 412 | Optimization<br>Prerequisite: MATH 204, MATH 231, and Senior Standing | 3 cr. |
| MATH 413 | Game Theory<br>Prerequisite: MATH 315 | 3 cr. |
| MATH 416 | Sample Survey Design and Analysis<br>Prerequisite: MATH 214, MATH 245, and Senior Standing | 3 cr. |
| MATH 426 | Finance in Discrete Time<br>Prerequisite: MATH 214, MATH 231, MATH 243 or MATH 245 | 4 cr. |
| MATH 432 | Mathematical Models in Biology<br>Prerequisite: MATH 204, MATH 206, MATH 242 or MATH 243 or MATH 244 | 3 cr. |

**Examples of elective choices per subdiscipline**

The purpose of the following table is to inform students and their advisors about courses that are usually associated with different mathematical subdisciplines. The aim is to assist and facilitate student's choice guided by student's interest in a particular mathematical subdiscipline. The table is provided as an illustration only. Indeed, students are free to make their own choice of elective courses per their preference.

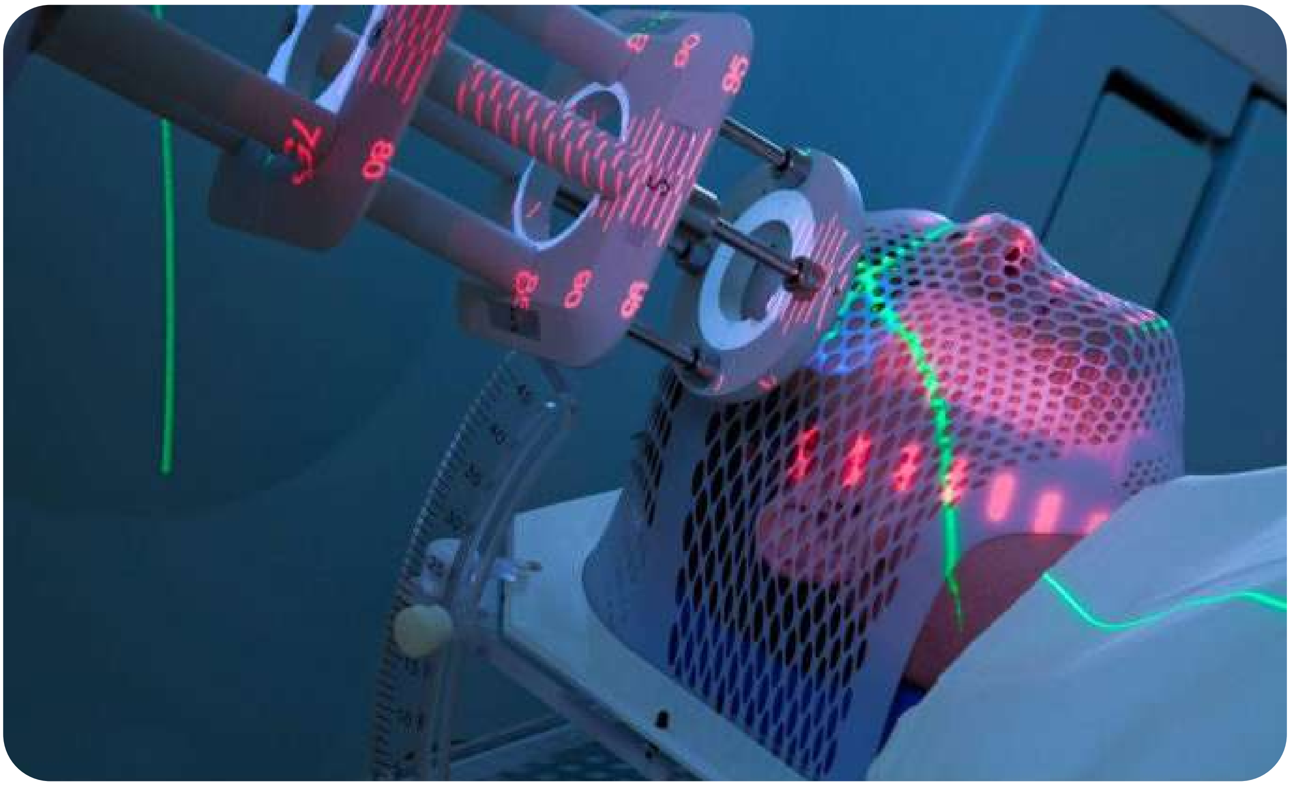
| EXAMPLES OF ELECTIVES | THEORETICAL MATHEMATICS | NUMERICAL MATHEMATICS | APPLIED STATISTICS | MATHEMATICAL FINANCE | APPLIED MATHEMATICS (GENERAL) | MATHEMATICAL BIOLOGY |
|---|---|---|---|---|---|---|
| | MATH 316<br>MATH 320<br>MATH 324<br>MATH 352<br>MATH 410<br>MATH 411<br>MATH 412<br>MATH 495 | MATH 316<br>MATH 319<br>MATH 333<br>MATH 412<br>MATH 419 | MATH 245<br>MATH 317<br>MATH 318<br>MATH 415 | MATH 245<br>MATH 412<br>MATH 426 | MATH 316<br>MATH 412<br>MATH 413<br>MATH 414 | MATH 316<br>MATH 319<br>MATH 412<br>MATH 432 |

**Additional information**

1. The Minor in Mathematics will be overseen by the Associate Chair for Undergraduate Studies in the Department of Mathematics. One of the mathematics faculty will be assigned as an advisor to students pursuing the Minor in Mathematics.
2. The Minor in Mathematics will be assessed three (3) years after its inception. The assessment will involve:
   a) number of students in the program
   b) completion rate of those who enter the program
   c) questionnaire filled out by students who completed the program
   d) questionnaire filled out by a portion of students who are still in the pipeline.

**Matrix with the contributions of each course to the Program Learning Outcomes of the Minor in Mathematics**

| CODE | TITLE | CR. | A | B | C | D |
|---|---|---|---|---|---|---|
| **CORE REQUIREMENTS** | | | | | | |
| MATH 101 | Fundamentals of Mathematical Reasoning | 3 | H | --- | H | --- |
| MATH 214 | Mathematical and Statistical Software | 3 | H | H | --- | --- |
| MATH 231 | Calculus III | 3 | M | --- | L | --- |
| MATH 232 | Engineering Mathematics | 3 | M | --- | L | --- |
| MATH 315 | Advanced Linear Algebra | 3 | L | L | M | --- |
| **ELECTIVE REQUIREMENTS (GROUP A)** | | | | | | |
| MATH 245 | Mathematical Statistics | 3 | H | M | L | M |
| MATH 317 | Nonparametric Statistics | 3 | H | H | H | M |
| MATH 318 | Multivariate Statistics | 3 | H | H | --- | M |
| MATH 319 | Numerical Analysis I | 3 | H | M | M | L |
| MATH 320 | Mathematical Foundations of General Relativity | 3 | H | M | L | M |
| MATH 333 | Applied Engineering Mathematics | 3 | H | L | --- | H |
| MATH 352 | Complex Functions | 3 | H | --- | H | M |
| MATH 412 | Optimization | 3 | H | M | H | M |
| MATH 413 | Game Theory | 3 | M | M | M | H |
| MATH 416 | Sample Survey Design and Analysis | 3 | M | H | --- | M |
| MATH 426 | Finance in Discrete Time | 4 | H | L | M | M |
| MATH 432 | Mathematical Models in Biology | 3 | H | H | --- | H |



## DEPARTMENT OF PHYSICS

**Introduction**

The Department of Physics offers a Physics BSc degree program that prepares graduates for a wide range of careers and thereby supply the UAE with skilled, scientifically-trained, professionals who can help "power and drive" the UAE's knowledge-based economy. In order to achieve this, the Physics Department's strategy is to provide a generous number of electives with a lean core curriculum delivering the necessary professional skills, competencies, and physics knowledge. The degree provides elective options in Engineering Physics, Space Science, and Physics Education. Alternatively, students will be encouraged to consider taking a minor with their Physics BSc degree, for example in Nuclear Engineering or Unmanned Aerial Vehicles. A wide range of elective physics courses, such as in Advanced Instrumentation, Astronomy and Astrophysics, Atomic and Molecular Physics, Biological Physics, Nanotechnology, Nuclear and Particle Physics, Quantum Mechanics, and others will be made available to students.

## BACHELOR OF SCIENCE IN PHYSICS

The BSc in Physics program involves the development of a great range of knowledge, skills, and competencies. These may be summarized in terms of:

- critical thinking, inventiveness and ability to address unforeseen problems
- core physics knowledge, including basic concepts and the "canon" of physics topics
- scientific and technical skills, including problem solving, use of advanced mathematics, modelling and simulations, generic experimental skills, coding and software use, data processing and analysis (including use of industry-standard software)
- communication skills, including scientific presentations and writing (such as for professional conferences and journals) and the ability to communicate science content and outcomes to individuals untrained in science (such as investors, managers, general audience or young people)

- professional and workplace skills, including problem solving, communication, management, working effectively with others, and dealing with constraints (applicable in a range of careers in industry, government, non-governmental organizations, teaching, or self-employment)

Prospects for employment opportunities for physics graduates is excellent. There is a growing demand in almost every sector of the job market. Physicists are employed in many industries, including energy (nuclear power, oil, and gas), materials (petrochemicals and metals); aviation, aerospace, and defence; pharmaceuticals, biotechnology and life sciences; healthcare equipment and services; transportation, trade, and logistics; education; financial services; and telecommunications.

**Program Educational Objectives**

The Physics BSc will provide students with:

- Flexibility – to allow increased options for students to pursue interests and choices of courses aligned with career goals.
- Career-relevant tracks – to better prepare students for diverse careers, especially targeting UAE needs and employment opportunities.
- Capstone experiences that are career relevant – to provide meaningful integration of program learning outcomes with experiences with industry requirements and standard tools.
- Applications and career-relevant skills as part of coursework – to connect the learning of physics principles and techniques with real-world and cross-disciplinary applications, contexts, and requirements; to introduce problem definition, project management, and authentic research experiences; to incorporate communication and professional skills development and use of industry-standard tools throughout the curriculum.
- Co-curricular activities – to provide diverse opportunities for achieving learning outcomes via Department colloquia, interactions with alumni, student organization, outreach activities, undergraduate participation in teaching and research, site visits, advising and mentoring activities.

**Program Learning Outcomes**

Students graduating with a BSc in Physics will have achieved the following set of knowledge and performance based skills, and affective competencies:

- Apply understanding of the sciences, mathematics, and other relevant disciplines to physics and integration of this knowledge to solve problems; apply crosscutting themes; apply laws of physics (demonstrate the breadth of physics specific knowledge).
- Solve problems individually and collaboratively involving the integration of physics and other knowledge, development of theoretical solutions, use of various concept representations, computational methods, simulations, and experimental tests (demonstrate types of physics specific knowledge).
- Solve complex, ambiguous problems in real-world contexts; relate and explain results, suggest follow-on steps, place results in perspective; demonstrate competence with 1) instrumentation, 2) professional software, 3) coding, and 4) data analytics (demonstrate the range of scientific and technical skills).
- Identify appropriate approaches to a question or problem such as applying or developing theory, developing an analytic model, making rough estimates based on reasoned, specific strategies, performing an experiment, performing a simulation (demonstrate the selectivity of scientific and technical skills).
- Obtain information and evaluate its accuracy by reading, listening, discussing; explain or persuade an audience on scientific or technical concepts; use feedback to revise and improve written work and other informative presentations (demonstrate the range of communication skills).

- Organize and communicate about scientific and technical concepts for different audiences and contexts using various and appropriate communication methods and modalities (demonstrate selectivity of communication skills).
- Demonstrate individual preparation for work and work collegially and collaboratively in diverse, interdisciplinary teams both as a leader and as a member in pursuing a common goal (demonstrate professional/workplace competency regarding autonomy and responsibility).
- Identify independently what must be understood and learn it; generate new ideas; obtain knowledge about existing resources relevant for the task at hand (demonstrate professional/workplace competency regarding self-development).
- Demonstrate familiarity with basic workplace concepts, issues, practices, professional conduct, and life skills (demonstrate professional/workplace competency in regard to a role in context).

**Program Facilities**

- Studio-format courses are conducted in state-of-the-art classrooms and workshops that facilitate active learning, development of skills and appropriate habits of mind, and higher-order thinking, through cooperative and collaborative activities and projects.
- Lecture-format courses are conducted in a traditional classroom setting using both the whiteboard and PowerPoint software.
- Laboratory classes are conducted in Physics Laboratories equipped with state-of-the-art technology and equipment, designed for optimal instructional use and safety.

**Professional Chapters and Clubs**

Students are encouraged to take up Undergraduate Membership of one, or more, of the professional physical societies such as the Institute of Physics (IoP) and the American Physics Society (APS). Students will also be encouraged to join an on-campus student Physics Club to help organize and participate student-focused seminars, activities, and competitions.

**Degree Requirements**

To be recommended for the degree of BSc in Physics, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements, additional Mathematics and Science course requirements, the Physics Core, and Technical Electives requirements. The normal length of the undergraduate BSc in Physics is 120 credits, comprising 48 credits of University General Education Requirements (GERs) , additional Science and Math Requirements (13 credits), core courses (44 credits), technical electives (11 credits) and Math/Science/Engineering Electives (4 credits).

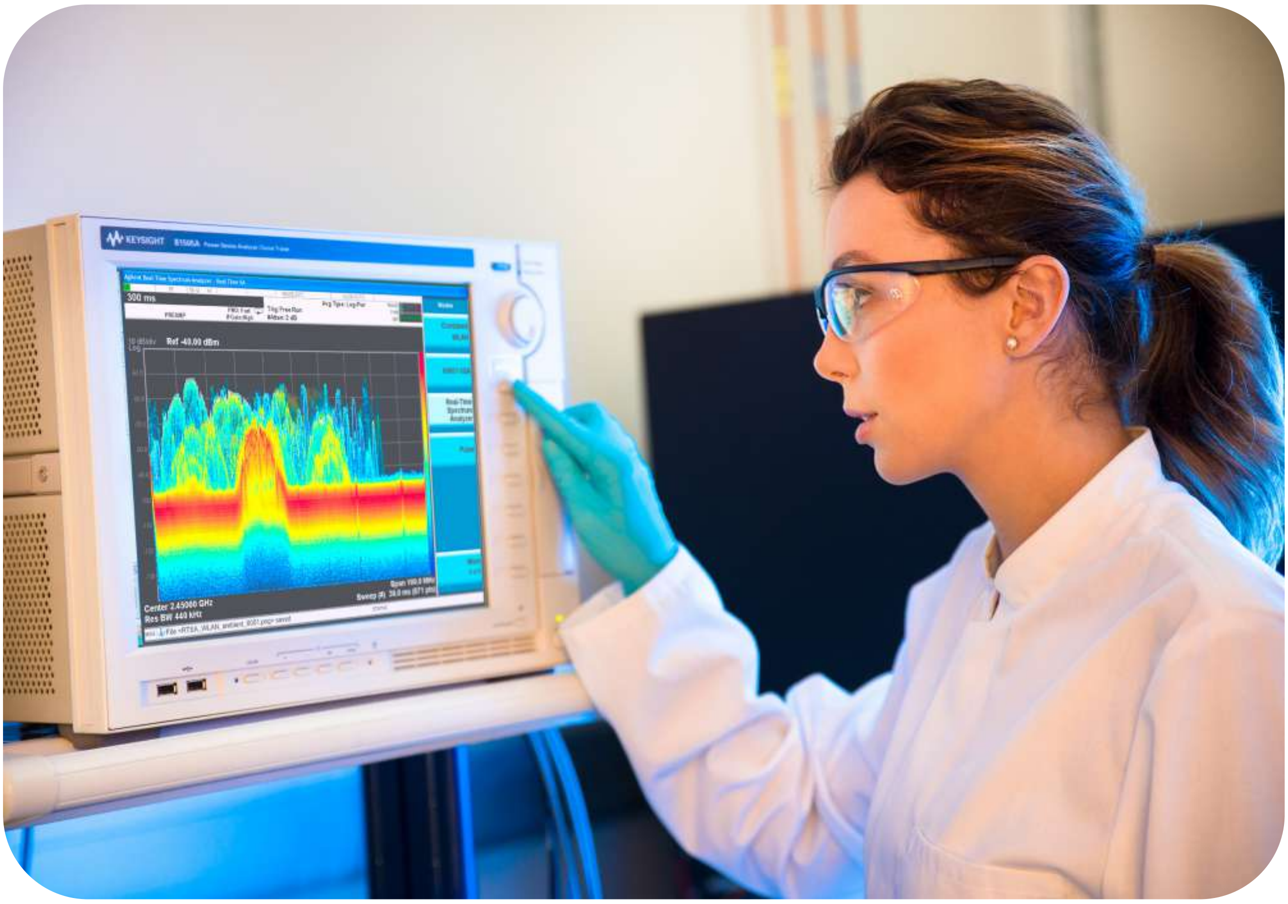
**Additional Science and Mathematics Requirements (13 credits)**

Students must take the following four courses:

| | | |
|---|---|---|
| CHEM 116 | General Chemistry II | 4 cr. |
| MATH 231 | Calculus III | 3 cr. |
| MATH 204 | Linear Algebra | 3 cr. |
| MATH 206 | Differential Equations | 3 cr. |

**Physics Core Requirements (44 credits)**
Students must take the following four courses:

| | | |
|---|---|---|
| PHYS 103 | Orientation to Physics | 4 cr. |
| PHYS 201 | Physics Instrumentation I | 3 cr. |
| PHYS 211 | Computational Physics | 4 cr. |
| PHYS 213 | University Physics III | 4 cr. |
| PHYS 250 | Mathematical Physics | 4 cr. |
| PHYS 311 | Intermediate Mechanics | 3 cr. |
| PHYS 321 | Electricity and Magnetism I | 4 cr. |
| PHYS 331 | Quantum Mechanics I | 4 cr. |
| PHYS 340 | Thermal and Statistical Physics | 4 cr. |
| PHYS 351 | Advanced Laboratory I | 3 cr. |
| PHYS 399 | Physics Internship | 1 cr. |
| PHYS 497 | Senior Project I | 3 cr. |
| PHYS 498 | Senior Project II | 3 cr. |



**Physics Technical Electives (11 credits)**
To satisfy the BSc in Physics Technical Elective requirement, students must have a minimum of 11 credits from any of the courses in the following list:

| | | |
|---|---|---|
| PHYS 203 | Introduction to Astronomy | 4 cr. |
| PHYS 231 | Optics | 4 cr. |
| PHYS 295 | Introduction to Microscopy | 3 cr. |
| PHYS 350 | Introduction to Nanophysics | 3 cr. |
| PHYS 361 | Engineering Physics I | 3 cr. |
| PHYS 362 | Engineering Physics II | 3 cr. |
| PHYS 363 | Physics Instrumentation II | 3 cr. |
| PHYS 371 | Introduction to Physics Education | 3 cr. |
| PHYS 372 | Physics Teaching Methods | 3 cr. |
| PHYS 381 | Introduction to Biological Physics | 3 cr. |
| PHYS 482 | Introduction to Medical Physics | 4 cr. |
| PHYS 403 | Observational Stellar and Galactic Astrophysics | 3 cr. |
| PHYS 412 | Advanced Mechanics | 3 cr. |
| PHYS 420 | Atomic and Molecular Physics | 3 cr. |
| PHYS 422 | Electricity and Magnetism II | 3 cr. |
| PHYS 431 | Solid State Physics | 3 cr. |
| PHYS 432 | Quantum Mechanics II | 4 cr. |
| PHYS 441 | Space Physics | 3 cr. |
| PHYS 450 | Nuclear and Particle Physics | 3 cr. |
| PHYS 452 | Advanced Laboratory II | 3 cr. |
| PHYS 471 | Physics Teaching Practicum I | 3 cr. |
| PHYS 472 | Physics Teaching Practicum II | 3 cr. |

**Mathematics/Science/Engineering Electives (4 credits)**
Students must select at least four credits of Elective courses to develop depth and/or breadth of theoretical and/or experiential knowledge to support their career paths and individual interests. These courses are additional to the degree's Technical Electives and must be upper-level (3XX or 4XX) courses in mathematics, science, or engineering. For example, these upper-level elective courses might help to satisfy the requirements of a Minor degree.

**Physics BSc Tracks (Optional)**
Physics students may select one of three available tracks before selecting their Technical Electives and their Mathematics/Science/Engineering Electives. These tracks are provided as a guide for the selection of courses and do not appear as a separate transcript record. The following courses are approved by the Physics Department for each track.

**Engineering Physics Track (17 credits)**

| | | |
|---|---|---|
| ENGR 111 | Engineering Design (No prerequisites) | 4 cr. |
| PHYS 231 | Optics | 4 cr. |
| PHYS 361 | Engineering Physics I | 3 cr. |
| PHYS 362 | Engineering Physics II | 3 cr. |
| PHYS 363 | Physics Instrumentation II | 3 cr. |

**Space Science Track (17 credits)**

| | | |
|---|---|---|
| PHYS 203 | Introduction to Astronomy | 4 cr. |
| PHYS 231 | Optics | 4 cr. |
| PHYS 363 | Physics Instrumentation II | 3 cr. |
| PHYS 403 | Observational Stellar and Galactic Astrophysics | 3 cr. |
| PHYS 441 | Space Physics | 3 cr. |

**Physics Education Track (16 credits)**

| | | |
|---|---|---|
| PHYS 203 | Introduction to Astronomy | 4 cr. |
| SCED 467 | Introduction to Science Teaching | 3 cr. |
| SCED 468 | Assessment and Practical Work in the Science Classroom | 3 cr. |
| PHYS 471 | Physics Teaching Practicum I | 3 cr. |
| PHYS 472 | Physics Teaching Practicum II | 3 cr. |

**Optional Minor Degrees (Compatible with the BSc in Physics)**
As an alternative to one of the optional Physics Degree Tracks, the Physics Department will also recommend qualifying students to consider the option of an official Minor degree from Khalifa University. In particular, there are currently three Minor degrees offered by the College of Engineering, including a Minor in Artificial Intelligence (18 credits), a Minor in Nuclear Engineering (15 credits), and a Minor in Mechatronics (21 credits). Specific pre-requisites/co-requisites may be mandatory for each Minor. Consequently, students must work carefully with their advisors (for their Major and Minor degree programs) to identify and schedule these prerequisites while making their individual study plan. More options for Minor degrees are expected in the future.

Typical Course Sequence for the **BSc in Physics**

| | FALL SEMESTER | | SPRING SEMESTER | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr. | PHYS 103 Orientation to Physics | 4 cr. |
| | MATH 111 Calculus I | 4 cr. | MATH 112 Calculus II | 4 cr. |
| | CHEM 115 General Chemistry I | 4 cr. | CHEM 116 General Chemistry II | 4 cr. |
| | GENS 101 Grand Challenges | 4 cr. | PHYS 121 University Physics I | 4 cr. |
| S | | | | |
| YEAR 2 | ENGL 102 Academic English II | 3 cr. | PHYS 201 Physics Instrumentation I | 3 cr. |
| | MATH 231 Calculus III | 3 cr. | PHYS 211 Computational Physics | 4 cr. |
| | MATH 204 Linear Algebra | 3 cr. | PHYS 213 University Physics III | 4 cr. |
| | MATH 206 Differential Equations | 3 cr. | PHYS 250 Mathematical Physics | 4 cr. |
| | PHYS 122 University Physics II | 4 cr. | HUMA XXX Arabic Language Elective | 3 cr. |
| S | | | | |
| YEAR 3 | BUSS XXX Business Elective | 3 cr. | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr. |
| | PHYS 311 Intermediate Mechanics | 3 cr. | PHYS XXX Technical Elective | 3 cr. |
| | PHYS 321 Electricity and Magnetism I | 4 cr. | PHYS 351 Advanced Laboratory I | 3 cr. |
| | PHYS 331 Quantum Mechanics I | 4 cr. | PHYS 340 Thermal and Statistical Physics | 4 cr. |
| | HUMA XXX UAE Studies Elective | 3 cr. | SDAS 300 Career Development | 0 cr. |
| S | PHYS 399 Physics Internship | 1 cr. | | |
| YEAR 4 | HUMA XXX Islamic Studies Elective | 3 cr. | HUMA XXX Humanities Elective or BUSS XXX Business Elective | 3 cr. |
| | Math, Science, or Engineering Elective(s) (3XX or 4XX) | 4 cr. | PHYS XXX Technical Elective | 3 cr. |
| | PHYS XXX Technical Elective | 3 cr. | PHYS 498 Senior Project II | 3 cr. |
| | PHYS XXX Technical Elective | 2 cr. | | |
| | PHYS 497 Senior Project I | 3 cr. | | |
| | | | Total credit Hours | 120 cr. |

S SUMMER

# COLLEGE OF ENGINEERING

One of the main pillars of Abu Dhabi's social, political and economic future is a sustainable knowledge-based economy, as outlined in the Abu Dhabi Vision 2030. The overarching purpose of the College of Engineering at the Khalifa University of Science and Technology is to work towards this vision by advancing the discovery of new knowledge, its dissemination and exploitation.

The College of Engineering 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 information and communication technologies.

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. 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.

## 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 the Abu Dhabi Vision 2030.

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 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.

## COLLEGE UNDERGRADUATE DEGREE PROGRAMS

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

- Bachelor of Science (BSc) in Aerospace Engineering
- Bachelor of Science (BSc) in Biomedical Engineering
- Bachelor of Science (BSc) in Chemical Engineering
- Bachelor of Science (BSc) in Civil Engineering
- Bachelor of Science (BSc) in Computer Engineering (with optional Concentration: Software Systems)
- Bachelor of Science (BSc) in Computer Science (with optional Concentrations: Artificial Intelligence or Cybersecurity)
- Bachelor of Science (BSc) in Electrical Engineering
- Bachelor of Science (BSc) in Industrial and Systems Engineering
- Bachelor of Science (BSc) in Mechanical Engineering
- Bachelor of Science (BSc) in Petroleum Engineering

The length of the undergraduate engineering programs ranges between 134-140 credits. These credits are divided into 48 credits of University General Education Requirements (GERs), minimum 18 credits of College of Engineering Requirements (CERs), and 68-74 credits of specific Major requirements.

## COLLEGE UNDERGRADUATE MINORS

The minors offered by the College of Engineering are:

- Minor in Artificial Intelligence
- Minor in Mechatronics
- Minor in Nuclear Engineering

**College of Engineering Requirements (minimum 18 credits)**

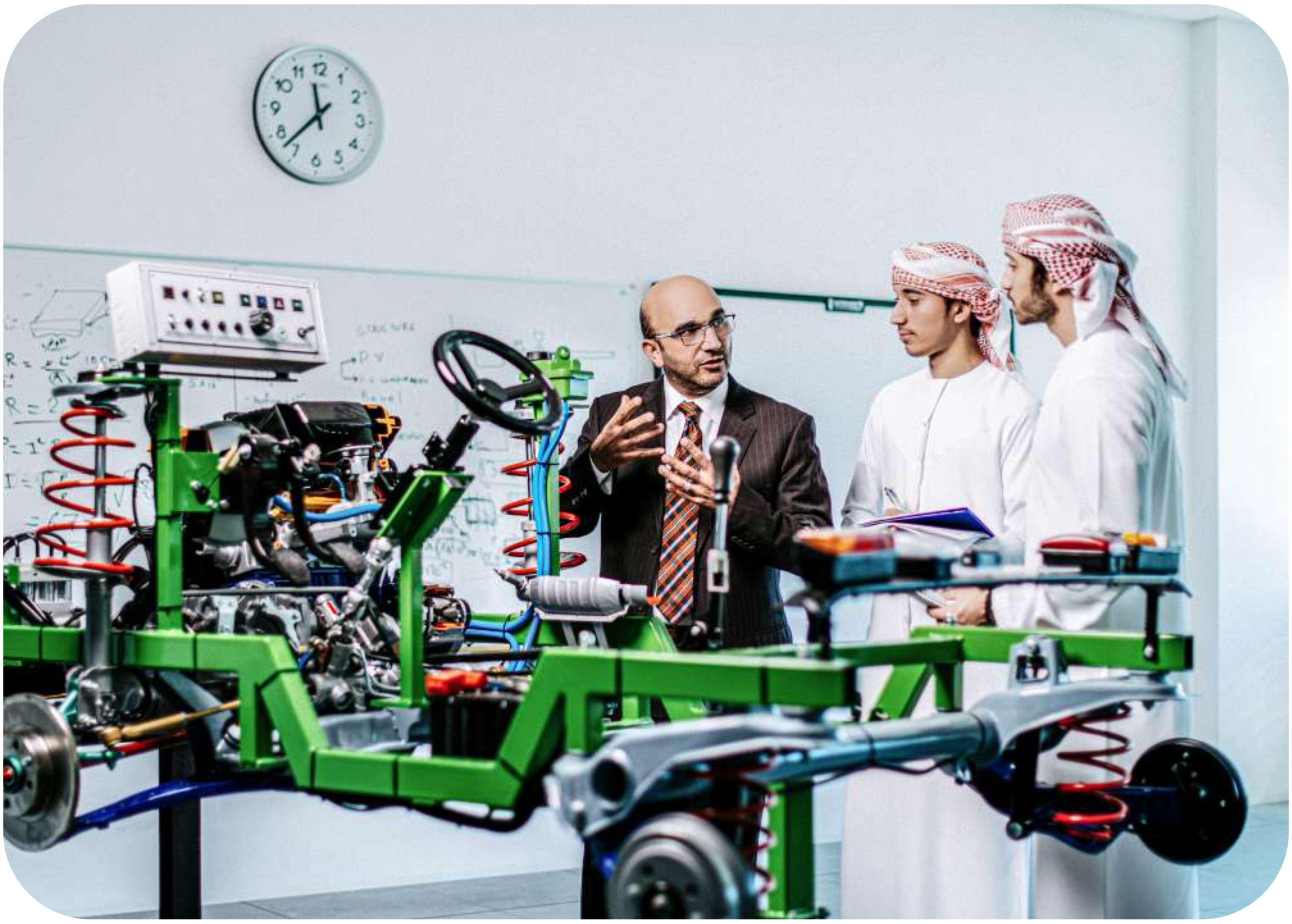
1. Additional Math/Science (minimum 12 credits):
   In addition to the 20 credits of Math/Science GERs, a minimum of 12 credits of major-dependent Math/Science courses are required by the College of Engineering.

2. General Engineering (4 credits):

| | |
|---|---|
| ENGR 112 Introduction to Computing using C++ Or ENGR 113 Introduction to Computing using Matlab Or ENGR 114 Introduction to Computing using Python | (4 cr.) |

3. Engineering Internship (2 credits):

All Students are required to spend 16 weeks on an approved engineering internship program. The internship provides students with practical, on-the-job experience which allows them to integrate theory with "real world" situations.



## DEPARTMENT OF AEROSPACE ENGINEERING

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 IN AEROSPACE ENGINEERING

A BSc in Aerospace Engineering 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 and space-related profession and industry. Principles of science and engineering are applied to design and analysis of flight vehicles and related aerospace 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 processes. Using advanced computer modeling and simulations, as well as hands-on laboratories and real-life projects, students are equipped with the tools to contribute immediately and effectively to the aerospace and the blooming space industries in UAE and the region.

**Program Educational Objectives**

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

**Student Learning Outcomes**

Students graduating with a BSc in Aerospace Engineering will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

The Aerospace Engineering Program laboratories include:

- Computer-Aided Design Laboratory
- Mechanics of Solids Laboratory
- Material Testing Laboratory
- Aerodynamics Laboratory
- Dynamic Systems/ Vibrations Laboratory
- Space Dynamics Laboratory
- Thermodynamics Laboratory

**Professional Chapters**

**AIAA Student Chapter**

The objectives of the American Institute of Aeronautics and Astronautics (AIAA) student 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 University AIAA student 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 the Khalifa University of Science and Technology. 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.

**Degree Requirements**

To be recommended for graduation with a BSc in Aerospace Engineering, students must satisfactorily complete the courses in the specified curriculum categories. These categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 18 credits), two free electives (6 credits),  as well as the Aerospace Engineering Core and Technical Electives requirements (68 credits).. The length of the program is 140 credits.

**Additional Aerospace Engineering Math/Sciences Requirement (12 credits)**

To satisfy the College of Engineering requirements, the BSc in Aerospace Engineering curriculum requires the following four Math courses in addition to the Math/Sciences required in GERs: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |
| MATH333 | Applied Engineering Mathematics | 3 cr. |

**Aerospace Engineering Major Requirements (62 credits)**

| | | |
|---|---|---|
| AERO200 | Statics | 3 cr. |
| AERO201 | Engineering Dynamics | 3 cr. |
| AERO215 | Introduction to Aerospace Engineering | 3 cr. |
| AERO225 | Mechanics of Solids | 4 cr. |
| AERO240 | Thermofluids for Aerospace Engineering | 4 cr. |
| AERO320 | Aerospace Materials | 3 cr. |
| AERO321 | Aerospace Structures | 3 cr. |
| AERO335 | Aerodynamics I | 4 cr. |
| AERO336 | Aerodynamics II | 3 cr. |
| AERO350 | Dynamic Systems and Control | 4 cr. |
| AERO415 | Aerospace Materials Manufacturing | 3 cr. |
| AERO440 | Aerospace Propulsion | 3 cr. |
| AERO450 | Flight Dynamics and Stability | 3 cr. |
| AERO465 | Space Mechanics and Control | 3 cr. |
| AERO470 | Aircraft Design Laboratory | 3 cr. |
| AERO480 | Aerospace Vehicle Performance | 3 cr. |
| AERO497 | Senior Design Project I | 3 cr. |
| AERO498 | Senior Design Project II | 3 cr. |
| ECCE200 | Fundamentals of Electronic Systems | 4 cr. |

**Aerospace Engineering Electives (6 credits)**

The following is a sample list of courses that will satisfy the technical electives in the Aerospace Engineering program. The student must select a total of six credits from this list. A technical elective course must be at 300-level or 400-level. At most three credits may be Undergraduate Research. 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.

| | | |
|---|---|---|
| AERO377/ 477 | Undergraduate Research | 1-3 cr. |
| AERO401 | UAV Modeling and Control | 3 cr. |
| AERO402 | UAV Sensing | 3 cr. |
| AERO403 | UAV Navigation | 3 cr. |
| AERO404 | UAV Systems | 3 cr. |
| AERO426 | Composite Materials Design | 3 cr. |
| AERO430 | Intermediate Aerodynamics | 3 cr. |
| AERO431 | Viscous Flows | 3 cr. |
| AERO433 | Introduction to Computational Fluid Dynamics | 3 cr. |
| AERO435 | Rotorcraft Aerodynamics and Performance | 3 cr. |
| AERO441 | Introduction to Combustion | 3 cr. |
| AERO461 | Aviation Management and Certification | 3 cr. |
| AERO485 | Spacecraft Design | 3 cr. |
| AERO495 | Special Topics in Aerospace Engineering | 3 cr. |
| CIVE370 | Introduction to Environmental Engineering | 4 cr. |
| ENGR455 | Finite Element Analysis | 3 cr. |
| MEEN360 | Computational methods for Mechanical Engineers | 3 cr. |
| MEEN343 | Heat Transfer | 4 cr. |

**Free Electives (6 credits)**

Students must complete 6 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

Typical Course Sequence for a **BSc in Aerospace Engineering**

| Year | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 English Communication I | 3 cr | ENGL 102 English Communication II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | ENGR 113 Introduction to Computing using Matlab | 4 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | MATH 204 Linear Algebra | 3 cr | MATH 231 Calculus III | 3 cr |
| | MATH 206 Differential Equations | 3 cr | AERO 201 Engineering Dynamics | 3 cr |
| | PHYS 122 University Physics II | 4 cr | AERO 215 Introduction to Aerospace Engineering | 3 cr |
| | AERO 200 Statics | 3 cr | AERO 225 Mechanics of Solids | 4 cr |
| | HUMA XXX Arabic Language Elective | 3 cr | AERO 240 Thermofluids for Aerospace Engineering | 4 cr |
| S | HUMA XXX UAE Studies Elective | 3 cr | | |
| YEAR 3 | BUSS XXX Business Elective | 3 cr | BUSS 322 Innovation & Private Enterprise in Science | 3 cr |
| | MATH 333 Applied Engineering Mathematics | 3 cr | ECCE 200 Fundamentals of Electronic Systems | 4 cr |
| | AERO 320 Aerospace Materials | 3 cr | AERO 321 Aerospace Structures | 3 cr |
| | AERO 335 Aerodynamics I | 4 cr | AERO 336 Aerodynamics II | 3 cr |
| | AERO 350 Dynamic Systems & Control | 4 cr | HUMA/BUSS XXX Business Studies or Humanities Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | AERO 440 Aerospace Propulsion | 3 cr | AERO 415 Aerospace Material Manufacturing | 3 cr |
| | AERO 450 Flight Dynamics and Stability | 3 cr | AERO 480 Aerospace Vehicle Performance | 3 cr |
| | AERO 465 Space Dynamics and Control | 3 cr | AERO 498 Senior Design Project II | 3 cr |
| | AERO 470 Aircraft Design Laboratory | 3 cr | Technical Elective | 3 cr |
| | AERO 497 Senior Design Project I | 3 cr | Technical Elective | 3 cr |
| | Free Elective | 3 cr | Free Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credit Hours | 140 |

S SUMMER

## DEPARTMENT OF BIOMEDICAL ENGINEERING

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 (MD) and the Masters in Public Health (MPH).

## BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING

A BSc in Biomedical Engineering provides a solid foundation in both engineering and the life sciences. The curriculum integrates engineering and molecular and cellular biology into a single biomedical engineering 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. The 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 Educational Objectives

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

### Student Learning Outcomes

Students graduating with a BSc in Biomedical Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

### Program Facilities

The Biomedical Engineering Program laboratories and facilities include:

- Organic Chemistry Laboratory
- Molecular Biology Laboratory
- Cell and Tissue Laboratory
- Electrophysiology Laboratory
- Human Movement Laboratory
- Biomaterials Testing Facilities
- Advanced Microscopy Facilities
- 3D Bioprinting Facilities

### Degree Requirements

To be recommended for graduation with a BSc in Biomedical Engineering degree, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 18 credits), as well as the Biomedical Engineering Core and Technical/Free Electives requirements. The program includes a total of 139 credits of required coursework.

**Additional Math/Science Requirements (12 credits)**

To satisfy the College of Engineering requirements, BSc in Biomedical Engineering requires the following four Math and Science courses in addition to the Math/Sciences required in GERs: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH242 | Introduction to Probability and Statistics | 3 cr. |
| BIOL111 | General Biology l | 3 cr. |

**Biomedical Engineering Core Requirements (49 credits)**

| | | |
|---|---|---|
| BMED202 | Biomedical Engineering Fundamentals | 4 cr. |
| BMED211 | Human Anatomy | 4 cr. |
| BMED212 | Physiological Systems and Modeling II | 4 cr. |
| BMED321 | Mechanics for Biomedical Engineers | 4 cr. |
| BMED322 | Functional Biomechanics | 4 cr. |
| BMED331 | Biotransport Phenomena | 3 cr. |
| BMED341 | Molecular Cell Biology | 4 cr. |
| BMED342 | Molecular Genetics, Technologies and Tools | 4 cr. |
| BMED351 | Biomedical Circuits and Systems | 4 cr. |
| BMED352 | Fundamentals of Biomedical Signal Processing | 4 cr. |
| BMED497 | Senior Design Project I | 3 cr. |
| BMED498 | Senior Design Project II | 3 cr. |
| CHEM211 | Organic Chemistry | 4 cr. |

**Biomedical Engineering Technical Electives (12 credits)**
The following is a sample list of courses that will satisfy the technical electives in the BSc in Biomedical Engineering. Additional courses may be approved by the department as technical electives. A technical elective must be at 300-level or 400-level.

| | |
|---|---|
| BMED411 | Biomaterials |
| BMED412 | Regenerative Medicine |
| BMED413 | Application of Bio-molecular Tools |
| BMED421 | Physiological Control Systems |
| BMED422 | Rehabilitation Engineering |
| BMED423 | Biorobotics and Medical Devices |
| BMED430 | Bioinformatics |
| BMED431 | Data Mining and Machine Learning for Bioinformatics |
| BMED495 | Special Topics in Biomedical Engineering |
| BMED496 | Data Measurement, Modeling and Analysis |
| CHEM311 | Biochemistry |
| BMED377/477 | Undergraduate Research |

**Free Electives (12 credits)**
All students must complete 12 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Biomedical Engineering Pre-MED Track (Optional)**
The Pre-MED track, as part of the undergraduate program in Biomedical Engineering, is designed to provide the BME students with sufficient preparation to successfully take the American Medical College Admission Test (MCAT) exam upon the completion of their junior year.

The MCAT, developed and administered by the Association of American Medical Colleges (AAMC), is a standardized, multiple-choice examination created to help 4 plus 4 medical school admission offices assess student skills in problem solving, critical thinking, and knowledge of natural, behavioral, and social science concepts and principles, prerequisite to the study of medicine.

The Pre-MED track is designed with 15 credit hours, such that the courses included fulfill both the requirements for the BSc. in BME, as well as, the prerequisites required by 4 plus 4 American model medical schools, all while maintaining the same total number of credit hours required for an undergraduate BME degree.

The following 4 courses are required:

| COURSE CODE | REQUIREMENTS | CREDITS |
|---|---|---|
| CHEM 116 | General Chemistry II | 4 cr. |
| CHEM 222 | Organic Chemistry II | 4 cr. |
| CHEM 311 | Biochemistry I | 4 cr. |
| HUMA 156 | Human Behavior and Mental Health | 3 cr. |

In order to fulfill this, the Chemistry courses requirement (CHEM 116, 222, 311) will replace 9 credits of "Free Elective" and 3 credits of "Technical Elective" from the core requirements of the Biomedical Engineering program. HUMA 156 will replace "HUMA/BUSS XXX Humanities or Business Elective" in the program.

In addition, students opting for the Pre-Med track, should replace CHEM 211 with CHEM 221.

Typical Course Sequence for **BSc in Biomedical Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS101 Grand Challenges | 4 cr | ENGR 112 Introduction to Computing with C++ | 4 cr |
| S | | | | |
| YEAR 2 | MATH 206 Differential Equations | 3 cr | MATH 242 Introduction to Probability & Statistics | 3 cr |
| | PHYS 122 University Physics II | 4 cr | MATH 204 Linear Algebra | 3 cr |
| | BMED 202 Biomedical Engineering Fundamentals | 4 cr | BMED 212 Human Physiology & Modeling | 4 cr |
| | BMED 211 Human Anatomy | 4 cr | CHEM 211 Organic Chemistry | 4 cr |
| | BIOL 111 General Biology I | 3 cr | HUMA XXX Arabic Language Elective | 3 cr |
| S | HUMA XXX UAE Studies Electives | 3 cr | | |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | BMED 322 Functional Biomechanics | 4 cr |
| | BMED 321 Mechanics for Biomedical Engineers | 4 cr | BMED 331 Biotransport Phenomena | 3 cr |
| | BMED 341 Molecular Cell Biology | 4 cr | BMED 342 Molecular Genetics, Technologies & Tools | 4 cr |
| | BMED 351 Biomedical Circuits and Systems | 4 cr | BMED 352 Fundamentals of Biomedical Signal Processing | 4 cr |
| | Free Elective | 3 cr | Free Elective | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | BMED 497 Senior Design Project I | 3 cr | BMED 498 Senior Design Project II | 3 cr |
| | HUMA XXX Islamic Studies Elective | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Free Elective | 3 cr |
| | Free Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| | BUSS XXX Business Elective | 3 cr | | |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credit Hours | 139 |

S SUMMER

Typical Course Sequence for **BSc in Biomedical Engineering (Pre-Med)**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS101 Grand Challenges | 4 cr | ENGR 112 Introduction to Computing with C++ | 4 cr |
| S | | | | |
| YEAR 2 | MATH 206 Differential Equations | 3 cr | MATH 242 Introduction to Probability & Statistics | 3 cr |
| | PHYS 122 University Physics II | 4 cr | MATH 204 Linear Algebra | 3 cr |
| | BMED 202 Biomedical Engineering Fundamentals | 4 cr | BMED 212 Human Physiology & Modeling | 4 cr |
| | BMED 211 Human Anatomy | 4 cr | CHEM 116 General Chemistry II | 4 cr |
| | BIOL 111 General Biology I | 3 cr | HUMA XXX Fundamental Concepts in the Social Sciences | 3 cr |
| S | HUMA XXX UAE Studies Electives | 3 cr | | |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | BMED 322 Functional Biomechanics | 4 cr |
| | BMED 321 Mechanics for Biomedical Engineers | 4 cr | BMED 331 Biotransport Phenomena | 3 cr |
| | BMED 341 Molecular Cell Biology | 4 cr | BMED 342 Molecular Genetics, Technologies & Tools | 4 cr |
| | BMED 351 Biomedical Circuits and Systems | 4 cr | BMED 352 Fundamentals of Biomedical Signal Processing | 4 cr |
| | CHEM 221 Organic Chemistry I | 4 cr | Free Elective | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | BMED 497 Senior Design Project I | 3 cr | BMED 498 Senior Design Project II | 3 cr |
| | HUMA XXX Islamic Studies Elective | 3 cr | Technical Elective | 3 cr |
| | CHEM 311 Biochemistry | 4 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | CHEM 222 Organic Chemistry II | 3 cr |
| | BUSS XXX Business Elective | 3 cr | HUMA XXX Arabic Language Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credit Hours | 139 |

S SUMMER

## DEPARTMENT OF CHEMICAL ENGINEERING

The Chemical Engineering Department aims to provide a world class education in chemical engineering and related disciplines to produce engineers and future leaders who are capable of meeting or exceeding the needs and expectations in 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 BSc degree in Chemical Engineering.

## BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

The field of chemical engineering deals with the science and engineering of chemical reactions and separation processes. It applies physical and life sciences together with engineering and economic principles to produce, transform, transport, and properly use chemicals, materials and energy.

A BSc in Chemical Engineering program 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. The program incorporates extensive laboratory work and computer process simulation to reinforce the principles and concepts used in the classroom.

**Program Educational Objectives**

- Successful practice of the chemical engineering profession.
- Design and safe operation of process plants.
- Successful career in research and development.

**Student Learning Outcomes**
Students graduating with a BSc in Chemical Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**
The Chemical Engineering Program laboratories include:
- Catalysis Laboratory
- Computing Laboratory
- Instrumentation Laboratory
- Polymer Chemistry Laboratory
- Polymer Processing Laboratory
- Polymer Properties and Characterization Laboratory
- Reaction Engineering Laboratory
- Thermodynamics Laboratory
- Unit Operations Laboratory
- Petroleum Refinery Laboratory

**Professional Chapters**
The Chemical Engineering program is supported by a student chapter of the American Institute of Chemical Engineering (AIChE). The aim of the chapter is to promote chemical engineering and establish a bridge between the students and the professional community at large. AIChE holds regular meetings for its members and organizes social and technical activities open to all students.

**Degree Requirements**
To be recommended for graduation with a BSc in Chemical Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 20 credits), as well as Chemical Engineering Core and Technical Electives requirements. The normal length of the program is 137 credits.

**Additional Math/Sciences Requirements (14 credits)**

To satisfy the College of Engineering requirements, the BSc in Chemical Engineering requires the following Mathematics and Sciences courses in addition to the Math/Science required in GERs: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| CHEM116 | General Chemistry II | 4 cr. |
| CHEM211 | Organic Chemistry | 4 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |

**Chemical Engineering Core Requirements (54 credits)**

| | | |
|---|---|---|
| CHEG205 | Principles of Chemical Engineering | 3 cr. |
| CHEG210 | Introduction to Biochemical Engineering | 3 cr. |
| CHEG213 | Experimental Design | 3 cr. |
| CHEG230 | Chemical Engineering Thermodynamics I | 3 cr. |
| CHEG232 | Fluid Mechanics | 4 cr. |
| CHEG 301 | Introduction to Artificial Intelligence and Applications in Chemical Engineering | 3 cr. |
| CHEG312 | Numerical Methods for Chemical Engineers | 3 cr. |
| CHEG324 | Mass Transfer | 3 cr. |
| CHEG332 | Chemical Engineering Thermodynamics II | 4 cr. |
| CHEG335 | Heat Transfer | 4 cr. |
| CHEG350 | Materials Science and Engineering | 3 cr. |
| CHEG412 | Process Dynamics and Control | 4 cr. |
| CHEG443 | Reaction Engineering | 4 cr. |
| CHEG485 | Separation Processes | 4 cr. |
| CHEG497 | Senior Design Project I | 3 cr. |
| CHEG498 | Senior Design Project II | 3 cr. |

**Chemical Engineering Technical Electives (12 credits)**

The following is a sample list of courses that will satisfy the Technical Electives requirement for the BSc in Chemical Engineering program. Students must select a total of 12 credits from this list. All Technical electives must be at 300-level or 400-level and at most three credits may be Undergraduate Research. 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.

| | | |
|---|---|---|
| CHEG325 | Fundamentals of Nanotechnology | 3 cr. |
| CHEG340 | Chemical Extraction of Metals | 3 cr. |
| CHEG341 | Electrochemical Engineering | 3 cr. |
| CHEG360 | Introduction to Hydrogen Technologies and Applications | 3 cr. |
| CHEG361 | Hydrogen safety | 3 cr. |
| CHEG380 | Introduction to Polymer Science and Engineering | 3 cr. |
| CHEG381 | Polymer Chemistry and Reaction Engineering | 3 cr. |
| CHEG377/477 | Undergraduate Research | 1-3 cr. |
| CHEG395/495 | Special Topics in Chemical Engineering | 3 cr. |
| CHEG410 | Pollution Prevention and Waste Management | 3 cr. |
| CHEG411 | Green Chemical Engineering | 3 cr. |
| CHEG415 | Combustion and Air Pollution Control | 3 cr. |
| CHEG416 | Corrosion Engineering | 3 cr. |
| CHEG423 | Gas Processing Engineering | 3 cr. |
| CHEG424 | Petroleum Refining and Processing | 3 cr. |
| CHEG430 | Bioseparation Engineering | 3 cr. |
| CHEG432 | Food Engineering | 3 cr. |
| CHEG460 | Introduction to Clean Energy Production | 3 cr. |
| CHEG470 | Industrial Catalysis | 3 cr. |
| CHEG471 | Water Chemistry for Environmental Engineering | 3 cr. |
| CHEG472 | Water Treatment and Membrane Processes | 3 cr. |
| CHEG488 | Polymer Properties | 3 cr. |

**Free Electives (3 credits)**
Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Pre-Med Track for Chemical Engineering (optional)**
The Pre-MED track, as part of the undergraduate program in Chemical Engineering, is designed to provide the CHEG students with sufficient preparation to successfully take the American Medical College Admission Test (MCAT) exam upon the completion of their junior year.

| | | |
|---|---|---|
| CHEM 311 | Biochemistry l | CHEG Technical Elective |
| BIOL 111 | General Biology l | Free Elective |
| BIOL 112 | General Biology ll | Additional Course |

**Hydrogen and Sustainable Energy Track (optional)**
This track will provide students with an appropriate mastery of knowledge, techniques, skills and modern tools in major features of hydrogen and sustainable energy technologies, current impact and interactions of such technologies with the environment, as well as relevant hydrogen economic and policy developments. Students are expected to develop a thorough understanding of existing and emerging technologies to generate, purify, transport and safely utilize Hydrogen, in the framework of renewable and clean energies, with a strong focus on industrialization and technology implementation. Students should take all 4 courses.

| | | |
|---|---|---|
| CHEG360 | Introduction to Hydrogen Technologies and Applications | CHEG Technical Elective |
| CHEG460 | Introduction to Clean Energy Production | CHEG Technical Elective |
| CHEG361 | Hydrogen Safety | CHEG Technical Elective |
| CHEG325 | Fundamentals of Nanotechnology | CHEG Technical Elective |

**Water and Environmental Engineering Track (optional)**
This track aims to equip chemical engineering students with the basic tools needed to create engineered solutions to environmental challenges within the chemical industry and beyond. The track draws on a range of disciplines, including chemistry, ecology, mathematics, biology, and engineering to cover key topics, such as clean water supply, proper wastewater treatment and discharge, treatment and disposal of liquid and solid wastes, and the control of water, soil and atmospheric pollution. Students should take CHEG472 as well as 3 of the remaining 5 offered courses.

| | | |
|---|---|---|
| CHEG472 | Water Treatment and Membrane Processes | CHEG Technical Elective |
| CHEG415 | Combustion and Air Pollution Control | CHEG Technical Elective |
| CHEG410 | Pollution Prevention and Waste Management | CHEG Technical Elective |
| CHEG411 | Green Chemical Engineering | CHEG Technical Elective |
| CHEG471 | Water Chemistry | CHEG Technical Elective |

**Materials Track (optional)**

This track considers modern applications of downstream petroleum-based industries such as polymers and plastics and also novel nanomaterials such as carbon and metal oxide materials. Students should take 4 out of the 6 offered.

| | | |
|---|---|---|
| CHEG325 | Fundamentals of Nanotechnology | CHEG Technical Elective |
| CHEG340 | Chemical Extraction of Metals | CHEG Technical Elective |
| CHEG380 | Introduction to Polymer Science and Engineering | CHEG Technical Elective |
| CHEG416 | Corrosion Engineering | CHEG Technical Elective |
| CHEG470 | Industrial Catalysis | CHEG Technical Elective |
| CHEG488 | Polymer Properties | CHEG Technical Elective |

Typical Course Sequence for a **BSc in Chemical Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | CHEM 116 General Chemistry II | 4 cr |
| S | | | | |
| YEAR 2 | ENGR 113/ 114 Introduction to Computing | 4 cr | MATH 206 Differential Equations | 3 cr |
| | PHYS 122 University Physics II | 4 cr | CHEG 210 Introduction to Biochemical Engineering | 3 cr |
| | MATH 231 Calculus III | 3 cr | CHEG 213 Experimental Design | 3 cr |
| | CHEM 211 Organic Chemistry | 4 cr | CHEG 230 Chemical Engineering Thermodynamics I | 3 cr |
| | CHEG 205 Principles of Chemical Engineering | 3 cr | CHEG 232 Fluid Mechanics | 4 cr |
| S | BUSS 150 Introduction to Economics | 3 cr | | |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | CHEG 301 Introduction to Artificial Intelligence and Applications in Chemical Engineering | 3 cr |
| | CHEG 312 Numerical Methods for Chemical Engineers | 3 cr | CHEG 350 Materials Science & Engineering | 3 cr |
| | CHEG 332 Chemical Engineering Thermodynamics II | 4 cr | CHEG 324 Mass Transfer | 3 cr |
| | CHEG 335 Heat Transfer | 4 cr | HUMA XXX Islamic Studies Elective | 3 cr |
| | HUMA XXX Arabic Language Elective | 3 cr | Free Elective | 3 cr |
| | SDAS 300 Career Development | 0 cr | Technical Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | CHEG 497 Senior Design Project I | 3 cr | CHEG 498 Senior Design Project II | 3 cr |
| | CHEG 485 Separation Processes | 4 cr | CHEG 412 Process Dynamics and Control | 4 cr |
| | CHEG 443 Reaction Engineering | 4 cr | HUMA XXX UAE Studies Elective | 3 cr |
| | HUMA/BUSS XXX Humanities or Business Elective | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Technical Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credit Hours | 137 |

S SUMMER


## DEPARTMENT OF CIVIL INFRASTRUCTURE AND ENVIRONMENTAL ENGINEERING

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 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 IN CIVIL ENGINEERING

The BSc in Civil Engineering program lays the foundation for 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 BSc in Civil Engineering program at the Khalifa University of Science and Technology is to provide a high-quality education and prepare students for successful careers in this field.

**Program Educational Objectives**

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

**Student Learning Outcomes**

Students graduating with a BSc in Civil Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

- Environmental Engineering Laboratory
- Geotechnical Materials Laboratory
- Structure Computing Laboratory
- Structural Materials Laboratory
- Transportation and GIS Laboratory

**Professional Chapters**

**ASCE Student Chapter**

The mission of American Society of Civil Engineers (ASCE) Student Chapter 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 national and international competitions, helps students participate in the ASCE Student Conferences and sends potential members to workshops for Student Chapter Leaders. The 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.

**Degree Requirements**

To be recommended to graduate with a BSc in Civil Engineering degree, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 18 credits), as well as the Civil Engineering Core and Technical Electives requirements. The normal length of the program is 138 credits.

**Additional Math/Sciences Requirements (12 credits)**
To satisfy the College of Engineering Requirements, the BSc in Civil Engineering requires the following Math courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |
| MATH242 | Introduction to Probability and Statistics | 3 cr. |

**Civil Engineering Core Requirements (63 credits)**

| | | |
|---|---|---|
| CIVE180 | Engineering Graphics and Visualization | 3 cr. |
| CIVE200 | Statics | 3 cr. |
| CIVE201 | Engineering Dynamics | 3 cr. |
| CIVE225 | Mechanics of Solids | 4 cr. |
| CIVE310 | Geomatics | 3 cr. |
| CIVE330 | Artificial Intelligence and Data Analytics in Civil Engineering | 3 cr. |
| CIVE332 | Fundamentals of Construction Engineering and Management | 3 cr. |
| CIVE335 | Fluid Mechanics | 4 cr. |
| CIVE336 | Civil Engineering Materials | 4 cr. |
| CIVE338 | Geotechnical Engineering | 4 cr. |
| CIVE340 | Behavior and Analysis of Structures | 3 cr. |
| CIVE341 | Design of Steel Structures | 3 cr. |
| CIVE370 | Introduction to Environmental Engineering | 4 cr. |
| CIVE380 | Transportation Engineering | 3 cr. |
| CIVE442 | Design of Concrete Structures | 3 cr. |
| CIVE470 | Foundation Engineering | 4 cr. |
| CIVE497 | Senior Design Project I | 3 cr. |
| CIVE498 | Senior Design Project II | 3 cr. |
| XXX xxx | Science Elective* | 3 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. Students must select a total of six credits from this list. Technical electives must be at 300-level or 400-level, and at most three credits may be Undergraduate Research. 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.

| | | |
|---|---|---|
| CIVE377/ 477 | Undergraduate Research | 1-3 cr.3cr. |
| CIVE450 | Coastal Engineering | 3 cr. |
| CIVE455 | Blast Effects and Modern Protective Infrastructures | 3 cr. |
| CIVE463 | Water and Wastewater Treatment Technologies | 3 cr. |
| CIVE465 | Ground and Surface Water Hydrology and Contaminant Transport | 3 cr. |
| CIVE469 | Air Pollution Control | 3 cr. |
| CIVE472 | Pavements Design and Maintenance | 3 cr. |
| CIVE473 | Structural Building Design | 3 cr. |
| CIVE475 | Earth Structures: Embankments, Slopes and Buried Structures | 3 cr. |
| CIVE480 | Project Management and Contract Administration | 3 cr. |
| CIVE482 | Project Control and Life Cycle Execution of Constructed Facilities | 3 cr. |
| CIVE484 | Project Planning, Scheduling and Control | 3 cr. |
| CIVE485 | Construction Project Management | 3 cr. |
| CIVE488 | Advanced Construction Management | 3 cr. |
| CIVE492 | Urban Transit Planning and Operations | 3 cr. |
| CIVE493 | Airport Planning and Traffic Management | 3 cr. |
| CIVE495 | Special Topics in Civil Engineering | 3 cr. |

**Free Electives (3 credits)**

Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Civil Engineering Tracks (optional)**

Civil Engineering students may select one of two available tracks and enroll on appropriately selected technical electives. The two tracks are:

- Infra-Structural Engineering
- Environmental Engineering

Both tracks require students to replace the two Technical Electives (6 credits) and the Free Elective (3 credits) in the program with 9 credits of department-approved courses related to the selected track. The following is the currently approved list of courses in each track.

**Infra-Structural Engineering Track**

| | | |
|---|---|---|
| CIVE 450 | Coastal Engineering | 3 cr. |
| CIVE 455 | Blast Effects & Modern Protective Infrastructures | 3 cr. |
| CIVE 472 | Pavements Design and Maintenance | 3 cr. |
| CIVE 473 | Structural Building Design | 3 cr. |
| CIVE 475 | Earth Structures: Embankments, Slopes and Buried Structures | 3 cr. |
| CIVE 484 | Project Planning, Scheduling and Control | 3 cr. |

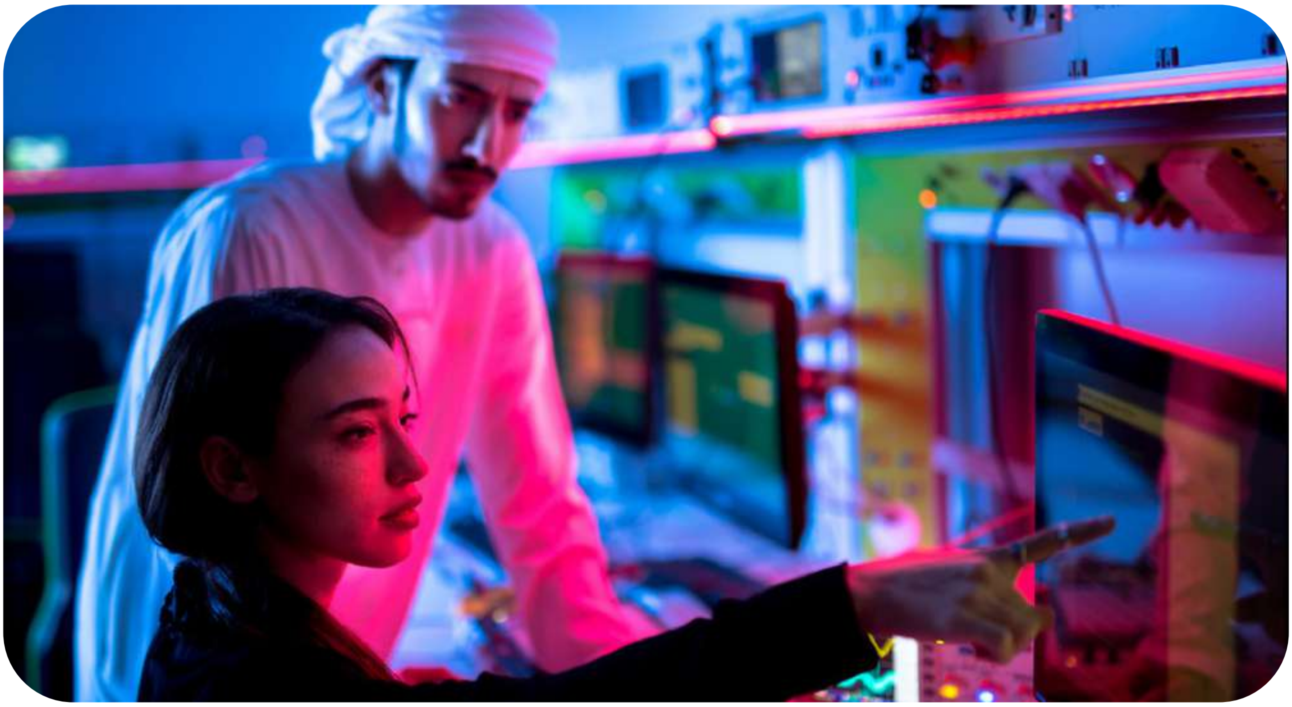
**Environmental Engineering Track**

| | | |
|---|---|---|
| CIVE 463 | Water and Wastewater Treatment Technologies | 3 cr. |
| CIVE 465 | Ground and Surface Water Hydrology and Contaminant Transport | 3 cr. |
| CIVE 469 | Air Pollution Control | 3 cr. |
| CIVE 484 | Project Planning, Scheduling and Control | 3 cr. |

Typical Course Sequence for **BSc in Civil Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| YEAR 1 | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| YEAR 1 | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| YEAR 1 | GENS 101 Grand Challenges | 4 cr | ENGR 113 Introduction to Computing with Matlab | 4 cr |
| S | HUMA XXX Arabic Language Elective | 3 cr | | |
| YEAR 2 | MATH 204 Linear Algebra | 3 cr | MATH 206 Differential Equations | 3 cr |
| YEAR 2 | MATH 231 Calculus III | 3 cr | MATH 242 Intro to Probability & Statistics | 3 cr |
| YEAR 2 | PHYS 122 University Physics II | 4 cr | CIVE 201 Engineering Dynamics | 3 cr |
| YEAR 2 | CIVE 200 Statics | 3 cr | CIVE 225 Mechanics of Solids | 4 cr |
| YEAR 2 | CIVE 180 Engineering Graphics and Visualization | 3 cr | CIVE 310 Geomatics | 3 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | CIVE 332 Fundamentals of Construction Engineering and Management | 3 cr | CIVE 335 Fluid Mechanics | 4 cr |
| YEAR 3 | CIVE 336 Civil Engineering Materials | 4 cr | CIVE 338 Geotechnical Engineering | 4 cr |
| YEAR 3 | CIVE 340 Behavior & Analysis of Structures | 3 cr | CIVE 341 Design of Steel Structures | 3 cr |
| YEAR 3 | CIVE 330 Artificial Intelligence and Data Analytics in Civil Engineering | 3 cr | CIVE 380 Transportation Engineering | 3 cr |
| YEAR 3 | CIVE 370 Introduction to Environmental Engineering | 4 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr |
| YEAR 3 | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | BUSS XXX Business Elective | 3 cr | Science Elective | 3 cr |
| YEAR 4 | HUMA XXX UAE Studies Elective | 3 cr | CIVE 498 Senior Design Project II | 3 cr |
| YEAR 4 | CIVE 442 Design of Concrete Structures | 3 cr | Technical Elective | 3 cr |
| YEAR 4 | CIVE 470 Foundation Engineering | 4 cr | Technical Elective | 3 cr |
| YEAR 4 | CIVE 497 Senior Design Project I | 3 cr | Free Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 138 |

S SUMMER



## DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

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

EECS currently offers BSc degrees in Electrical Engineering, Computer Engineering (with an optional concentration in Software Systems), and Computer Science (with optional concentrations in Artificial Intelligence or Cybersecurity), as well as MSc and PhD programs in EECS. EECS encompasses diverse fields such as advanced communications and information systems, information security, e-services and networks, electrical energy systems and smart grids, embedded systems, and artificial intelligence to name a few.

EECS faculty collaborate with the many research institutes at the University on research related to artificial intelligence, robotics, communications, semiconductors, renewable and clean energy, etc. They also collaborate frequently with prestigious research laboratories around the world. EECS research is aligned with the 2030 Abu Dhabi strategic plan, which calls for diversification of the economy beyond oil and gas and promotes innovation, entrepreneurship and spinoffs in the semiconductor, energy, and ICT sectors, among others.

All EECS programs offer many benefits to businesses and industries. 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 and; affiliates have early access to student resumes, as well as 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 EECS department, whose vision is to achieve a world-class stature and become the premier technology hub in the Gulf region.

## BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

The BSc in Computer Engineering program is concerned with the design and development of computers and computer-based systems. It involves the study of hardware, software, and networking. The program 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. The BSc in Computer Engineering program also gives students the opportunity to select a concentration in Software Systems.

**Program Educational Objectives**

- Graduates would meet the expectations of Employers and the Society for timely and relevant technical knowledge and competencies, for careers and potential leadership related to their fields.
- Graduates would be able to pursue advanced studies or professional growth through continuous learning and adaptation to technological advancement and the changing needs of their professions.

**Student Learning Outcomes**

Students graduating with a BSc in Computer Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

The Computer Engineering Program laboratories include:

- Analog Electronics Laboratory
- Digital & Embedded Systems Laboratory
- Computer Networks Laboratory
- Software Engineering Laboratory
- Power Systems Laboratory
- Projects Laboratory
- Communication Systems Laboratory
- Control System Laboratory

**Degree Requirements**

To be recommended for graduation with a BSc in Computer Engineering degree, students must successfully complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), the College of Engineering Requirements (CER, 21 credits), as well as Computer Engineering Core (54 credits), Free Electives (3 credits) and Technical Electives requirements (12 credits). Students may also opt for the degree concentration in Software Systems.

**Additional Math/Sciences Requirements (15 credits)**

in addition to the CER 18 credits, To satisfy the College of Engineering Requirements, the BSc in Computer Engineering requires one more additional math course of 3 credits.  The following Math courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH232 | Engineering Mathematics | 3 cr. |
| MATH234 | Discrete Mathematics | 3 cr. |
| MATH243 | Probability and Statistical Inference | 3 cr. |

**Computer Engineering Core Requirements (54 credits)**

| | | |
|---|---|---|
| ECCE210 | Digital Logic Design | 4 cr. |
| ECCE221 | Electric Circuits I | 4 cr. |
| ECCE230 | Object Oriented Programming | 4 cr. |
| ECCE302 | Signals and Systems | 3 cr. |
| ECCE312 | Electronic Circuits and Devices | 4 cr. |
| ECCE316 | Microprocessor Systems | 4 cr. |
| ECCE336 | Introduction to Software Engineering | 3 cr. |
| ECCE342 | Data Structures and Algorithms | 3 cr. |
| ECCE350 | Computer Architecture and Organization | 3 cr. |
| ECCE354 | Operating Systems | 3 cr. |
| ECCE356 | Computer Networks | 4 cr. |
| ECCE434 | Database Systems | 3 cr. |
| ECCE450 | Embedded Systems | 3 cr. |
| ECCE497 | Senior Design Project I | 3 cr. |
| ECCE498 | Senior Design Project II | 3 cr. |
| COSC330 | Introduction to Artificial Intelligence | 3 cr. |

**Computer Engineering Technical Electives (12 credits)**
Students are required to take a total of 12 credits (four courses) from an approved technical electives list. Technical electives must be at 300-level or 400-level and at most three credits may be Undergraduate Research. Students can choose any course from the approved list of technical electives at the department to satisfy both their technical and/or free elective requirements as long as it is not a core requirement course in their program. Additional courses may be approved by the department as technical electives.

**Free Electives (3 credits)**
Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Computer Engineering Tracks (Optional)**
Computer engineering students may select one of two available tracks before selecting their technical electives. The two tracks are:

- Artificial Intelligence
- Cyber Security

All tracks require students to replace four technical electives (12 credits) with department-approved courses related to the selected track. The following courses are currently approved by the department for each track.

**Artificial Intelligence Track**

| | | |
|---|---|---|
| COSC 330 | Introduction to Artificial Intelligence | 3 cr. |
| COSC 430 | Data Analytics | 3 cr. |
| COSC 434 | Introduction to Machine Learning | 3 cr. |
| COSC 432 | Algorithmic Robotics | 3 cr. |

**Cyber Security Track**

| | | |
|---|---|---|
| ECCE 444 | Computer Security | 3 cr. |
| ECCE 446 | Network Security | 3 cr. |
| COSC 440 | Digital Forensics | 3 cr. |
| COSC 442 | Applied Cryptography | 3 cr. |

**Computer Engineering – Software Systems (Concentration)**

If students wish, they may select the Software Systems concentration before choosing the technical/free electives. Selecting a degree concentration at Khalifa University of Science and Technology leads to a specialization which will be specified the student's academic record (transcript).

The Software Systems concentration requires the student to replace all technical electives (9 credits) and the free elective (3 credits) with the following five courses (15 credits).

| | | |
|---|---|---|
| ECCE330 | System Analysis and Software Design | 3 cr. |
| ECCE432 | Introduction to Human Computer Interfaces | 3 cr. |
| ECCE436 | Software Testing and Quality Assurance | 3 cr. |
| ECCE438 | Software Architecture | 3 cr. |
| ECCE444 | Computer Security | 3 cr. |

Typical Course Sequence for a **BSc in Computer Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | ENGR 112 Introduction to Computing using C++ | 4 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | ECCE 210 Digital Logic Design | 4 cr | MATH 206 Differential Equations | 3 cr |
| | MATH 232 Engineering Mathematics | 3 cr | ECCE 336 Introduction to Software Engineering | 3 cr |
| | PHYS 122 University Physics II | 4 cr | MATH 243 Probability & Statistical Inference | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | ECCE 221 Electric Circuits I | 4 cr |
| | ECCE 230 Object-Oriented Programming | 4 cr | BUSS XXX Business Elective | 3 cr |
| S | HUMA XXX Arabic Language Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | COSC 330 Introduction to Artificial Intelligence | 3 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 4 cr |
| | ECCE 302 Signals and Systems | 3 cr | ECCE 354 Operating Systems | 4 cr |
| | ECCE 350 Computer Architecture and Organization | 3 cr | ECCE 356 Computer Networks | 3 cr |
| | MATH 234 Discrete Mathematics | 3 cr | ECCE 312 Electronic Circuits and Devices | 3 cr |
| | ECCE 316 Microprocessor Systems | 4 cr | ECCE 342 Data Structures and Algorithms | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | ECCE 450 Embedded Systems | 3 cr | HUMA XXX UAE Studies Elective | 3 cr |
| | ECCE 434 Database Systems | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Free Elective | 3 cr |
| | ECCE 497 Senior Design Project I | 3 cr | ECCE 498 Senior Design Project II | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 138 |

S SUMMER

Typical Course Sequence for **BSc in Computer Engineering** with Software Systems Concentration

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | ENGR 112 Introduction to Computing using C++ | 4 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | ECCE 210 Digital Logic Design | 4 cr | MATH 206 Differential Equations | 3 cr |
| | MATH 232 Engineering Mathematics | 3 cr | ECCE 336 Introduction to Software Engineering | 3 cr |
| | PHYS 122 University Physics II | 4 cr | MATH 243 Probability & Statistical Inference | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | ECCE 221 Electric Circuits I | 4 cr |
| | ECCE 230 Object-Oriented Programming | 4 cr | BUSS XXX Business Elective | 3 cr |
| S | HUMA XXX Arabic Language Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | COSC 330 Introduction to Artificial Intelligence | 3 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr |
| | ECCE 302 Signals and Systems | 3 cr | ECCE 354 Operating Systems | 3 cr |
| | ECCE 350 Computer Architecture and Organization | 3 cr | ECCE 356 Computer Networks | 4 cr |
| | MATH 234 Discrete Mathematics | 3 cr | ECCE 312 Electronic Circuits and Devices | 4 cr |
| | ECCE 316 Microprocessor Systems | 4 cr | ECCE 342 Data Structures and Algorithms | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | ECCE 330 System Analysis and Design | 3 cr | HUMA XXX UAE Studies Elective | 3 cr |
| | ECCE 450 Embedded Systems | 3 cr | ECCE 436 Software Testing and Quality Assurance | 3 cr |
| | ECCE 434 Database Systems | 3 cr | ECCE 438 Software Architecture | 3 cr |
| | ECCE 444 Computer security | 3 cr | ECCE 432 Introduction to Human Computer Interfaces | 3 cr |
| | ECCE 497 Senior Design Project I | 3 cr | ECCE 498 Senior Design Project II | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 138 |

S SUMMER

## BACHELOR OF SCIENCE IN COMPUTER SCIENCE

The BSc in Computer Science program is concerned with the theoretical foundations of information and computation. Computation is defined as any type of calculation or use of computing technology that follows well-defined models (such as algorithms and protocols) in the practice of information processing. The study of computer science involves systematically studying, building, and testing methodical processes (such as algorithms) in order to aid the acquisition, representation, processing, storage, and communication of information. The program provides a strong understanding of the relationship between computer hardware and software and all related issues. It is key to many career opportunities in high-tech manufacturing, in software development, and in mobile and digital security. Students are offered opportunities to customize their education by selecting from a wide pool of technical elective courses.

**Program Educational Objectives**

The program's graduates are expected to be able to:

- Develop in their chosen profession and/or progress toward an advanced degree
- Gain the trust and respect of others as effective and ethical team members
- Achieve a reputation as a source of innovative solutions to complex problems in computer science and related areas; and
- Reach positions of leadership in an organization and/or on teams.

**Student Learning Outcomes**

Upon successful completion of the BSc in CS program, the graduates of the B.Sc. in Computer Science program will be able, without guidance, to:

| | |
|---|---|
| (1) | Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions. |
| (2) | Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of computer science. |
| (3) | Communicate effectively in a variety of professional contexts. |
| (4) | Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. |
| (5) | Function effectively as a member or leader of a team engaged in activities appropriate to computer science. |
| (6) | Apply computer science theory and software development fundamentals to produce computing-based solutions. |

**Career Opportunities**

Computer Scientists usually work in research laboratories that design, build and test various types of computer software models. Most work in high-tech manufacturing firms in the software development, mobile and digital security industries. There are also computer systems opportunities in design firms, research and development firms, or in governmental bodies such as defense, armed forces, police, health care and information technology (IT).

**Career Specialization**

Some indicative career specializations include:

- Artificial Intelligence
- Cloud Computing
- Data Mining and Business Intelligence
- Game Development
- Digital Security/Cryptography
- Mobile Applications Development
- Robotics
- Software development & Testing
- Virtualization
- Web and Multimedia Design

**Degree Requirements**

To be recommended for graduation with a BSc in Computer Science degree, students must successfully complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), the College of Engineering Requirements (CER, 18 credits), as well as Computer Science Core (53 credits), Free Electives (6 credits), and Technical Electives requirements (9 credits). The normal length of the program is 134 credits. Students may also opt for a concentration in Artificial Intelligence or Cybersecurity.

**Additional Math/Sciences Requirements (12 credits)**

To satisfy the College of Engineering Requirements, the BSc in Computer Science requires the following courses in addition to the Math/Sciences required in GERs: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH234 | Discrete Mathematics | 3 cr. |
| MATH243 | Probability and Statistical Inference | 3 cr. |
| COSC 301 | Automata, Computability, and Complexity | 3 cr. |

**Computer Science Core Requirements (53 credits)**

| | | |
|---|---|---|
| COSC 101 | Foundations of Computer Science | 3 cr. |
| COSC 201 | Computer Systems Organization | 3 cr. |
| ECCE 230 | Object Oriented Programming | 4 cr. |
| ECCE 336 | Introduction to Software Engineering | 3 cr. |
| COSC 310 | Data Structures | 3 cr. |
| COSC 312 | Design and Analysis of Algorithms | 3 cr. |
| COSC 320 | Concepts of Programming Languages | 3 cr. |
| COSC XXX | Artificial Intelligence Concentration course | 3 cr. |
| COSC XXX | Cybersecurity Concentration course | 3 cr. |
| ECCE 354 | Operating Systems | 3 cr. |
| ECCE 356 | Computer Networks | 4 cr. |
| COSC 410 | Parallel and Distributed Computing | 3 cr. |
| COSC 452 | Human-Computer Interaction | 3 cr. |
| ECCE 434 | Database Systems | 3 cr. |
| ECCE 436 | Software Testing and Quality Assurance | 3 cr. |
| COSC 497 | Senior Design Project I | 3 cr. |
| COSC 498 | Senior Design Project II | 3 cr. |

**Computer Science Technical Electives (9 credits)**

Students are required to take a total of 9 credits from the following approved technical electives list. Technical electives must be at 300-level or 400-level and at most three credits may be Undergraduate Research. Additional courses may be approved by the department as technical electives.

| | | |
|---|---|---|
| COSC 377/ 477 | Undergraduate Research | 1-3 cr. |
| COSC 401 | Computational Social Science | 3 cr. |
| COSC 412 | Numerical Computing | 3 cr. |
| COSC 430 | Data Analytics | 3 cr. |
| COSC 432 | Algorithmic Robotics | 3 cr. |
| COSC 434 | Introduction to Machine Learning | 3 cr. |
| COSC 440 | Digital Forensics | 3 cr. |
| COSC 442 | Applied Cryptography | 3 cr. |
| COSC 454 | Computer Graphics | 3 cr. |
| COSC 460 | Bioinformatics and Genomic Data Science | 3 cr. |
| COSC 462 | Mobile and Web Applications Development | 3 cr. |
| COSC 464 | Natural Language Processing | 3 cr. |
| ECCE 446 | Network Security | 3 cr. |
| ECCE 448 | Cloud Infrastructure and Services | 3 cr. |
| COSC 495 | Special Topics in Computer Science | 3 cr. |

**Free Electives (6 credits)**

Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Computer Science Concentrations (Optional)**

Computer Science students may opt for selecting a concentration in either Artificial Intelligence or Cyber Security. Selecting a degree concentration at Khalifa University leads to a specialization which will be specified on the student's academic record (transcript). A concentration consists of 15 credits in the specialized area. The student can replace all technical and free electives credits in the major in order to meet the concentration requirement.

**Artificial Intelligence Concentration**

| | | |
|---|---|---|
| COSC 330 | Introduction to Artificial Intelligence | 3 cr. |
| COSC 430 | Data Analytics | 3 cr. |
| COSC 434 | Introduction to Machine Learning | 3 cr. |
| COSC 432 | Algorithmic Robotics | 3 cr. |
| COSC XXX | Artificial Intelligence Elective* | 3cr. |

*from an approved list of courses.

**Cyber Security Concentration**

| | | |
|---|---|---|
| COSC 340 | Introduction to Computer Security | 3 cr. |
| ECCE 446 | Network Security | 3 cr. |
| COSC 440 | Digital Forensics | 3 cr. |
| COSC 442 | Applied Cryptography | 3 cr. |
| ECCE 448 | Cloud Infrastructure and Services | 3cr. |

Typical Course Sequence for a **BSc in Computer Science**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | PHYS 121 University Physics I | 4 cr |
| | ENGR 112 Introduction to Computing with C++ | 4 cr | COSC 101 Foundations of Computer Science | 3 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | PHYS 122 University Physics II | 4 cr | CHEM 115 General Chemistry | 4 cr |
| | HUMA XXX Arabic Language Elective | 3 cr | BUSS XXX Business Elective | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | MATH 242 Introduction to Probability and Statistics | 3 cr |
| | MATH 234 Discrete Mathematics | 3 cr | COSC 201 Computer Systems Organization | 3 cr |
| | ECCE 230 Object Oriented Programming | 4 cr | ECCE 336 Introduction to Software Engineering | 3 cr |
| S | HUMA XXX UAE Studies Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | ECCE 356 Computer Networks | 3 cr |
| | COSC 301 Automata, Computability, and Complexity | 3 cr | COSC 312 Design and Analysis of Algorithms | 3 cr |
| | COSC 310 Data Structures | 3 cr | COSC 320 Concepts of Programming Languages | 3 cr |
| | ECCE 354 Operating Systems | 4 cr | COSC 330 Introduction to Artificial Intelligence | 3 cr |
| | Free Elective | 3 cr | COSC 340 Introduction to Computer Security | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | COSC 497 Senior Design Project I | 3 cr | COSC 498 Senior Design Project II | 3 cr |
| | ECCE 434 Database Systems | 3 cr | Free Elective | 3 cr |
| | ECCE 436 Software Testing and Quality Assurance | 3 cr | COSC 452 Human-Computer Interaction | 3 cr |
| | COSC 410 Parallel and Distributed Computing | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Technical Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 134 |

S SUMMER

Typical Course Sequence for **BSc in Computer Science with Artificial Intelligence Concentration**

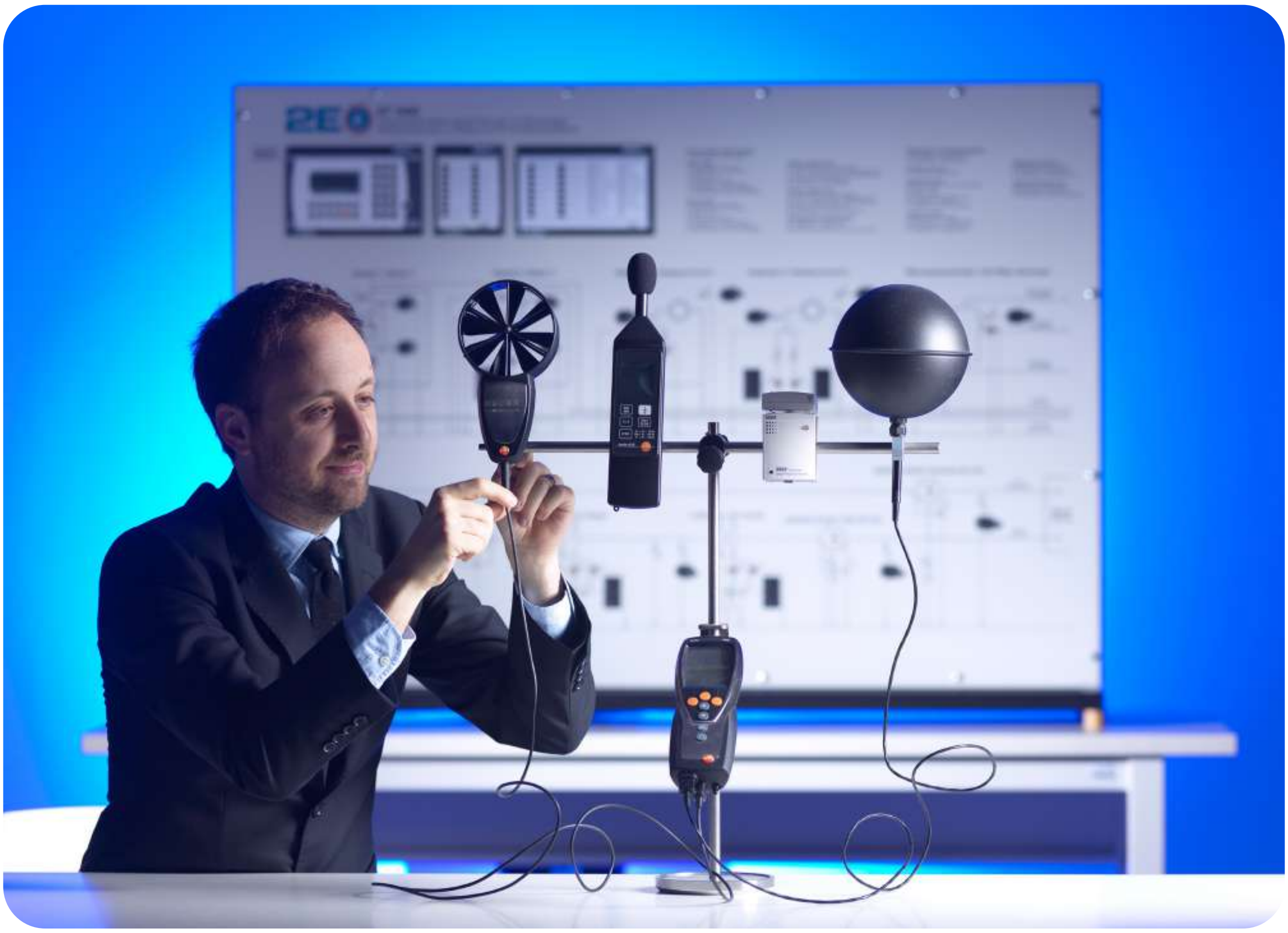
| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | PHYS 121 University Physics I | 4 cr |
| | ENGR 112 Introduction to Computing with C++ | 4 cr | COSC 101 Foundations of Computer Science | 3 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | PHYS 122 University Physics II | 4 cr | CHEM 115 General Chemistry | 4 cr |
| | HUMA XXX Arabic Language Elective | 3 cr | BUSS XXX Business Elective | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | MATH 242 Introduction to Probability and Statistics | 3 cr |
| | MATH 234 Discrete Mathematics | 3 cr | COSC 201 Computer Systems Organization | 3 cr |
| | ECCE 230 Object Oriented Programming | 4 cr | ECCE 336 Introduction to Software Engineering | 3 cr |
| S | HUMA XXX UAE Studies Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | ECCE 356 Computer Networks | 3 cr |
| | COSC 301 Automata, Computability, and Complexity | 3 cr | COSC 312 Design and Analysis of Algorithms | 3 cr |
| | COSC 310 Data Structures | 3 cr | COSC 320 Concepts of Programming Languages | 3 cr |
| | ECCE 354 Operating Systems | 4 cr | COSC 330 Introduction to Artificial Intelligence | 3 cr |
| | Free Elective | 3 cr | COSC 340 Introduction to Computer Security | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | COSC 497 Senior Design Project I | 3 cr | COSC 498 Senior Design Project II | 3 cr |
| | ECCE 434 Database Systems | 3 cr | COSC XXX Artificial Intelligence Elective | 3 cr |
| | ECCE 436 Software Testing and Quality Assurance | 3 cr | COSC 452 Human-Computer Interaction | 3 cr |
| | COSC 410 Parallel and Distributed Computing | 3 cr | COSC 434 Introduction to Machine Learning | 3 cr |
| | COSC 432 Algorithmic Robotics | 3 cr | COSC 430 Data Analytics | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 134 |

S SUMMER

Typical Course Sequence for **BSc in Computer Science with Cybersecurity Concentration**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | PHYS 121 University Physics I | 4 cr |
| | ENGR 112 Introduction to Computing with C++ | 4 cr | COSC 101 Foundations of Computer Science | 3 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | PHYS 122 University Physics II | 4 cr | CHEM 115 General Chemistry | 4 cr |
| | HUMA XXX Arabic Language Elective | 3 cr | BUSS XXX Business Elective | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | MATH 242 Introduction to Probability and Statistics | 3 cr |
| | MATH 234 Discrete Mathematics | 3 cr | COSC 201 Computer Systems Organization | 3 cr |
| | ECCE 230 Object Oriented Programming | 4 cr | ECCE 336 Introduction to Software Engineering | 3 cr |
| S | HUMA XXX UAE Studies Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | ECCE 356 Computer Networks | 3 cr |
| | COSC 301 Automata, Computability, and Complexity | 3 cr | COSC 312 Design and Analysis of Algorithms | 3 cr |
| | COSC 310 Data Structures | 3 cr | COSC 320 Concepts of Programming Languages | 3 cr |
| | ECCE 354 Operating Systems | 4 cr | COSC 330 Introduction to Artificial Intelligence | 3 cr |
| | Free Elective | 3 cr | COSC 340 Introduction to Computer Security | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | COSC 497 Senior Design Project I | 3 cr | COSC 498 Senior Design Project II | 3 cr |
| | ECCE 434 Database Systems | 3 cr | ECCE 446 Network Security | 3 cr |
| | ECCE 436 Software Testing and Quality Assurance | 3 cr | COSC 452 Human-Computer Interaction | 3 cr |
| | COSC 410 Parallel and Distributed Computing | 3 cr | COSC 440 Digital Forensics | 3 cr |
| | ECCE 448 Cloud Infrastructure and Services | 3 cr | COSC 442 Applied Cryptography | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 134 |

S SUMMER



## BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

The BSc in Electrical Engineering program offers students a 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 students the opportunity to select technical electives from a large pool of courses in order to specialize in certain areas.

Electrical systems are at the heart of the new industrial revolution and they affect 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 the UAE because of the new and growing electrical and electronics industries.

**Program Educational Objectives**

- Graduates would meet the expectations of Employers and the Society for timely and relevant technical knowledge and competencies, for careers and potential leadership related to their fields.
- Graduates would be able to pursue advanced studies or professional growth through continuous learning and adaptation to technological advancement and the changing needs of their professions.

**Student Learning Outcomes**

Students graduating with a BSc in Electrical Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (6) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

The Electrical Engineering Program laboratories include:

- Analog Electronics Laboratory
- Computer Simulation Laboratory
- Digital & Embedded Systems Laboratory
- Electric Circuits Laboratory
- Electric Machines Laboratory
- Feedback Control Laboratory
- High Voltage Laboratory
- Industrial Automation Laboratory
- Microcontrollers Laboratory
- Measurements and Instrumentation Laboratory
- Computer Networks Laboratory
- Power Systems Laboratory
- Projects Laboratory
- Renewable Energy Laboratory
- Communication Systems Laboratory

**Degree Requirements**

To be recommended for graduation with a BSc in Electrical Engineering, students must successfully complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), the College of Engineering Requirements (CER, 18 credits), as well as Electrical Engineering Core (51 credits) and Major (3 credits), Free Electives (3 credits), and Technical Electives requirements (15 credits). The normal length of the program is 138 credits.

**Additional Math/Sciences Requirements (12 credits)**

To satisfy the College of Engineering Requirements, the BSc in Electrical Engineering requires the following Math courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH232 | Engineering Mathematics | 3 cr. |
| MATH243 | Probability and Statistical Inference | 3 cr. |

**Electrical Engineering Core Requirements (51 credits)**

| | | |
|---|---|---|
| ECCE210 | Digital Logic Design | 4 cr. |
| ECCE221 | Electric Circuits I | 4 cr. |
| ECCE222 | Electric Circuits II | 4 cr. |
| ECCE230 | Object Oriented Programming | 4 cr. |
| ECCE302 | Signals and Systems | 3 cr. |
| ECCE312 | Electronic Circuits and Devices | 4 cr. |
| ECCE316 | Microprocessor Systems | 4 cr. |
| ECCE320 | Applied Electromagnetics | 3 cr. |
| ECCE322 | Electrical Machines | 4 cr. |
| ECCE323 | Feedback Control Systems | 4 cr. |
| ECCE360 | Communication Systems | 4 cr. |
| ECCE497 | Senior Design Project I | 3 cr. |
| ECCE498 | Senior Design Project II | 3 cr. |
| COSC 330 | Introduction to Artificial Intelligence | 3 cr. |

**Electrical Engineering Major Elective (3 credits)**
Students are required to select, in consultation with their advisor, one of four courses for their major elective, which are important in various specialization areas. These four courses are:

| | |
|---|---|
| ECCE402 | Digital Signal Processing |
| ECCE406 | Instrumentation and Measurements |
| ECCE411 | Analog Integrated Circuits Design |
| ECCE421 | Power Systems Analysis |

**Electrical Engineering Technical Electives (15 credits)**
Students are required to take a total of 15 credits (five courses) from an approved technical electives list. Technical electives may be at 300-level or 400-level and at most three credits may be undergraduate research. Students can choose any course from the approved list to satisfy both their technical and/or free elective requirements as long as it is not a core requirement course in their program. Additional courses may be approved by the department as technical electives.

**Free Electives (3 credits)**
Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Electrical Engineering Tracks – (Optional)**
Electrical Engineering students may select one of four available tracks before selecting their technical electives. The four tracks are:
- Electronics
- Communications
- Power Systems
- Control and Instrumentation

All tracks require students to replace three technical electives (9 credits) with department-approved courses related to the selected track. The following courses are currently approved by the department for each track.

**Electronics Track**

| | | |
|---|---|---|
| ECCE 326 | Introduction to Semiconductor Devices | 4 cr. |
| ECCE 404 | Microwave Circuits and Devices | 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 450 | Embedded Systems | 3 cr. |

**Communications Track**

| | | |
|---|---|---|
| ECCE 362 | Digital Communications I | 3 cr. |
| ECCE 402 | Digital Signal Processing | 3 cr. |
| ECCE 460 | Wireless Communications | 3 cr. |
| ECCE 461 | Advanced Digital Communications | 3 cr. |
| ECCE 462 | Communication Systems Design and Prototyping | 3 cr. |
| ECCE 463 | Information and Coding Theory | 3 cr. |
| ECCE 470 | Antennas and Propagation | 3 cr. |
| ECCE 472 | Optical Communications and Networks | 3 cr. |
| ECCE 481 | Wireless Sensor Networks and Internet of Things | 3 cr. |
| ECCE 484 | Satellite and Space Communications | 3 cr. |

**Power Systems Track**

| | | |
|---|---|---|
| ECCE 421 | Power System Analysis | 3 cr. |
| ECCE 422 | High Voltage Engineering | 3 cr. |
| ECCE 423 | Power Electronics | 3 cr. |
| ECCE 424 | Electrical Power Distribution Systems | 3 cr. |
| ECCE 425 | Power System Stability and Control | 3 cr. |
| ECCE 426 | Power Electronics for Renewables Integration | 3 cr. |
| ECCE 427 | Power System Protection | 3 cr. |

**Control and Instrumentation Track**

| | | |
|---|---|---|
| ECCE 402 | Digital Signal Processing | 3 cr. |
| ECCE 406 | Instrumentation and Measurements | 3 cr. |
| ECCE 420 | Industrial Automation | 3 cr. |
| ECCE 428 | Modern Control Systems | 3 cr. |
| ECCE 429 | Digital Control Systems | 3 cr. |

Typical Course Sequence for **BSc in Electrical Engineering**

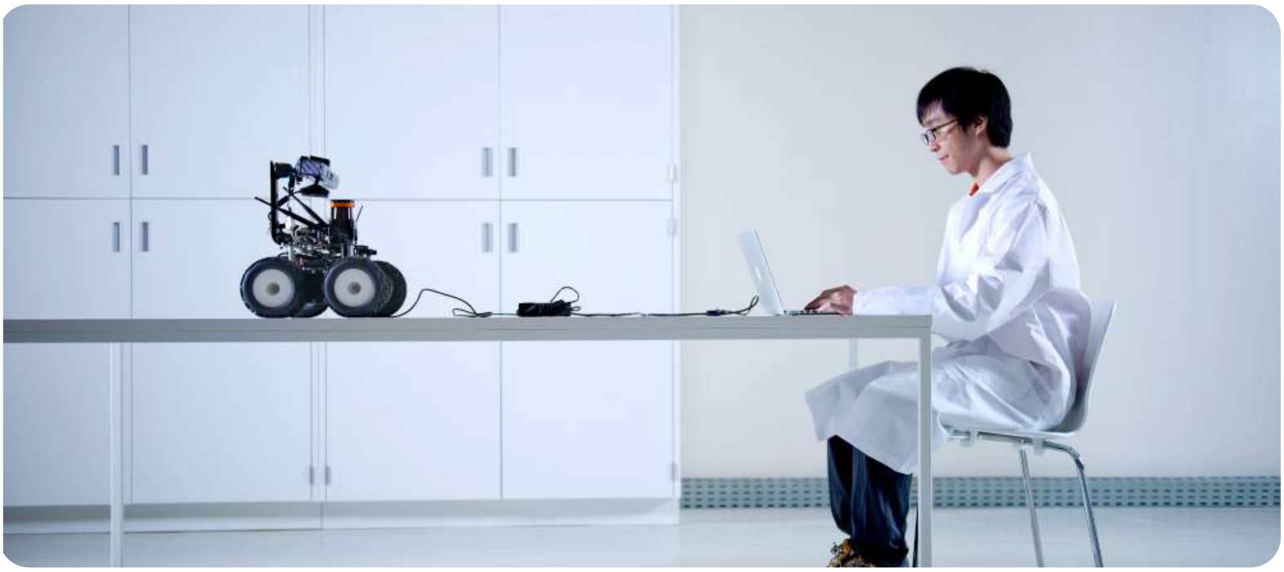
| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | ENGR 113 Introduction to Computing using Matlab | 4 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | MATH 232 Engineering Mathematics | 3 cr | MATH 206 Differential Equations | 3 cr |
| | PHYS 122 University Physics II | 4 cr | MATH 243 Probability & Statistical Inference | 3 cr |
| | MATH 204 Linear Algebra | 3 cr | ECCE 210 Digital Logic Design | 4 cr |
| | ECCE 221 Electric Circuits I | 4 cr | ECCE 222 Electric Circuits II | 4 cr |
| | ECCE 230 Object-Oriented Programming | 4 cr | ECCE 320 Applied Electromagnetics | 3 cr |
| S | BUSS XXX Business Elective | 3 cr | | |
| YEAR 3 | COSC 330 Introduction to Artificial Intelligence | 3 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr |
| | ECCE 302 Signals and Systems | 3 cr | ECCE 323 Feedback Control Systems | 4 cr |
| | ECCE 312 Electronic Circuits and Devices | 4 cr | HUMA XXX Arabic Language Elective | 3 cr |
| | ECCE 322 Electrical Machines | 4 cr | ECCE 316 Microprocessor Systems | 4 cr |
| | ECCE 360 Communication Systems | 4 cr | ECCE XXX Major Elective | 3 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | Technical Elective | 3 cr | Free Elective | 3 cr |
| | Technical Elective | 3 cr | Technical Elective | 3 cr |
| | HUMA XXX UAE Studies Elective | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| | ECCE 497 Senior Design Project I | 3 cr | ECCE 498 Senior Design Project II | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 138 |

S SUMMER

**List of approved Electrical and Computer Engineering Technical Electives:**

| | | |
|---|---|---|
| COSC330 | Introduction to Artificial Intelligence | 3 cr. |
| COSC430 | Data Analytics | 3 cr. |
| COSC432 | Algorithmic Robotics | 3 cr. |
| COSC434 | Introduction to Machine Learning | 3 cr. |
| COSC440 | Digital Forensics | 3 cr. |
| COSC442 | Applied Cryptography | 3 cr. |
| ECCE326 | Introduction to Semiconductor Devices | 4 cr. |
| ECCE330 | System Analysis and Software Design | 3 cr. |
| ECCE336 | Introduction to Software Engineering | 3 cr. |
| ECCE341 | Java and Network Programming | 3 cr. |
| ECCE350 | Computer Architecture and Organization | 3 cr. |
| ECCE362 | Digital Communications I | 3 cr. |
| ECCE377/ 477 | Undergraduate Research | 1-3 cr. |
| ECCE401 | Filter Synthesis | 3 cr. |
| ECCE402 | Digital Signal Processing | 3 cr. |
| ECCE404 | Microwave Circuits and Devices | 3 cr. |
| ECCE406 | Instrumentation and Measurements | 3 cr. |
| ECCE408 | Digital Systems Design | 3 cr. |
| ECCE410 | VLSI Systems Design | 3 cr. |
| ECCE411 | Analog Integrated Circuits Design | 3 cr. |
| ECCE420 | Industrial Automation | 3 cr. |
| ECCE421 | Power System Analysis | 3 cr. |
| ECCE422 | High Voltage Engineering | 3 cr. |
| ECCE423 | Power Electronics | 3 cr. |
| ECCE424 | Electrical Power Distribution Systems | 3 cr. |
| ECCE425 | Power System Stability and Control | 3 cr. |
| ECCE426 | Power Electronics for Renewables Integration | 3 cr. |
| ECCE427 | Power System Protection | 3 cr. |
| ECCE428 | Modern Control Systems | 3 cr. |
| ECCE429 | Digital Control Systems | 3 cr. |
| ECCE432 | Introduction to Human Computer Interfaces | 3 cr. |
| ECCE436 | Software Testing and Quality Assurance | 3 cr. |
| ECCE438 | Software Architecture | 3 cr. |
| ECCE440 | Distributed Systems | 3 cr. |
| ECCE444 | Computer SecurityS | 3 cr. |
| ECCE446 | Network Security | 3 cr. |
| ECCE448 | Cloud Infrastructure and Services | 3 cr. |

| | | |
|---|---|---|
| ECCE449 | iOS App Development | 3 cr. |
| ECCE450 | Embedded Systems | 3 cr. |
| ECCE454 | Artificial Intelligence | 3 cr. |
| ECCE456 | Image Processing and Analysis | 3 cr. |
| ECCE460 | Wireless Communications | 3 cr. |
| ECCE461 | Advanced Digital Communications | 3 cr. |
| ECCE462 | Communication Systems Design and Prototyping | 3 cr. |
| ECCE463 | Information and Coding Theory | 3 cr. |
| ECCE470 | Antennas and Propagation | 3 cr. |
| ECCE472 | Optical Communications and Networks | 3 cr. |
| ECCE481 | Wireless Sensor Networks and Internet of Things | 3 cr. |
| ECCE484 | Satellite and Space Communications | 3 cr. |
| ECCE495 | Special Topics in ECE | 3 cr. |



## MINOR IN ARTIFICIAL INTELLIGENCE

The EECS department offers a minor in Artificial Intelligence (AI) which is designed for non-Computer Engineering and non-Computer Science majors. It is open to all other engineering and science majors.

**Program Goal**

The goal of the Minor in AI program is to provide students with the needed AI knowledge and related skills to serve the UAE government agencies and industry in various engineering and science disciplines.

**Learning Outcomes**

A student graduating with a Minor in Artificial Intelligence will be able to:

- Design, implement, and evaluate AI-based solutions to meet a given set of engineering and computing requirements.
- Use techniques, skills, and tools necessary for AI-based solutions.

**Program Requirements**
The Minor in AI consists of 18 credit hours distributed as follows: 7 credits of Background courses; 6 credits of Core courses; 3 credits of an AI Elective course; and 2 credits of AI project.

**Background Courses**

| | |
|---|---|
| ECCE 230 Object Oriented Programming (or equivalent) | 4 |
| ECCE 342 Data Structures and Algorithms (or equivalent) | 3 |

**Core Courses**

| | |
|---|---|
| COSC 330 Introduction to Artificial Intelligence | 3 |
| COSC 434 Introduction to Machine Leaning | 3 |

**AI Elective courses (Choose one)**

| | |
|---|---|
| COSC 430 Data Analytics | 3 |
| COSC 432 Algorithmic Robotics | 3 |

**AI Project**

| | |
|---|---|
| COSC 496 Artificial Intelligence Project | 2 |

**Professional Chapters**
**IEEE Student Chapter**
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 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. Its mission is to be the definite article that merges all disciplines and activities into one big integrated multidisciplinary team of innovation and productivity.

The goals of the IEEE student chapter can be summarized as:
- Explain the importance of networking and resources through technical societies.
- Invite several qualified speakers to the campus from various backgrounds to share their experience and knowledge.
- Coordinate with the other student chapters of to conduct workshops, activities and conferences.

## DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

Industrial and systems engineers make decisions concerning the best utilization of people, material, equipment and energy to minimize costs and make 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 within 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 thinking of any business or enterprise. Their ability to function on multidisciplinary 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, and financial systems. Career specializations include: production and operations managers, process engineers, quality managers, operations research analysts, supply chain managers and healthcare managers.

## BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS ENGINEERING

BSc in Industrial and Systems Engineering program 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 Educational Objectives**

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

**Student Learning Outcomes**

- Students graduating with a BSc in Industrial and Systems Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

- Human Factors Laboratory
- Supply Chain Operations Laboratory
- Production Laboratory
- lab

**Professional Chapters**

**IISE Student Chapter**

The objectives of the Institute of Industrial and Systems Engineers (IISE) student chapter at the Khalifa University of Science and Technology (#671) is to promote the profession and practice 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 chapter 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 and Middle East and North Africa to network with future colleagues from other universities.

**Degree Requirements**

To be recommended for graduation with a BSc in Industrial and Systems Engineering, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 18 credits), as well as the Industrial and Systems Engineering Core (64 credits), Free Electives (3 credits), and Technical Electives (6 credits) requirements. The normal length of the program is 139 credits.

**Additional Math/Sciences Requirements (12 credits)**

To satisfy the College of Engineering Requirements, BSc in Industrial and Systems Engineering requires the following Math courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |
| MATH242 | Introduction to Probability and Statistics | 3 cr. |

**Industrial and Systems Engineering Core Requirements (64 credits)**

| | | |
|---|---|---|
| ISYE200 | Engineering Economic Analysis | 3 cr. |
| ISYE201 | Introduction to Industrial and Systems Engineering | 3 cr. |
| ISYE251 | Operations Research I | 4 cr. |
| ISYE271 | Modern Methods of Manufacturing | 4 cr. |
| ISYE311 | Quality & Reliability Engineering | 4 cr. |
| ISYE331 | Stochastic Processes | 3 cr. |
| ISYE341 | Simulation Modeling and Analysis | 4 cr. |
| ISYE351 | Production and Operations Management | 3 cr. |
| ISYE352 | Lean Manufacturing | 3 cr. |
| ISYE360 | Design for People | 4 cr. |
| ISYE361 | Data and Information Engineering | 3 cr. |
| ISYE362 | Systems Project Management | 3 cr. |
| ISYE430 | Supply Chain and Logistics | 4 cr. |
| ISYE440 | Fundamentals of Business Analytics | 3 cr. |
| ISYE451 | Operations Research II | 3 cr. |
| ISYE475 | Facilities Planning and Warehousing | 4 cr. |
| ISYE497 | Senior Design Project I | 3 cr. |
| ISYE498 | Senior Design Project II | 3 cr. |
| BUSS150 | Introduction to Economics | 3 cr. |

**Industrial and Systems Engineering Technical Course Electives 6 credits)**

The following is a sample list of courses that will satisfy the technical electives for the BSc in Industrial and Systems Engineering. Students must select a total of six credits from this list. Technical electives may be at 300-level or 400-level and at most three credits may be Undergraduate Research. 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.

| | | |
|---|---|---|
| ISYE377/ 477 | Undergraduate Research | 1-3 cr. |
| ISYE401 | Advanced Systems Engineering | 3 cr. |
| ISYE422 | Reliability | 3 cr. |
| ISYE431 | Time Series Forecasting | 3 cr. |
| ISYE432 | Advanced Stochastic Processes | 3 cr. |
| ISYE433 | Advanced Statistics | 3 cr. |
| ISYE441 | Advanced Simulation | 3 cr. |
| ISYE445 | Six-Sigma Methodology and Applications | 3 cr. |
| ISYE461 | Engineering Psychology | 3 cr. |
| ISYE480 | Financial Engineering | 3 cr. |
| ISYE481 | Procurement and Supply Management | 3 cr. |
| ISYE485 | Stochastic Manufacturing and Service Systems | 3 cr. |
| ISYE495 | Special Topics in Industrial and Systems Engineering | 3 cr. |

**Free Electives (3 credits)**

Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

**Industrial and Systems Engineering Track (optional)**

Industrial and Systems Engineering students may select an optional Operations & Data Analytics (ODA) track and enroll on appropriately selected technical electives.

In addition to the core ISYE courses, the students must select the following courses as technical electives:

1. 1) ISYE 440 Fundamentals of Business Analytics (3 credits)
2. 2) Two of the following courses
    a. ISYE 444 Healthcare Analytics and Management (3 credits)
    b. ISYE 445 Six Sigma Methodology and Applications (3 credits)
    c. SYE 441 Advanced Simulation (3 credits)

Students who completed the above courses are highly encouraged to apply their ODA knowledge in their SDP work.

Typical Course Sequence for **BSc in Industrial and Systems Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | ENGR 114 Introduction to Computing -Python | 4 cr |
| S | BUSS 150 Introduction to Economics | 3 cr | | |
| YEAR 2 | MATH 204 Linear Algebra | 3 cr | MATH 231 Calculus III | 3 cr |
| | MATH 242 Introduction to Probability and Statistics | 3 cr | ISYE 200 Engineering Economic Analysis | 3 cr |
| | PHYS 122 University Physics II | 4 cr | ISYE 251 Operations Research I | 4 cr |
| | ISYE 201 Intro to Industrial & Systems Engineering | 3 cr | ISYE 271 Modern Methods of Manufacturing | 4cr |
| | BUSS 201 Fundamentals of Accounting & Finance | 3 cr | MATH 206 Differential Equations | 3 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | HUMA XXX Arabic Language Elective | 3 cr |
| YEAR 3 | ISYE 311 Quality & Reliability Engineering | 4 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr |
| | ISYE 341 Simulation Modeling and Analysis | 4 cr | ISYE 362 Systems Project Management | 3 cr |
| | ISYE 351 Production and Operations Management | 3 cr | ISYE 331 Stochastic Processes | 3 cr |
| | ISYE 361 Data and Information Engineering | 3 cr | ISYE 352 Lean Manufacturing | 3 cr |
| | Free Elective | 3 cr | ISYE 360 Human Factors and Safety Engineering | 4 cr |
| | | | SDAS 300 Career Development | 0 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | ISYE 430 Supply Chain and Logistics | 4 cr | HUMA XXX UAE Studies Elective | 3 cr |
| | ISYE 440 Fundamentals of Business Analytics | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| | ISYE 451 Operations Research II | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | ISYE 475 Facilities Planning & Warehousing | 4 cr |
| | ISYE 497 Senior Design Project I | 3 cr | ISYE 498 Senior Design Project II | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 139 |

S SUMMER


## DEPARTMENT OF MECHANICAL ENGINEERING

Mechanical Engineering is the discipline that puts the laws of mechanics – classical, and at a rapidly increasing pace, modern- to work in order to design, construct, and operate engines, machines, devices, and processes that address societal and industrial needs. The underlying scientific fundamentals relate (but are not limited) to mechanics of solids and fluids, dynamics, control theory, thermodynamics, transport phenomena, materials science, and computational and applied mathematics. Mechanical engineers apply these scientific fundamentals in a wide variety of sectors of the economy which are of strategic importance to the UAE, such as energy and the environment, automation and robotics, manufacturing and structures, health and biomechanics, security, defense, and transportation.

## BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

The BSc in Mechanical Engineering program is designed to provide comprehensive engineering education for students interested in mechanics, thermo-fluids, manufacturing, and controls and automation. Complex mechanical systems involve structures, advanced materials, sensors, and thermo-fluid systems. 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 Educational Objectives**

- Graduates will meet the expectations of employers of mechanical engineers in the UAE and beyond.
- Qualified graduates will pursue advanced study if they so desire.
- Provide the students with adequate exposure to entrepreneurship and innovation in order to enable them to pursue entrepreneurial efforts upon graduation.

**Student Learning Outcomes**

Students graduating with a BSc in Mechanical Engineering will have attained the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

The Mechanical Engineering Program laboratories include:

- Composites Laboratory
- Computer Aided Design Laboratory
- Computer Simulation Laboratory
- Fluid Mechanics Laboratory
- Heat Transfer Laboratory
- Machine Workshop
- Manufacturing Laboratory
- Materials Testing Laboratory
- Measurement and Instrumentation Laboratory
- Mechatronics & Control Laboratories
- Robotics and Automation Laboratory
- Solid Mechanics Laboratory
- Technical Services Workshop

**Professional Chapters**

**ASME Student Chapter**

The American Society of Mechanical Engineering (ASME) student chapter serves to help students become more 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. It also seeks to offer online courses and workshops that develop engineering and communication skills.

**Degree Requirements**

To be recommended for graduation with a BSc in Mechanical Engineering degree, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), College of Engineering Requirements (CER, 18 credits), as well as the Mechanical Engineering Core and Technical Electives requirements. The normal length of the program is 138 credits.

**Additional Math/Sciences Requirements (12 credits)**

To satisfy the College of Engineering Requirements, the BSc in Mechanical Engineering requires the following Math courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112.

| | | |
|---|---|---|
| MATH204 | Linear Algebra | 3 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |
| MATH243 | Probability and Statistical Inference | 3 cr. |

**Mechanical Engineering Core Requirements (66 credits)**

| | | |
|---|---|---|
| MEEN180 | Computer Aided Design | 3 cr. |
| MEEN200 | Statics | 3 cr. |
| MEEN201 | Engineering Dynamics | 3 cr. |
| MEEN225 | Engineering Materials | 4 cr. |
| MEEN240 | Thermodynamics | 3 cr. |
| MEEN301 | Introduction to Artificial Intelligence and Its Applications in Mechanical Engineering | 3 cr. |
| MEEN325 | Mechanics of Solids | 4 cr. |
| MEEN335 | Fluid Mechanics | 4 cr. |
| MEEN343 | Heat Transfer | 4 cr. |
| MEEN350 | Dynamic Systems and Vibration | 3 cr. |
| MEEN356 | Computer Controlled Systems | 4 cr. |
| MEEN360 | Computational Methods for Mechanical Engineers | 3 cr. |
| MEEN370 | Introduction to Manufacturing Processes | 4 cr. |
| MEEN387 | Machine Element Design | 3 cr. |
| MEEN435 | Turbomachinery | 3 cr. |
| MEEN441 | Applied Thermodynamics | 3 cr. |
| MEEN455 | Finite Element Analysis | 3 cr. |
| MEEN484 | Mechatronics | 3 cr. |
| MEEN497 | Senior Design Project I | 3 cr. |
| MEEN498 | Senior Design Project II | 3 cr. |

**Mechanical Engineering Major/Technical Electives (6 credits)**

The following is a sample list of courses that will satisfy the major/technical electives for the BSc in Mechanical Engineering. A major elective is a course from the department with MEEN code. A technical elective is selected from an approved list and can be taken from another major. Major technical electives are at 300-level or 400-level. At most three credits may be Undergraduate Research. In addition, courses from the list below may be taken to satisfy the free elective requirement.

| | | |
|---|---|---|
| MEEN380 | Introduction to Polymer Science | 3 cr. |
| MEEN377/ 477 | Undergraduate Research | 1-3 cr. |
| MEEN405 | Vibration Analysis | 3 cr. |
| MEEN410 | Viscous and Boundary Layer Flows | 3 cr. |
| MEEN420 | Materials Strength and Fracture | 3 cr. |
| MEEN421 | Mechanics of Deformable Solids | 3 cr. |
| MEEN422 | Fatigue and Fracture Analysis | 3 cr. |
| MEEN423 | Physical Metallurgy | 3 cr. |
| MEEN439 | Machine Dynamics | 3 cr. |
| MEEN450 | Vehicle Engineering | 3 cr. |
| MEEN454 | Refrigeration, Air Conditioning &Cryogenics | 3 cr. |
| MEEN465 | Bioengineering | 3 cr. |
| MEEN485 | Introduction to Robotics | 3 cr. |
| MEEN486 | Sustainable Energy | 3 cr. |
| MEEN495 | Special Topics in Mechanical Engineering | 3 cr. |

Typical Course Sequence for **BSc in Mechanical Engineering**

| | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| YEAR 1 | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| YEAR 1 | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| YEAR 1 | GENS 101 Grand Challenges | 4 cr | ENGR 113 Introduction to Computing using Matlab | 4 cr |
| S | HUMA XXX Islamic Studies Elective | 3 cr | | |
| YEAR 2 | MEEN 180 Computer Aided Design | 3 cr | MEEN 201 Engineering Dynamics | 3 cr |
| YEAR 2 | PHYS 122 University Physics II | 4 cr | MEEN 225 Engineering Materials | 4 cr |
| YEAR 2 | MATH 231 Calculus III | 3 cr | MEEN 240 Thermodynamics | 3 cr |
| YEAR 2 | MATH 204 Linear Algebra | 3 cr | MATH 206 Differential Equations | 3 cr |
| YEAR 2 | MEEN 200 Statics | 3 cr | MATH 243 Probability and Statistical Inference | 3 cr |
| S | HUMA/BUSS XXX Humanities or Business Elective | 3 cr | | |
| YEAR 3 | MEEN 301 – Introduction to Artificial Intelligence and Its Applications in Mechanical Engineering | 3 cr | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr<br>4 cr |
| YEAR 3 | MEEN 325 Mechanics of Solids | 4 cr | MEEN 370 Introduction to Manufacturing Processes | 4 cr |
| YEAR 3 | MEEN 335 Fluid Mechanics | 4 cr | MEEN 343 Heat Transfer | 4 cr |
| YEAR 3 | MEEN 350 Dynamic Systems & Vibration | 3 cr | MEEN 356 Computer Controlled Systems | 3 cr |
| YEAR 3 | MEEN 360 Computational Methods for Mechanical Engineers | 3 cr | MEEN 387 Machine Element Design | |
| YEAR 3 | SDAS 300 Career Development | 0 cr | | |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | HUMA XXX Arabic Language Elective | 3 cr | HUMA XXX UAE Studies Elective | 3 cr |
| YEAR 4 | BUSS XXX Business Elective | 3 cr | MEEN 435 Turbomachinery | 3 cr |
| YEAR 4 | MEEN 455 Finite Element Analysis | 3 cr | MEEN 498 Senior Design Project II | 3 cr |
| YEAR 4 | MEEN 484 Mechatronics | 3 cr | MEEN XXX Major Elective | 3 cr |
| YEAR 4 | MEEN 441 Applied Thermodynamics | 3 cr | Technical Elective | 3 cr |
| YEAR 4 | MEEN 497 Senior Design Project I | 3 cr | | |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credits | 138 |

S SUMMER

**Minor in Mechatronics (Minimum 12 credits additional to Major)**

**Learning Outcomes**

a. Ability to design, implement, and evaluate mechatronics solutions to meet a given set of engineering and manufacturing requirements.
b. Ability to use techniques, skills, and tools necessary for mechatronics-based solutions.
c. Ability to synthesize and integrate mechatronics-based solutions for optimum implementation.

**Background Courses**

| | |
|---|---|
| ECCE 300 | Signals, Circuits and Communications |
| MEEN 300 | System Dynamics and Control |

**Core Courses**

| | |
|---|---|
| MEEN 484 | Mechatronics |
| MEEN 485 | Introduction to Robotics |
| MEEN 487 | Advanced Mechatronics |
| MEEN 488 | Mechatronics Systems Design |

**One Mechatronics Elective**

The Mechatronics Elective is a list of approved courses from the College of Engineering. The following list is currently approved.

| | |
|---|---|
| MEEN 489 | Kinematics and Dynamics of Machines |
| MEEN 405 | Vibration Analysis |
| MEEN 450 | Vehicle Engineering |
| AERO 402 | UAV Sensing |
| AERO 403 | UAV Navigation |
| AERO 404 | UAV Systems |
| AERO 450 | Flight Dynamics and Stability |
| AERO 465 | Space Dynamics and Control |
| ECCE 406 | Instrumentation and Measurements |
| ECCE 420 | Industrial Automation |
| ECCE 456 | Image Processing and Analysis |

## DEPARTMENT OF NUCLEAR ENGINEERING

The Department of Nuclear Engineering does not currently offer an undergraduate degree but students may choose the minor of nuclear engineering in many of the undergraduate degrees on offer at the Khalifa University of Science and Technology; although a minor in Nuclear Engineering is currently restricted to sponsored students from specific agencies. Interested students should check with the Registration Office to find out 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 nuclear engineering.

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:

1. Radiation Science and Health Physics
2. Nuclear Reactor Physics
3. Nuclear Systems and Operation

**Goals**

The goals of the program are:

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

**Learning Outcomes**

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

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Minor Requirements**

Students must take all five courses:

| | |
|---|---|
| NUCE301 Radiation Science and Health Physics | 3 cr. |
| NUCE303 Mechanics and Thermal-hydraulics Principles for Nuclear Engineering (or MEEN343 Heat Transfer.) | 3 cr. |
| NUCE 304 Evaluative Methods for Nuclear Non-proliferation and Security (MATH 242 or MATH 243 | 3 cr.<br>3 cr. |
| NUCE401 Introduction to Nuclear Reactor Physics | 3 cr. |
| NUCE402 Introduction to Nuclear Systems and Operation OR NUCE403 Introduction to Nuclear Technology and Reactor Systems | 3 cr. |

## DEPARTMENT OF PETROLEUM ENGINEERING

The Petroleum Engineering department aims to become a leading international center of excellence in education, training, research and professional service dedicated to serving the competence, training and technology development needs of the petroleum industry in general, and the Abu Dhabi National Oil Company (ADNOC) and other allied sponsors in particular. Our mission is to provide a platform for life-long learning while also emphasizing the importance of interdisciplinary approach, ethical conduct, and health, safety and environmental issues.

## BACHELOR OF SCIENCE IN PETROLEUM ENGINEERING

The BSc in Petroleum Engineering program has a modern and well-balanced curriculum that emphasizes not only petroleum engineering fundamentals but also the business processes applied to reach optimal engineering solutions for field development and operations.

This program is uniquely defined by well-equipped, state-of-the-art modern laboratory and computer facilities and access to local operating companies. The content of our courses, projects, and assignments are selected to help prepare graduates to launch their oil industry careers as willing and eager contributors. Students are well equipped with skills and knowledge of basic engineering and science, fundamental understandings of reservoir, well, and production and surface facilities.

**Program Educational Objectives**

The BSc in Petroleum Engineering aims to produce graduates who will be able to:

- Demonstrate highest levels of technical competencies, ethical commitments, and social responsibilities to serve the current and future needs of the society.
- Develop and establish themselves as competent professional Engineers in the Oil and Gas Industry to support energy sustainability at large.
- Engage in life-long learning and/or undertake graduate studies to contribute to knowledge creation and innovation.

**Student Learning Outcomes**

Students graduating with a BSc in Petroleum Engineering degree will attain the following:

| | |
|---|---|
| (1) | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. |
| (2) | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. |
| (3) | An ability to communicate effectively with a range of audiences. |
| (4) | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. |
| (5) | An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. |
| (6) | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. |
| (7) | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |

**Program Facilities**

The Petroleum Engineering Program laboratories include:

- Analytical Instrument Laboratory
- Core Preparation Laboratory
- Drilling Fluids Laboratory
- Drilling Simulation Laboratory
- Fluid Properties Laboratory
- Rock Mechanics Laboratory
- Rock Properties Laboratory
- Production and Facilities Laboratory

**Professional Chapters**

The Petroleum Engineering program is supported by a student chapter of the Society of Petroleum Engineers (SPE). Activities of the SPE student chapter are broadly divided into technical and social functions. Major technical activities include sponsoring students to conferences and Education Weeks organized annually by SPE in conjunction with major oil and gas conferences in the region, field trips, company visits, and technical presentations delivered by industry professionals. Students also participate in regional and international student paper contests where they can showcase their research skills, competing with other students for honors. Social activities include the annual Sports Day, dinners, dhow cruises, visits to other chapters, etc.

**Degree Requirements**

To be recommended for graduation with a BSc in Petroleum Engineering degree, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 48 credits), Introduction to Computing (4 credits), Engineering Internship (2 credits), and additional math/science courses (13 credits), as well as Petroleum Engineering Core, Technical and Free Electives requirements. The normal length of the program is 139 credits.

**Additional Math/Sciences Requirements (13 credits)**

To satisfy the College of Engineering Requirements, the BSc in Petroleum Engineering requires the following Math/Sciences courses in addition to the Math/Sciences required in GER: CHEM115, PHYS121, PHYS122, MATH111, and MATH112. The BSc. In Petroleum Engineering requires different math/sciences courses for a total of 13 credits.

| | | |
|---|---|---|
| CHEM116 | General Chemistry II | 4 cr. |
| MATH206 | Differential Equations | 3 cr. |
| MATH231 | Calculus III | 3 cr. |
| EPSS200 | Earth System Science | 3 cr. |

**Petroleum Engineering Core Requirements (57 credits)**

| | | |
|---|---|---|
| MEEN240 | Thermodynamics | 3 cr. |
| PEEG218 | Reservoir Rock Properties | 3 cr. |
| PEEG219 | Reservoir Fluid Properties | 3 cr. |
| PEEG252 | Statics and Mechanics of Materials for PE | 3 cr. |
| PEEG302 | Fluid Mechanics and Heat Transfer | 3 cr. |
| PEEG314 | Well Logging | 3 cr. |
| PEEG315 | Reservoir Characterization | 3 cr. |
| PEEG322 | Drilling Engineering I | 3 cr. |
| PEEG326 | Drilling Engineering II | 3 cr. |
| PEEG331 | Reservoir Engineering I | 3 cr. |
| PEEG336 | Well Testing | 3 cr. |
| PEEG341 | Completion and Work Over | 3 cr. |
| PEEG360 | Petroleum Economics and Risk Analysis | 4 cr. |
| PEEG434 | Reservoir Engineering II | 4 cr. |
| PEEG 447 | Production Engineering | 3 cr. |
| PEEG497 | Senior Design Project I | 3 cr. |
| PEEG498 | Senior Design Project II | 3 cr. |
| EPSS305 | Sedimentology | 4 cr. |

**Petroleum Engineering Technical Electives (12 credits)**

The following is a sample list of courses that will satisfy the technical electives of the BSc in Petroleum Engineering. Students must select a total of 12 credits from this list. Technical electives must be at 300-level or 400-level and at most three credits may be Undergraduate Research or Research Topics. 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.

| | | |
|---|---|---|
| PEEG420 | Well Treatment | 3 cr. |
| PEEG423 | Horizontal and Multilateral Well Technology | 3 cr. |
| PEEG424 | Underbalanced Drilling Technology | 3 cr. |
| PEEG425 | Pressure Control | 3 cr. |
| PEEG437 | Natural Gas Engineering | 3 cr. |
| PEEG 442 | Surface Production Facilities | 3 cr. |
| PEEG 443 | Production System Design and Analysis | 3 cr. |
| PEEG445 | Production Enhancement | 3 cr. |
| PEEG456 | Petroleum Related Rock Mechanics | 3 cr. |
| PEEG377/477 | Undergraduate Research | 1-3 cr. |
| PEEG394/494 | Research Topics in Petroleum Engineering | 1-3 cr. |
| PEEG395/495 | Special Topics in Petroleum Engineering | 1-3 cr. |

**Free Electives (3 credits)**

Students must complete 3 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

Typical Course Sequence for **BSc in Petroleum Engineering**

| Year | FALL | | SPRING | |
|---|---|---|---|---|
| YEAR 1 | ENGL 101 Academic English I | 3 cr | ENGL 102 Academic English II | 3 cr |
| | MATH 111 Calculus I | 4 cr | MATH 112 Calculus II | 4 cr |
| | CHEM 115 General Chemistry I | 4 cr | PHYS 121 University Physics I | 4 cr |
| | GENS 101 Grand Challenges | 4 cr | CHEM 116 General Chemistry II | 4 cr |
| S | | | | |
| YEAR 2 | ENGR 112/113/114 Introduction to Computing | 4 cr | MATH 206 Differential Equations | 3 cr |
| | PHYS 122 University Physics II | 4 cr | PEEG 219 Reservoir Fluid Properties | 3 cr |
| | MATH 231 Calculus III | 3 cr | EPSS 200 Earth System Science | 3 cr |
| | PEEG 218 Reservoir Rock Properties | 3 cr | PEEG 252 Statics and Mechanics of Materials for PE | 3 cr |
| | MEEN 240 Thermodynamics | 3 cr | PEEG 302 Fluid Mechanics and Heat Transfer | 3 cr |
| | | | BUSS 150 Introduction to Economics | 3 cr |
| S | | | | |
| YEAR 3 | BUSS 322 Fundamentals of Innovation & Entrepreneurship | 3 cr | PEEG 315 Reservoir Characterization | 3 cr |
| | EPSS 305 Sedimentology | 4 cr | PEEG 326 Drilling Engineering II | 3 cr |
| | PEEG 314 Well Logging | 3 cr | PEEG 336 Well Testing | 3 cr |
| | PEEG 322 Drilling Engineering I | 3 cr | PEEG 341 Completion and Work over | 3 cr |
| | PEEG 331 Reservoir Engineering I | 3 cr | PEEG 360 Petroleum Economics & Risk Analysis | 4 cr |
| | SDAS 300 Career Development | 0 cr | Technical Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| YEAR 4 | HUMA XXX Arabic Language Elective | 3 cr | HUMA/BUSS XXX Humanities or Business Elective | 3 cr |
| | PEEG 434 Reservoir Engineering II | 4 cr | HUMA XXX Islamic Studies Elective | 3 cr |
| | Technical Elective | 3 cr | HUMA XXX UAE Studies Elective | 3 cr |
| | PEEG 447 Production Engineering | 3 cr | PEEG 498 Senior Design Project II | 3 cr |
| | PEEG 497 Senior Design Project I | 3 cr | Technical Elective | 3 cr |
| | Technical Elective | 3 cr | Free Elective | 3 cr |
| S | ENGR 399 Engineering Internship | 1 cr | | |
| | | | Total Credit Hours | 139 |

S SUMMER


VARIAN
EMERGENCY
eye wash
STATION

# COURSE DESCRIPTIONS

## COLLEGE OF ARTS AND SCIENCE COURSES

### BIOL BIOLOGY

#### BIOL101 FUNDAMENTALS OF BIOLOGY (2-2-3)

Prerequisite: None

This course introduces the structure and function of both animals and plants. It will introduce the principles of taxonomical classification of biological organisms. It will focus on the morphology and anatomy of biological organisms, as well as their physiological processes, life cycle and behavior. Students will develop an understanding of the relationships that exist between animals, plants and micro-organisms.

#### BIOL 111 GENERAL BIOLOGY I (2-2-3)

Prerequisite: None

This course covers the biological principles that apply to life, with emphasis on the biology of prokaryotic and eukaryotic cells. Topics include cell structure, energy and metabolism, genetics and molecular biology, including mitosis, meiosis, regulation of gene expression and genomics. This course serves as a foundation for more advanced and complex concepts that students will learn in their advanced biology courses.

#### BIOL 112 GENERAL BIOLOGY II (3-3-4)

Prerequisite: BIOL 111

This course covers broad topics including evolution and taxonomy of protists, fungi, plants, and animals. It provides fundamental information about evolutionary relationships between different species using taxonomy and phylogenetic trees, as well as an explanation of the major plant and animal anatomical structures and their physiological functions. Finally, the course presents an overview of the ecology and interactions between populations and ecosystems.

#### BIOL 211 GENERAL GENETICS (3-3-4)

Prerequisite: BIOL 111

This course introduces the fundamental concepts of classical Mendelian genetics and molecular genetics such as the functions of genetic material, mechanisms of inheritance, as well as genetic mutations and their physiological effects. The course also provides an overview of the epigenetic modifications of the genetic material and its relationship to chromatin states. Finally, the course discusses the concept of population genetics and factors that influence the frequency and variation of alleles within populations.

#### BIOL 221 APPLIED MICROBIOLOGY (3-3-4)

Prerequisite: BIOL 112

The course covers the basic biology, structure, function, ecology and evolution of bacteria and viruses. The course covers principles related to microbial growth, metabolism, genetics and the scientific methods used in microbiology, and key discoveries such as pasteurization, vaccination and antibiotic treatment. The course introduces emerging microbiological issues, such as drug resistance and how the gut microbiome impacts human health.

### BIOL 301 CELL BIOLOGY (3-0-3)

Prerequisites: BIOL 112

This course focuses on the biology of the cell in terms of structure and function and the functional interaction of the cell with its microenvironment. Topics include the extracellular matrix, cell migration, intracellular compartmentalization, protein modifications and transport and signal transduction pathways. The course also covers different cell death processes specifically apoptosis and autophagy. Stem cells technology and its ethical issues are also covered in this course.

### BIOL 312 BIOCHEMISTRY II (2-3-3)

Prerequisite: CHEM 311
In this course, students apply their basic knowledge of Biochemistry to specific metabolic reactions and certain physiologically important biomolecules. The course covers regulation of carbohydrates (including gluconeogenesis) and fatty acids (including fatty acid catabolism, and ketone bodies). The course also deals with photosynthesis, metabolism of nitrogen, and biochemical cellular signaling.

### BIOL 331 PHYSIOLOGY (2-2-3)

Prerequisite: BIOL 112

This course provides the basic physiological principles and the functional organization of living systems. Basic cell biology is reviewed and related to the physiology of the body. Students also learn about organ systems (including the endocrine, nervous, muscular, cardiovascular, urinary, respiratory and digestive systems) in terms of their physiology and how these systems integrate and work together to help maintain homeostasis.

### BIOL 335 DEVELOPMENTAL BIOLOGY (2-3-3)

Prerequisite: BIOL 301, BMED 341

The course provides an overview of the molecular and cellular mechanisms that control the development of organisms. The emphasis of the course is on connecting specific genetic pathways to developmental traits, and identifying the genes and proteins involved in cell-cell signaling, cell differentiation, morphogenesis and growth. The focuses on animal development using invertebrate and vertebrate model systems, and will cover the use of stem cells in medical treatment.

### BIOL 399 INTERNSHIP (0-0-1)

Prerequisite: A minimum of 70 credits earned by the end of the preceding Fall semester, including at least 24 credits in core major courses

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 designated internship supervisor who provides feedback to the university about the student’s progress. The duration of the internship is a minimum of 8 consecutive weeks, and is graded on a Pass/Fail basis.

BIOL 411 IMMUNOLOGY (3-0-3)
Prerequisite: BIOL 112 and CHEM 312

This course is an introductory course in mammalian immunology, with a focus on humans and human diseases. It describes how the immune system protects the body from foreign agents. The molecular and cellular basis of innate and acquired immunity and how the two systems interact with specific foreign agents are covered. Finally, applications of immunology, such as vaccine design, immune based therapeutics, and organ transplantation are also discussed.

BIOL 430 BIOINFORMATICS (3-3-4)
Prerequisites: BMED 342 or BIOL 312

This course introduces future life-scientists to bioinformatics, its tools and analysis methods. Fundamental and current topics in bioinformatics, genomics, proteomics, metabolomics, transcriptomics, as well as epigenomics will be presented. Students are also exposed to the R software and other basic bioinformatic tools. Finally, the course also introduces students to current issues of bioethics, especially with regards to -omics data and individual privacy. Students who have already BMED 430 cannot take this course.

BIOL 497 AND 498 SENIOR RESEARCH PROJECT I & II (0-0-3)
Prerequisite: Senior Standing, or departmental approval

Over the course of two semesters, students work closely in small teams with a faculty member to address a significant and complex question at the boundary of knowledge in Cell and Molecular Biology. The team combines and applies a broad range of theoretical and practical research techniques to the question and exercises advanced critical thinking and evaluation. The team is guided through the whole research process – from hypothesis generation to data acquisition, analysis and conclusion – and is encouraged to produce professional-standard reports and presentations.

**BUSS BUSINESS STUDIES**

BUSS150 INTRODUCTION TO ECONOMICS (3-0-3)
Prerequisite: ENGL102 or ENGL112

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.

BUSS201 FUNDAMENTALS OF ACCOUNTING AND FINANCE (3-0-3)
Prerequisites: ENGL102 or ENGL112; Sophomore Standing

This course is an introduction to financial and management accounting. It is aimed at providing a broad understanding of the theory and practice of financial, management accounting, and financial management, 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.

### BUSS202 BUSINESS COMMUNICATION (3-0-3)

Prerequisite: ENGL102 or ENGL112

Students will be introduced to effective business communication for various business settings. They will learn key business strategies for workplace communication, for business proposal and report writing, and for conducting successful meetings and presentations. Students will learn about business professionalism, teamwork, leadership and conflict resolution, as well as cultural diversity and cultural literacy.

### BUSS203 ENVIRONMENTAL ECONOMICS (3-0-3)

Prerequisite: BUSS150

This course offers an opportunity for students to explore the broad applicability of economic thinking in environmental and sustainability problems. On completion of this course, successful students will have a clear perspective of concepts such as market failures (particularly, externalities), market-based instruments for controlling regional and transboundary environmental problems, and economic methods for assessing the environment.

### BUSS204 INTRODUCTION TO ORGANIZATIONAL MANAGEMENT (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course provides a basic introduction to contemporary business and organizational environments through the theory and practice of managerial functions (planning and decision making, organizing and changing, leading and controlling). Topics covered include organizational performance, risk management, stakeholder analysis, strategic planning, the operating environment and organizational culture.

### BUSS296 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.

### BUSS301 CORPORATE LEADERSHIP AND HUMAN RESOURCE MANAGEMENT (3-0-3)

Prerequisite: Junior Standing

This course teaches students to be informed future leaders through the combination of theoretical analysis and practical application. They are placed in a variety of real-life situations in which they apply the decision-making process in relation to organizational problem-solving and development. They integrate key leadership and human resource functions by means of acquiring data, planning methodically, formulating strategy, collaborating, and communicating with clarity.

### BUSS322 INNOVATION AND PRIVATE ENTERPRISE IN SCIENCE (3-0-3)

Prerequisite: Junior Standing

This course introduces students to an innovative and entrepreneurial mindset, which will help them develop a creative problem-solving approach to challenges. Students design an opportunity analysis and a personal business plan, allowing them to find better solutions to challenges in their career and life.

### BUSS 339 ECONOMETRICS (3-0-3)

Prerequisite: BUSS 150, MATH 242 or MATH 243

This course introduces students to the main statistical methods and techniques used in business and finance related studies. The course assumes introductory knowledge of calculus, basic algebra and statistics. The emphasis throughout the course is real application of econometrics techniques to problems in business and finance fields. The course will cover simple linear regression model, multiple linear regression model, relaxing assumptions, univariate time series studies, limited dependent variables and panel data estimation techniques.

### BUSS 344 MANAGERIAL FINANCE (3-0-3)

Prerequisite: BUSS 201

This course emphasizes financial management, financial markets, tools, techniques, and methodologies used in financial decision making. Students are introduced to financial planning, working capital management, capital budgeting, long-term financing and international finance. The course will enable students to utilize various tools to evaluate and measure alternative solutions in decision making.

### BUSS 361 BUSINESS AND SUSTAINABILITY (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course explores the role of business in the accumulation of capital and power, the prospects for future socio-economic sustainability, and responsible practices. The course describes how organizations can contribute to a sustainably developed future world, with a focus on maximizing contributions to economic, social, and environmental well-being worldwide.

### BUSS 374 MANAGERIAL ACCOUNTING (3-0-3)

Prerequisite: BUSS 201

In this course, students learn alternative methods of preparing managerial accounting information and its application. The focus is on skills and strategies for decision-making, production management, product design and pricing techniques. Students gain an understanding of a company's internal operations, and learn to develop strategies to engage and resolve competitive and economic factors in business.

### BUSS 381 MACROECONOMICS AND THE UAE ECONOMY (3-0-3)

Prerequisite: BUSS 150

The course is designed to provide students with sound understanding of the UAE economy and other national economies. The aims of the course are: (i) to provide a deeper knowledge of the principles of macroeconomic analysis; (ii) use these principles to understand the macroeconomic dimensions of UAE economic history and in a broader international context; and (iii) develop good understanding of the general working of the economy to make sense of governmental policy-making and changes occurring in the world economy today.

BUSS 395  MANAGERIAL FINANCE (3-0-3)
Prerequisite:  Sophomore Standing and BUSS 201

This course emphasizes on financial management, financial markets, tools, techniques, and methodologies used in financial decision making. Students are introduced to financial planning, working capital management, capital budgeting, long-term financing and international finance. The overall goal of this course is to enable the student to utilize various tools to evaluate and measure alternative solutions in decision making.

BUSS 456  INVESTMENTS & PORTFOLIO MANAGEMENT (3-0-3)
Prerequisite:  MATH 204, MATH 231, MATH 242 or MATH 243

This course focuses on a quantitative finance analysis of risk and asset allocation. Students are introduced to the different steps to solve general asset allocation problems. This includes detecting statistical market invariants, estimating and modeling the market, defining the investor's optimal objectives, computing the optimal allocation and accounting for estimation risk. It provides comprehension of the main tools to perform portfolio analysis and risk assessment evaluation, including the use of Bloomberg terminals.

BUSS395  SPECIAL TOPICS IN BUSINESS STUDIES (3-0-3)
Prerequisite: Topic Specific

Course is repeatable if title and content differ.

## CHEM CHEMISTRY

CHEM115  GENERAL CHEMISTRY (3-2-1-4)
Prerequisite: None

This course presents a comprehensive study of the facts, concepts and laws of chemistry. It includes the study of the fundamental principles and laws of chemistry including stoichiometric relationships, aqueous chemistry, the ideal gas laws and kinetic molecular theory, thermochemistry, quantum theory and electronic structure, periodic properties, and chemical bonding and molecular structure. The course is accompanied by a laboratory component that emphasizes quantitative procedures.

CHEM116  GENERAL CHEMISTRY II (3-3-4)
Prerequisite:  CHEM115

This is the second course in the General Chemistry series. Topical emphasis is placed on intermolecular forces, colligative properties of mixtures, chemical kinetics, acid-base equilibria, buffer systems, introductory acid-base titrations, solubility and complex equilibria, entropy and free energy, and basic topics on both organic and inorganic chemistry. The importance of chemistry for both nuclear and environmental sciences is introduced.

### CHEM200 QUANTITATIVE METHODS IN PHYSICAL SCIENCES (3-2-4)

Prerequisites: CHEM116; MATH111

This course will provide students with the mathematical tools needed throughout their chemistry degree. By the end of the course, students will be able to manipulate algebraic expressions, perform statistical analysis of experimental data, perform basic computational modelling experiments using the Spartan'16 code and be familiar with the use of Excel for performing regression analysis. Foundational concepts in computational chemistry will also be introduced.

### CHEM 206 CHEMICAL SAFETY AND RESEARCH SKILLS

Prerequisites: CHEM116; Chemistry Major

The overall goal of this course is to provide a familiarity with chemistry as a 'language' including different structure representations and types of chemical information. Students will also develop the knowledge and skills they need to use electronic tools in chemistry. The principles behind safety from an operational and management point of view will be covered with an emphasis on risk assessment in the laboratory.

### CHEM211 FUNDAMENTALS OF ORGANIC CHEMISTRY (3-3-4)

Prerequisites: CHEM115

This course provides an introduction to naming, structure, bonding, reactivity, and properties of organic compounds such as alkanes, alkenes, 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.

### CHEM221 ORGANIC CHEMISTRY I (3-3-4)

Prerequisites: CHEM116

This course provides an introduction to naming, structure, bonding, reactivity, and properties of organic compounds such as alkanes, alkenes, alkynes, alkyl halides, and alcohols in relation to atomic and molecular orbital theories. These basic principles are applied to a variety of topics such as chemical reactions, reaction mechanisms, and fundamentals of organic synthesis.

### CHEM231 PHYSICAL CHEMISTRY I (3-3-4)

Prerequisite: CHEM 116

The properties of gas phase reactions are derived starting from basic assumptions and equations of state using the kinetic theory of gases. The First and Second Laws of Thermodynamics are introduced. Phase diagrams are introduced in the context of gas-liquid equilibria. The fundamental postulates of quantum mechanics are used to explain the observed atomic spectra of elements and diatomic molecules. Finally, vibrational and rotational spectroscopies are introduced using quantum models.

### CHEM241 INTRODUCTION TO ANALYTICAL CHEMISTRY (3-3-4)
Prerequisite: CHEM116

This course introduces the principles and practices of analytical chemistry. It covers both qualitative and quantitative measurements of simple mixtures containing biologically relevant inorganic and organic substances. The theory and practice will cover topics on statistical data treatment and analysis, calibration methods, volumetric titrations, selected electroanalytical techniques, chromatographic separations, and sampling/sample preparation methods.

### CHEM 251 INORGANIC CHEMISTRY I (3-3-4)
Prerequisite: CHEM116

This course introduces foundational concepts in inorganic chemistry including solid structures, advanced acidity and basicity, redox chemistry and its representations, and symmetry. It describes the properties and chemistry of the compounds of the main-group elements. It reviews techniques to characterize and quantify inorganic species.

### CHEM311 BIOCHEMISTRY I (3-3-4)
Prerequisite: CHEM 211 (for non-CHEM majors);CHEM 221 (for CHEM majors)

This course provides a basic working knowledge of biochemical concepts and techniques. Emphasis is placed on major biochemical concepts and techniques alongside factors affecting the structure and function of important classes of biomolecules and biomacromolecules – from proteins and enzymes to lipids and carbohydrates. These theoretical concepts are reinforced by hands-on laboratory activities.

### CHEM 322 ORGANIC CHEMISTRY II (3-3-4)
Prerequisite: CHEM 221

This course provides an introduction to the structure, conformation, stereochemistry, physical properties, spectroscopy and reactions of organic compounds, such as aromatic compounds, aldehydes, ketones, carboxylic acids and derivatives, and amines. Some of the important reaction mechanisms and advanced multi-step organic synthesis involving these compounds are discussed. Spectroscopy techniques such as NMR, IR, and MS are also covered.

### CHEM330 INTRODUCTION TO COMPUTATIONAL CHEMISTRY (3-2-4)
Prerequisite: CHEM231

This introductory course in computational chemistry introduces students to the principles of computational chemistry and computer-based molecular design. Students learn the basic theories and applications of modern computational chemistry methods. Emphasis is placed on the computational cost and accuracies of different levels of theory. Students apply the theories discussed to solve problems of interest such as those involving small molecules, macromolecules and supramolecules.

### CHEM332 PHYSICAL CHEMISTRY II (3-2-1-4)

Prerequisite: CHEM231

This course builds on the foundations of gas kinetics and thermodynamics introduced in Physical Chemistry I. The mathematical framework for rate laws will be extended to complex reaction mechanisms involving chain reactions and applications will be emphasized in polymerization processes and gas phase reactions in the upper atmosphere. Statistical mechanics will be used as a bridge between the microscopic properties of matter and their bulk properties.

The spontaneity of chemical and physical processes will be explained by introducing the Second Law of Thermodynamics and the Gibbs and Helmholtz energies will be used to probe the maximum work that can be achieved by a chemical process. The chemistry of surfaces will be discussed regarding how atoms are deposited and grown on surfaces. Experimental methods for probing the composition and structure of surfaces will also be described. Finally, several case studies of how surface chemistry is applied to catalysis will be discussed.

### CHEM342 MODERN TECHNIQUES FOR CHEMICAL ANALYSIS (3-3-4)

Prerequisite: CHEM 221 or CHEM 211, and CHEM 241

This course covers a range of electrochemical, separation, and spectrochemical instrumental methods that are used for routine qualitative and quantitative analysis of liquid and solid mixtures. The lecture component covers the theory, instrumentation, method classification and selection criteria, basic principles for method development, data analysis, and data interpretation. The lab offers hands-on and problem-based learning approaches of analytical and bioanalytical methods through real case studies.

### CHEM343 ADVANCED INSTRUMENTAL ANALYSIS TECHNIQUES IN CHEMISTRY (3-3-4)

Prerequisites: CHEM 342, CHEM 251 (or CHEM 351)

This course discusses contemporary instrumental analysis techniques and related studies of the physicochemical properties of materials at the bulk or surface level, based on microscopy, porosimetry, atomic and molecular spectroscopy, and thermal approaches. The course covers the basic principles of each technique, including instrumentation, operation mechanism, detection limit, resolution, interference, variable parameters, and specimen preparation for a range of applications.

### CHEM351 MAIN GROUP COMPOUNDS: STRUCTURE, REACTIVITY AND CHARACTERIZATION (3-1-4)

Prerequisites: CHEM106; CHEM116

This course introduces and reviews foundational concepts in inorganic chemistry; for example, solid structures, advanced acidity and basicity, redox chemistry and its representations, and symmetry This course describes the properties, compounds and chemistry of the main-group elements, with an emphasis on rationalizing trends and behaviors based on these foundational concepts, and introduces techniques to characterize and quantify inorganic species.

### CHEM 352 INORGANIC CHEMISTRY II (3-3-4)

Prerequisite: CHEM251

This course describes the properties, compounds and chemistry of the d- and f-block elements, including organometallics, thus providing students with an ability to rationalize trends and behaviors based on foundational concepts such as electronic structure and coordination chemistry. It introduces students to the applications, including materials and bioinorganic chemistry, with case studies such as inorganic chemistry in medicine, hydrogen-storage for energy applications and industrial catalysis.

### CHEM360 MICROBIOLOGY AND BIOCORROSION FOR ENGINEERS

Prerequisite: CHEM115, 60 credits or Junior Standing

This course focuses on two primary areas of study; microbiology and biocorrosion. The microbiology unit is designed to impart an understanding of the biological and chemical interactions of microbes and their impact on the oil and gas industry. The biocorrosion unit gives the students an in depth understanding of how microbes, initiate, facilitate and/or accelerate corrosion of various metals both in aqueous and non-aqueous environments. This knowledge will enable students to apply new methods and technologies in their engineering fields.

### CHEM391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisite: Junior Standing and approval of the department

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### CHEM399 INTERNSHIP (0-0-1)

Prerequisite: Minimum of 70 credits earned by end of the preceding Fall semester, including at least 24 credits in core major courses

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 designated internship supervisor who provides feedback to the university about the student's progress. The student must keep a detailed log book and prepare a formal report that documents the work undertaken during the internship period, and both of these 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 the supervising faculty member, with input from the internship supervisor.

### CHEM 423 INTRODUCTION TO MEDICINAL CHEMISTRY (3-0-1-4)

Prerequisite: CHEM 311 and CHEM 322

This course introduces students to the principles of modern medicinal chemistry from drug action to the design and development of drugs and medicines. Students discover what factors need to be considered in designing effective drug molecules and how their physico-chemical characteristics and therapeutic properties are related. The action and fate of pharmaceuticals in the body are described within various physiological systems, with the discussion of specific case studies of successful drugs.

### CHEM 424 SYNTHESIS OF MEDICINAL COMPOUNDS (3-3-4)
Prerequisite: CHEM 423, CHEM322

This course introduces and illustrates how contemporary synthetic organic chemistry is used in the identification and preparation of medicinally valuable compounds. The strategies and synthetic methods used to identify and prepare potential drug molecules are described along with some of the specialized technologies and techniques that are needed for structural confirmation. Real-world examples are used throughout to illustrate these methods, primarily through analysis of published papers.

### CHEM461 ENVIRONMENTAL CHEMISTRY (3-3-4)
Prerequisites: CHEM 241; CHEM 251

This course lays the foundation for environmental chemical sciences through theory and practice. It introduces the biotic, chemical, and physical characteristics of the natural components of the earth system and the interactions among the various spheres.

### CHEM462 POLLUTION SCIENCE AND CONTROL (4-0-4)
Prerequisite: CHEM461

This course introduces the basic concepts of environmental pollution and focuses on the sources, movements, reactions and fates of contaminants found in air, water and soil. The course deals with different facets of pollution analysis and management, including the basic principles of risk assessment, local and international laws and regulations, monitoring approaches, and control technologies.

### CHEM463 METHODS FOR ENVIRONMENTAL TRACE ANALYSIS (3-3-4)
Prerequisites: CHEM342; CHEM461

This course covers the principles, techniques, and applications of trace environmental analysis through both theory and practice. It focuses on sampling, sample preparation, and analysis methods of inorganic and organic traces in solid, liquid, and gaseous matrices. The course deals with an array of modern separation, spectrochemical, and electrochemical methods, and includes microanalytical and lab-on-chip approaches.

### CHEM471 FUNDAMENTALS OF FORENSIC SCIENCE (4-0-4)
Prerequisite: CHEM311

This course outlines concepts related to the application of scientific knowledge and methodologies to civil and criminal investigations within the justice system. It provides an introduction to forensic science within the context of applied chemistry and branching disciplines encompassing forensic toxicology, biology and statistics. The course follows the forensic process from crime scene to court.

### CHEM472 FORENSIC CHEMISTRY AND EVIDENCE ANALYSIS (3-3-4)
Prerequisite: CHEM471

The course introduces students to the application of modern analytical chemistry tools and procedures to support forensic investigations of several types of physical evidence. Topics include ignitable liquids, explosives, controlled substances, polymer films, fibers, soils, glass, paints, fingerprints and gunshot residues.

### CHEM473 FUNDAMENTALS OF FORENSIC TOXICOLOGY

Prerequisite: CHEM471

This course outlines concepts related to the toxicological principles underlying the actions of various drugs and poisons encountered in forensic toxicology as well as basic pharmacodynamics and pharmacokinetics. The course provides an understanding of the theoretical aspects of drug and analytical chemistry applied to forensic toxicology.

### CHEM481 MATERIALS CHEMISTRY (4-0-4)

Prerequisite: CHEM352

This course outlines concepts related to the basic concepts of material chemistry and solid-state chemistry. It covers topics related to the development, characteristics and uses of advanced materials. It provides an introduction to the chemistry of the preparation, processing, characterization of various types of materials such as ceramics, glasses metals, alloys, composites, semiconductors, thin films, crystalline and amorphous solids, membranes and porous materials, and surface science of materials and biomaterials.

### CHEM482 NANOCHEMISTRY (3-3-4)

Prerequisites: CHEM 481

This course provides students with an introductory perspective on different nanomaterials, their properties and applications in various emerging fields. Emphasis will be allocated to the design, synthesis, characterization and functionalization of nanomaterials for practical applications. A variety of topics covering applications of nanomaterials in drug delivery, molecular imaging, nanomedicine, biosensors, nanoenergy, catalysis and environmental fields will be surveyed.

### CHEM483 POLYMER CHEMISTRY (4-0-4)

Prerequisites: CHEM 481

This course provides an introduction to polymer chemistry with an emphasis on synthesis, structure, and characterization of polymeric materials, the reaction mechanisms of various polymerization techniques, and the mechanical and rheological properties of polymers. A brief survey of processing methods and modern applications of polymeric materials are covered.

### CHEM491 INDEPENDENT STUDY II (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisite: Senior Standing and approval of the department

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### CHEM495 SPECIAL TOPICS IN CHEMISTRY (3-0-3)

Prerequisite: Topic specific

This course mainly deals with new trends in Chemistry and related sciences. The course is repeatable if title and content differ.

CHEM497 SENIOR THESIS I (1-6-3)
CHEM498 SENIOR THESIS II (1-6-3)
Prerequisite: Senior Standing or departmental approval

Over the course of two semesters, students work closely with a faculty member to address a significant and complex question at the boundary of knowledge in chemistry. Students may work individually or in small teams subject to departmental approval. The project will require students to apply a broad range of theoretical and practical research techniques to the question and to exercise advanced critical thinking and evaluation as the project progresses, leading to new insights.

**CHNA CHINESE**

CHNA101 ELEMENTARY CHINESE I (3-0-3)
Prerequisite: None

This course is designed for students with no prior knowledge of Chinese. Students will be familiarized with Chinese language and culture through short passages or dialogues dealing with everyday life, using audiovisual and textbook materials. Students will acquire basic Chinese conversational skills, Chinese vocabulary and grammar. Special topics on Chinese modern technology such as express highways and robots, among others, will be included.

**ENGL ENGLISH**

ENGL101 ACADEMIC ENGLISH I (3-0-3)
Prerequisite: TOEFL iBT 79, EmSAT 1400, or IELTS 6.0

This course introduces reading, writing and digital composing in scientific and professional fields. Assignments include writing about numbers analytically and interpretively; abstracting and summarizing; and citing and referencing evidence. Extended written assignments include a review of evidence supporting a claim and a focused essay with a supporting digital presentation.

ENGL102 ACADEMIC ENGLISH II (3-0-3)
Prerequisite: ENGL101

This course extends skills in evidence-based reading, writing, and digital composition introduced in ENGL101. Major assignments include writing a data-based technical report that includes a digital presentation and a group-based funding proposal based on a realistic Request for Funding Proposal (RFP) with an oral presentation.

ENGL111 ENGLISH COMMUNICATION I (4-0-4)
Prerequisite: EmSAT 1400 or TOEFL iBT 79 or IELTS 6.0

This course focuses on the development of argumentative writing, with each student writing an individual formal, academic research paper. The course will also develop the skills to produce effective persuasive writing. It provides extensive practice in the use and integration of sources and also develops reading, critical thinking and presentation skills.

ENGL112 ENGLISH COMMUNICATION II (4-0-4)
Prerequisite: ENGL111

This course develops and builds on skills learned in the ENGL111 course. Students are required to undertake a collaborative group project leading to an extensive, full written report and a multimedia presentation. In addition, they will read scientific literature and other forms of writing and complete other compositions. Students will also explore communication theories and reflect on them in writing.

**EPSS EARTH AND PLANETARY SCIENCES**
EPSS 200 EARTH SYSTEMS SCIENCE (2-3-3)
Pre-requisite: BIOL 101, CHEM 115

This course covers the origin and evolution of the Earth and its atmosphere and oceans from the perspective of cycles of inorganic and organic materials and the processes that form and shape the Earth. Aspects of the use of energy and other human impacts on the Earth system are discussed. Laboratory work involves studies of geologic materials, maps related to different aspects of Earth Systems, and exercises pertaining to geologic processes. The course includes a field trip.

EPSS 210 EARTH MATERIALS (2-3-3)
Pre-requisite: EPSS200; CHEM 116

This course introduces the fundamentals of mineralogy, including systematics, chemistry and crystallography, and the physical and optical properties of minerals. The student is introduced to the most common analytical methodologies used in mineralogy and learns to use the petrographic microscope to describe and identify a variety of rock-forming minerals in hand samples and petrographic thin-sections.

EPSS 230 GEOLOGICAL MAPS (2-3-3)
Pre-requisite: EPSS200

The course introduces the theoretical background and provides practical exercises to enable students to measure field data, read geological maps, and organize a simple GIS database. Students learn to create and interpret static two-dimensional representations of three-dimensional sub-surface geometries. The course includes a three-day field exercise in the UAE.

EPSS 300 MATLAB FOR EARTH SCIENTISTS (2-3-3)
Pre-requisite: MATH 231

This course introduces algorithms to numerically solve mathematical problems relevant to earth science with a focus on programming using MATLAB. The course reviews the MATLAB environment and language for computing and plotting and introduces common numerical methods to solve the partial different equations (PDE) of importance in earth sciences. Students write MATLAB scripts to solve systems of linear equations, to compute linear and nonlinear regressions, and to make numerical computations using geoscience data, involving differentiation and integration.

### EPSS 305 SEDIMENTOLOGY (3-3-4)
Pre-requisite: EPSS 200, EPSS 210

This course includes the study of sediment compositions, textures, sedimentary structures, and depositional environments in terrestrial and marine environments. Students learn about the impact of climates, ecosystems, tectonics, and hydrological processes on sediments and sedimentary environments. The course includes two field trips (a one day trip and a three to four day trip).

### EPSS 310 REMOTE SENSING AND GEOMATICS (3-3-4)
Pre-requisite: EPSS 300

This course covers the basic principles and essential skills of remote sensing and geomatics using image visualization, processing, and techniques for geological, environmental, and/or planetary mapping. Students learn the physical principles of remote sensing and become familiar with major remote sensing satellites and datasets. Students learn skills including image visualization, processing, interpretation, and data manipulation for mapping.

### EPSS 315 ENVIRONMENTAL GEOLOGY (3-0-3)
Prerequisite: EPSS 200, CHEM 115

This course deals with how people interact with Earth's natural systems. The course covers natural hazards, landscape and soil characteristics, groundwater, surface water, climate change, water and air pollution, and ethics of environmental issues, emphasizing the environment and environmental issues of the UAE. The course includes a one-day field trip.

### EPSS 321 STRUCTURAL GEOLOGY (3-3-4)
Prerequisite: EPSS 200, EPSS 230, PHYS 121

This course introduces the mechanics of rock deformation. It discusses recognition, interpretation, and mechanics of faults, folds, structural features of igneous and metamorphic rocks. The course treats regional structural geology and tectonics, and includes a three-day field exercise.

### EPSS 322 GEOMORPHOLOGY AND GEOHAZARDS (4-0-4)
Prerequisite: Senior Standing or Department Approval

In this course, students learn about landscape forms and its evolution over time and space, and how it is impacted by the complex interplay between climate, tectonic, hydrological and cryospheric processes. Students will also explore the causes and effects of geohazards. This course includes a 2 day field trip.

### EPSS 323 SOLID EARTH GEOPHYSICS (3-3-4)
Prerequisite: EPSS 200 and PHYS 122

This course is an introduction to the quantitative analysis of Earth structure and plate tectonics using earthquake seismology, seismic reflection and refraction, gravity, magnetics, and heat flow. Methods applied in environmental geology, mining, petroleum, and seismology are covered in this course.

### EPSS 331 IGNEOUS AND METAMORPHIC PETROLOGY (2-3-3)
Prerequisite: EPSS 210

This course provides an overview of igneous and metamorphic rocks in terms of their origin and distribution in relation to plate tectonics. Students learn about igneous melt generation, evolution, and crystallization processes and their relationship with the geotectonic environment . Students learn to recognize, describe, and classify many rocks in both hand specimens and thin sections in the Petrology Laboratory.

### EPSS 397 FIELD GEOLOGY (UP TO 24 DAYS OF SUPERVISED FIELDWORK AND LAB WORK, 4 CREDITS)
Prerequisite: EPSS305, EPSS321

The course is concerned with the study of sedimentary, igneous, and metamorphic lithologies and structures in the field. The course addresses vertical and horizontal variability in rock bodies and their physical characteristics in three dimensions. Students are trained to observe and map primary and secondary structures at selected international localities. The course includes four weeks of fieldwork followed by two weeks of data integration and report writing.

### EPSS 400 PLANETARY SCIENCE (3-3-4)
Prerequisite: EPSS 310

This course examines the origin and evolution of the solar system, and the geology of planetary bodies. Emphasis is on comparing geologic processes on these bodies to well-understood processes on Earth, results from past, current, and upcoming planetary missions, and the future of human and robotic exploration of space.

### EPSS 411 ATMOSPHERIC, OCEAN AND CLIMATE DYNAMICS (2-3-3)
Prerequisite: Senior standing or instructor approval

This course covers the processes that drive weather patterns, the general circulation of the atmosphere, oceans, and climate on Earth. Topics include: the structure and composition of the atmosphere; sources of energy that drive atmospheric processes; weather forecasting, the hydrological cycle, and forces that create severe weather; the influence of humans on the atmosphere; and, factors that influence climate, climate variability and climate change.

### EPSS 412 HYDROGEOLOGY (2-3-3)
Prerequisite: Senior standing or instructor approval

This course introduces geological concepts related to the distribution and movement of water in the soil and rocks of the Earth's crust. It covers a range of topics related to water in the lithosphere, and its interactions with the hydrosphere and atmosphere. Specifically, the course topics include the hydrological cycle, groundwater flow, aquifer testing, and pollution with a special emphasis on UAE fresh water systems. The course requires one or more days of field trip in the UAE.

EPSS XXX GEOLOGY OF MARS AND OTHER PLANETARY BODIES (2-3-3)
Prerequisite: Senior standing or instructor approval

This course enables students to interpret and understand geological features on planetary bodies. The course uses geomorphological features on Earth to help students better understand and interpret remotely sensed data from other planets, including evidence of volcanism, ice, water and soil. Furthermore, the course examines the future of planetary exploration and potential of terraforming planets. This course includes two field trips: a 1-day trip and a 3-4-day trip.

EPSS 497 SENIOR RESEARCH PROJECT I (1-6-3)
Prerequisite: Senior standing

This is the first part of a two course sequence that guides students through the development of a research project on a topic in the Earth and Planetary Sciences. In this course, students learn the methodologies and ethics of project proposal preparation as they initiate and develop their own project. In addition to a written research proposal, students explain and defend their research plan via an oral presentation prior to commencing work on their project in EPSS 498.

EPSS 498 SENIOR RESEARCH PROJECT II (0-0-9-3)
Prerequisite: EPSS 497

Students work on projects selected during EPSS 497 course. They work closely with a faculty member to address significant questions or complex problems in Earth and Planetary Sciences. The project will require students to apply a broad range of theoretical and practical research techniques to the problem and to exercise advanced critical thinking and evaluation as the project progresses, leading to new insights.

**GENS GRAND CHALLENGES**

GENS 101 GRAND CHALLENGES (2-4-4)
Prerequisite: None

This course surveys science and engineering disciplines and highlights interdisciplinary, real-world applications, especially addressing Grand Challenge problems facing humanity. The course introduces aspects of problem solving ranging from the formulation of questions and problems to the testing of trial solutions within a standard framework. Students discuss ethical, social, economic, environmental, and technical aspects of Grand Challenges, and they contribute to collaborative and project-based activities.

**HUMA HUMANITIES AND SOCIAL SCIENCES**

HUMA100 ARABIC LANGUAGE FOR NON-NATIVE SPEAKERS (3-0-3)
Prerequisite: Approval required

This course offers students who are non-native speakers of the Arabic language the opportunity to develop four basic language skills: listening, reading, writing and speaking. Students will learn Arabic speech, syntax, and basic grammar and language components (phonetics, vocabulary and composition). The course will be delivered in an interactive learning environment that enables the students to gradually build their linguistic skills.

### HUMA101 ARABIC LANGUAGE (3-0-3)

Prerequisite: None

This course aims to improve students' linguistic skills, with an emphasis on reading and writing competencies. One focus is the functional writing of professional letters, messages, reports, and rewriting of machine-translated texts. Another area is academic writing, including the organization of ideas, research paper writing, quoting others, and summarizing. The ultimate goal is to help students develop the linguistic sensitivity that allows them to use idiomatic expressions and conventional vocabulary while abiding by the grammatical rules of the language. Regarding reading skills, the student is trained to read and discuss scientific texts and to analyze them in terms of linguistic structure. The course will also improve the student's listening skills.

### HUMA102 ISLAMIC CULTURE (3-0-3)

Prerequisite: HUMA 101

This course introduces students to Islam, giving understandings of its historical, theological and cultural components and aspects of relevance. Given the historical record of Islam, the established civilization, and the values and principles of Islam, students will also be introduced to matters of relevance to Islamic life and Islamic culture. These matters of relevance include: Islamic systems and principles of organization; and, modern issues and debates, highlighting an Islamic worldview. The language of instruction is Arabic.

### HUMA 103 ISLAMIC CULTURE AND CIVILIZATION (3-0-3)

Prerequisite: HUMA 100; ENGL 101

This course introduces students to Islam, giving understandings of its historical, theological and cultural components and aspects of relevance. Given the historical record of Islam, the established civilization, and the values and principles of Islam, students will also be introduced to matters of relevance to Islamic life and Islamic culture. These matters of relevance include: Islamic systems and principles of organization; and, modern issues and debates, highlighting an Islamic worldview. The language of instruction is English.

### HUMA105 EMIRATES SOCIETY (3-0-3)

Pre-requisite: ENGL102 or ENGL112

The course introduces the UAE society ranging from its historical, geographical, cultural, demographical, political, economic, and social aspects. It highlights the UAE society's evolution from traditional to modern times. It presents the economic and social infrastructure developments and policies, as well as the future vision and goals the UAE aspires to achieve.

### HUMA106 GULF REGION ECONOMIC AND SOCIAL OUTLOOK (3-0-3)

Pre-requisite: ENGL101 or ENGL111

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 global levels.

### HUMA110 MIDDLE EAST STUDIES (3-0-3)

Pre-requisite: ENGL101

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.

### HUMA111 ISLAMIC HISTORY (3-0-3)

Pre-requisite: ENGL101 or ENGL111

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.

### HUMA112 SCIENCES IN ISLAM (3-0-3)

Pre-requisite: ENGL101 or ENGL111

The birth of science and innovation in the Islamic World; the contribution of scientists in different areas of science like medicine, astronomy, mathematics, how the Western civilization benefited from the Islamic civilization will be addressed.

### HUMA140 INTRODUCTION TO PSYCHOLOGY (3-0-3)

Pre-requisite: ENGL101 or ENGL111

This course examines historical and current topics related to the mind and behavior with research methods and the scientific method as a foundation. Areas covered in this course include biology, development, memory, learning, social psychology, personality, psychological disorders, health psychology, and positive psychology.

### HUMA141 INTRODUCTION TO SOCIOLOGY (3-0-3)

Pre-requisite: ENGL102 or ENGL112

This course will introduce students to, and allow the analysis of, the social and cultural forces governing human behaviour. The principal topics include: social interaction and organization, socialization processes, primary groups including the family, collective behavior, population and the relationship between social life and the environment.

### HUMA 156 HUMAN BEHAVIOR AND WELL-BEING (3-0-3)

Pre-requisite: None

This course develops an understanding of the influence of biological, psychological and sociological factors on human behavior. Real-world cases are explored such as health and social issues in different contexts, national policies, and healthcare systems. Students learn to apply selected behavioral and social science concepts in their consideration of specific problems related to health, society, and human behavior.

### HUMA210 INTRODUCTION TO ISLAMIC LAW (3-0-3)

Prerequisite: None

This course explores classical and contemporary understandings of Islamic law, with an emphasis on Islamic legal methodology, a comparative perspective the history and development of Islamic law and its application in contemporary jurisdictions. Part of the challenge in studying Islamic law is its heterogeneity: there are several "schools" of Islamic law and there is no central religious adjudicative body. Furthermore, an overview of historical and jurisprudential themes includes the relationship between sacred texts and human reason in the development of the law, dissent and consensus in the articulation of the law, law and morality and normative pluralism. A detailed examination is made of the various applications of Islamic family law, with a regional focus on countries of the Middle East and South Asia. The initial inquiry will examine what exactly, Islamic law is. The course 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.

### HUMA211 ISLAM AND MODERNITY (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course is a study of the encounter between Islam and modernity, from 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.

### HUMA214 ENVIRONMENT AND SOCIETY (3-0-3)

Prerequisite: ENGL102 or ENGL112

Provides point of entry to global and local environmental issues, highlighting environmental crisis as a humanitarian crisis that needs to be solved at a collective level. Examines relationships between society and the environment, human impact on the environment, and challenges in environmental preservation. Introduces students to basic ideas of environmental studies, with emphasis on human impact on the environment, ethical issues and policies, and awareness and stewardship.

### HUMA220 PUBLIC SPEAKING (3-0-3)

Prerequisite: ENGL102 or ENGL112

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.

### HUMA264 ARABIC LANGUAGE II (3-0-3)

Prerequisite: HUMA101

This course is taught in Arabic. It is focused on developing competencies in listening, reading and writing. Students examine classical and modern texts, and analyze different genres. In the process, students construct various writing pieces, and develop advanced reading and writing skills, vocabulary and their understanding of Arabic grammar. The aim is to build on and enhance student skills and competencies in the Arabic language.

### HUMA 265 SUFISM IN ISLAM (3-0-3)

Prerequisite: ENGL 102 or ENGL 112

This course introduces students to Islamic mysticism (Sufism). It focuses on the various schools of the tradition, their fundamental ideas, practices, and institutions. It identifies the role of mysticism in Islamic history, literature and society, both among Muslims and non-Muslims. The course surveys major Muslim mystics, their thoughts, and their influence on contemporary Muslim thought.

### HUMA268 WESTERN CIVILIZATION FROM 1500 (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course is an introduction to the developments in human civilization in the Western world from 1500. In the course, students are encouraged to think historically by studying topics including: the definition and origin of civilizations; Western Europe in the Fifteenth Century; the Renaissance; the Reformation; European expansion into the New World; urbanization and migration; industrialization and technological innovation; imperialism and conflict; and globalization.

### HUMA277 INTRODUCTION TO LOGICAL REASONING (3-0-3)

Prerequisite: ENGL102

This course provides students with a solid introduction to logical thinking and critical analysis. Emphasis will be placed on arguments as basic units of thinking. By understanding the importance of the validity and soundness of reasoning, students will be able to identify, analyze, and evaluate arguments in scientific language and everyday discourse.

### HUMA291 LEADERSHIP BY DESIGN (3-0-3)

Prerequisite: Junior Standing

Students develop skills in leadership communication and how to communicate their ideas and solve problems with design thinking methodology and innovative techniques. The course focuses on using innovation and leadership skills to be successful. Students design a personal development plan, allowing them to demonstrate how leadership communication skills and design thinking can be adapted to many aspects of their career and life.

### HUMA295 SPECIAL TOPICS IN HUMANITIES AND SOCIAL SCIENCES (3-0-3)

Prerequisite: Topic specific

This course mainly deals with various trends in Humanities and Social Sciences. Course is repeatable if title and content differ.

### HUMA296 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.

HUMA395 ISLAM AND THE DISCOURSE OF THE ENLIGHTENMENT (3-0-3)
Prerequisite: HUMA211

This course is devoted to a sustained exploration of the encounter between Islam and the Enlightenment with a focus on the philosophical and intellectual sphere. It seeks to study the ways in which contemporary Muslim intellectuals engaged with different aspects of the epochal phenomenon of the Enlightenment and the likely outcome of such an encounter for the Arab-Muslim world. The course utilizes modern methodologies in hermeneutics and discourse analysis.

**JAPN JAPANESE**
JAPN101 ELEMENTARY JAPANESE (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.

JAPN102 ELEMENTARY JAPANESE II (3-0-3)
Prerequisite: JAPN101 or Placement Exam

The course is a continuation of JAPN101 and continues to build up the four basic language skills. Apart from building vocabulary and reinforcing grammatical concepts acquired in JAPN101, 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.

**KORA KOREAN**
KORA101 ELEMENTARY KOREAN I (3-0-3)
Prerequisite: 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.

KORA102 ELEMENTARY KOREAN II (3-0-3)
Prerequisite: KORA101 or placement exam

Continuation of KORA101 (Elementary Korean I). 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.

## LTCM LITERATURE AND COMMUNICATION

### LTCM 150 ACADEMIC READING (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course will give students the opportunity to read a wide variety of self-selected texts under the supervision of the instructor. Students will improve their reading skills and develop familiarity with a range of genres and increase their vocabulary, fluency and reading comprehension. Instruction will include close reading techniques, reading of 7-10 books totaling 400,000+ words, completion of short written assignments, and a multimodal presentation of each student's reading experience.

### LTCM213 SHORT STORIES FROM AROUND THE WORLD (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course introduces students to short fiction from around the globe. Works selected represent a sample of authors and kinds of writing (genre) from different historical periods and different geographical places, but they share universal humanistic concerns and themes. The course is designed to challenge and influence students' keenness of insight, ability to develop new critical ways of thinking, and awareness of other cultures and globalization.

### LTCM221 INTERCULTURAL COMMUNICATION (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course identifies and delineates the communication skills needed for effective interaction in a global society; examines the relationship between communication, language and culture; and studies the general concepts of intercultural communication.

### LTCM224 DIGITAL COMPOSITION (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course examines the role of multimedia across a wide range of web and computer-based media through theory, research, and practice, with an emphasis on relations between written print and images. Topics include: the history of multimedia; multimodal theory and design; and, the psychological and social implications of multimodal, digital communications. Activities and projects include: webpage design; composing across digital and web-based platforms; digital presentations; and, video editing and composition.

### LTCM225 MEDIA LITERACY (3-0-3)

Prerequisite: ENGL102

This course introduces principles of media literacy and their application to reading and viewing traditional (newspapers, radio, and television) and digital (social media, YouTube, and websites) media through project-based and case-study approaches. Topics include: the history of mass media; relations between print and images; and, identifying legitimate sources. Students will complete an analysis of one current media outlet and present findings in written and digital formats.

### LTCM230 THINKING THROUGH TECHNOLOGY (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course explores how humans have used tools to understand themselves and the world around them. This course also explores theoretical texts that highlight key ideas clarifying how to think about humans as engineers. It focuses on four contemporary sciences and technologies that are converging at increasing rates: the NBIC (nanotechnology, biotechnology, information technology, and cognitive science). In this course, we will discuss these key texts in relation to various sciences and technologies including genetic engineering, robotics and artificial intelligence.

### LTCM240 INTRODUCTION TO LINGUISTICS (3-0-3)

Prerequisite: ENGL102 or ENGL112

This course is an introduction to the scientific study of human language. The main focus is building a solid foundation in micro-linguistics (phonetics, phonology, morphology, syntax, semantics, and pragmatics) to facilitate understanding aspects of macro-linguistics including sociolinguistics and computational linguistics. The course provides a useful grounding for students whose degree involves the analysis and application of natural or invented languages.

### LTCM 260 WRITING ABOUT INNOVATION (3-0-3)

Prerequisite: ENGL102

This course focuses on the careful reading and discussion of a book on the social impact of technological innovation in world history. Students will choose one modern technological innovation in the Middle East and write an analysis of its social impact, based on principles generated from reading/discussion of the book. Students will propose their own technological innovation and imagine its social impact through a digital composition.

### LTCM 280 STUDYING HUMAN LANGUAGE (3-0-3)

Prerequisite: ENGL102

This course introduces students to the study of human language from a scientific perspective, investigating linguistic theories, current research, and engineering applications. A semester-long project involving reading, research and a final written report will help students demonstrate their understanding of the relationship between linguistic theory and its scientific applications ranging from speech processing and acoustic analysis of speech to machine translation.

### LTCM311 TECHNICAL COMMUNICATION (3-0-3)

Prerequisites: ENGL102

This course offers a project-based focus on professional reading, writing, and composing texts and documents related to engineering and the sciences. Students integrate the use of software from their technical fields with composition across multiple genres such as proposals, reviews, and reports. Projects include an article review, use of graphic software in the writing of instructions and specifications, a progress report, a research report and recommendation, and presentation supported by multimedia text.

### LTCM 325 TRAVEL WRITING (3-0-3)

Pre-requisite: ENGL 102

This course develops students' critical thinking and writing skills through the medium of travel writings. The course covers a wide range of topics that relate to travel writing: the development of the genre throughout history, describing places and cultures, travel writing in a touristic age and travel writing in the future, especially in space. Students will analyze features of travel books, compose travel narratives, prepare travel videos, and build travel blogs.

### LTCM 328 DIGITAL PUBLIC SPEAKING (3-0-3)

Pre-requisite: ENGL 102

This course focuses on public speaking using digital media: the production and delivery of spoken texts in a variety of formats including recorded live presentations, podcasts, vlogs, news broadcasts, and narrated videos. Students will prepare their own spoken texts to present before an audience as observe and evaluate others' spoken texts.

### LTCM 330 THINKING THROUGH TECHNOLOGY (3-0-3)

Prerequisite: ENGL 102

This course explores how humans have used tools to understand themselves and the world around them. This course also explores theoretical texts that highlight key ideas clarifying how to think about humans as engineers. It focuses on four contemporary sciences and technologies that are converging at increasing rates: the NBIC (nanotechnology, biotechnology, information technology, and cognitive science). In this course, we will discuss these key texts in relation to various sciences and technologies including genetic engineering, robotics, and artificial intelligence.

### LTCM 332 COMMUNICATIONS ETHICS (3-0-3)

Pre-requisite: ENGL 102

This course explores the ethical dimension of communication processes in various contexts ranging from interpersonal to global and focuses on contemporary topics related to the complexity of the digital communication processes in the scientific, technological, social media, and organizational domains. Students are introduced to major ethical theories and their connection to the communication process. Students will debate, write a position paper, and create a final video project.

### LTCM 335 GAMES AND NARRATIVE (3-0-3)

Pre-requisite: ENGL 102

This course examines narratives of digital games through practical classroom exercises and considers similarities and differences across character, setting, and plot. Topics include game theory and the concept of play from cognitive and humanistic perspectives; game studies and the experience of playing online games; and literary studies and narratology to frame narrative, representation, and simulation. Assignments include creating an original game outline and an analytic report of a digital game.

### LTCM 337 VISUAL COMMUNICATIONS (3-0-3)

Pre-requisite: ENGL 102

This course develops students' skills in multimodal design, data visualization and digital storytelling, using professional tools for graphic design and photo and video editing, and the advanced features of web design platforms. The major project includes research on a topic within the theme of "Exploring the UAE." Students will present findings through multiple genres, including infographics, a multimedia report, a website, and a video.

### LTCM 340 LANGUAGE AND INTERCULTURAL COMMUNICATIONS (3-0-3)

Pre-requisite: ENGL 102
This course focuses on the use of language in media, and especially media that is transnational and intercultural. Topics include patterns of language use across genres (e.g., news, drama, sports) and how citizens of one nation or culture understand programs from another nation or culture. Major projects include a research paper analyzing language use in media and a digital presentation.

### LTCM 345 SCIENCE JOURNALISM (3-0-3)

Pre-requisite: ENGL 102

This course introduces students to the area of science writing and journalism in the context of 21st-century digital technology and mass media. The course prepares students for future career specializations in media or public affairs publishing, leveraging both their technical scientific and engineering knowledge and their skills in English communication to broaden the scope of their employability. Assignments include composing journalistic articles and a digital media report such as a podcast or video.

### LTCM 370 GLOBAL MEDIA (3-0-3)

Pre-requisite: ENGL 102

This course presents an historical case-study approach to study the intersection of communications, technology, and the business of media. Students read and take notes about case studies of electronic media, from the invention of the radio to satellite television and digital streaming services, and then build a model of innovation from their notes that is applied to their own analysis of one digital media business. Major projects include an analytical paper and digital presentation of the analysis.

## MATH MATHEMATICS

### MATH101 FUNDAMENTALS OF MATHEMATICAL REASONING (3-0-3)

Prerequisite: None

This course provides a foundation in logical and mathematical reasoning. It develops first year university students' structured logical thinking and mathematical rigor. The course introduces methods of proof, basic concepts and properties of real numbers, relations and functions. The course also presents an introduction to combinatorics, set theory and number theory.

### MATH111 CALCULUS I (4-0-4)
Prerequisite: None

This course introduces students to the theory and techniques of single variable differential and integral calculus. The emphasis is on problem solving in a science and engineering context, as opposed to theory. Topics include studying the exponential, logarithmic, trigonometric, and polynomial functions and their limits, continuity, derivatives, extrema, integration, area under a curve, and volumes of revolution.

### MATH112 CALCULUS II (4-0-4)
Prerequisite: MATH111 (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. The emphasis in this course is on problem solving, rather than theory. Topics include integration techniques, parametric equations, infinite series, an introduction to vectors and vector-valued functions, as well as an introduction to functions of several variables and double integrals.

### MATH204 LINEAR ALGEBRA (3-0-3)
Prerequisite: MATH112

This is an introductory course in Linear Algebra. Topics covered in this course include basic properties of matrices and determinants, solving a system of linear equations, vector spaces, subspaces, linear independence, span, basis, coordinates, linear transformations, matrix representations of linear transformations, eigenvalues and eigenvectors, diagonalization, Euclidean inner product and orthogonality.

### MATH206 DIFFERENTIAL EQUATIONS (3-0-3)
Prerequisite: MATH112

This is a first course in ordinary differential equations. The topics covered in this course include first-order and second-order differential equations, series solutions, and the Laplace transform. Solution techniques are applied to engineering and science problems.

### MATH214 MATHEMATICAL AND STATISTICAL SOFTWARE (3-0-3)
Prerequisites: ENGR 113, MATH 204, MATH 242 or MATH 243 or MATH 244

This course introduces mathematical and statistical programming using the MATLAB and R programming languages. The topics covered span a variety of topics in data science and numerical computation, including tidy data, exploratory data analysis, plotting, and symbolic computation.

### MATH231 CALCULUS III (3-0-3)
Prerequisite: MATH112

This course covers differential and integral calculus in several variables. Topics include partial derivatives, gradient, divergence, curl, Lagrange multipliers, multiple integrals, line integrals, vector fields, Green's theorem, Stokes' theorem, and Gauss's theorem.

### MATH232 ENGINEERING MATHEMATICS (3-0-3)
Prerequisite: MATH112

This course covers selected topics from mathematical analysis with engineering applications, including complex numbers, partial derivatives, gradient vectors, multiple integrals, and Fourier series.

### MATH234 DISCRETE MATHEMATICS (3-0-3)
Prerequisite: MATH112

Topics covered in this course include propositional and predicate calculus, mathematical reasoning including mathematical induction, an introduction to sets, basic number theory, functions, relations, graphs, trees, cardinality, counting techniques, linear recurrence relations, and Boolean Algebra.

### MATH242 INTRODUCTION TO PROBABILITY AND STATISTICS (3-0-3)
Prerequisite: MATH112

This course introduces students to basic probability models and statistical methods for data analysis. The course will cover introductory probability theory, discrete and continuous probability distributions, elements of descriptive statistics, and different statistical inference methods such as estimation for the mean and the variance, hypothesis testing for the mean and the variance.

### MATH243 PROBABILITY AND STATISTICAL INFERENCE (3-0-3)
Prerequisite: MATH112

This course provides a mathematically rigorous introduction to probability theory and inferential statistics. Numerous real-world applications are presented throughout the course. After covering random variables/vectors, expectation/variance, and limit theorems, students are introduced to inferential statistics, including point estimation and interval estimation in the presence of nuisance parameters, and simple hypothesis testing.

### MATH244 PROBABILITY (3-0-3)
Prerequisites: MATH101; MATH112

This course introduces the mathematical theory of probability at an undergraduate level of rigor. The course covers basic concepts of axiomatic probability and conditional probability, random variables/vectors and their distribution, moments, and various models of random variables. Students will also study classical probability inequalities and limit theorems in large sample theory.

### MATH245 MATHEMATICAL STATISTICS (3-0-3)
Prerequisite: MATH 242 or MATH 243 or MATH 244

This course provides a rigorous introduction to classical statistics. Probabilistic concepts and tools are used to present inferential statistics methods, including sampling distributions, parametric point estimators and their properties, interval estimation, hypothesis testing and regression models. Students study some elements of Bayesian statistics.

### MATH252 INTRODUCTION TO APPLIED STATISTICS (3-0-3)

Prerequisite: MATH 112

This course introduces students to basic probability and statistical methods. It covers descriptive statistics, random variables, and basic discrete and continuous distributions. Emphasis is placed on point and interval estimation, tests of hypotheses, and regression. Applications to biosciences and engineering are given throughout the course.

### MATH315 ADVANCED LINEAR ALGEBRA (3-0-3)

Prerequisite: MATH204

This course presents the mathematical structure of vector spaces and linear transformations. The axioms of vector spaces are introduced along with the notion of basis and dimension. Properties of dual spaces and multilinear transformations are studied. Eigenvalues and eigenvectors theorems are used to diagonalize matrices. Adjoint, self-adjoint, normal and unitary operators on pre-Hilbert spaces are constructed.

### MATH316 PARTIAL DIFFERENTIAL EQUATIONS (3-0-3)

Prerequisites: MATH 204, MATH 206, MATH 324

This course presents the mathematical theory of partial differential equations (PDEs) in classical formulation. First order quasi-linear PDEs are solved by the method of characteristics. Second order quasi-linear PDEs are classified and then solved by the method of separation of variables. Solutions to PDEs are interpreted in physical and engineering contexts.

### MATH317 NONPARAMETRIC STATISTICS (3-0-3)

Prerequisites: MATH214; MATH245

This course presents the theory and practical tools from classical nonparametric statistics. Students learn to determine the suitability of parametric versus nonparametric methods, with an emphasis on applying procedures for testing hypotheses. This course discusses correlation and regression in a nonparametric setting. Students are trained to select and use software to perform nonparametric estimation and hypothesis testing on data.

### MATH318 MULTIVARIATE STATISTICS (3-0-3)

Prerequisites: MATH214; MATH231; MATH245

This course provides a thorough introduction to multivariate analysis methods, and some of the ethical issues involved in data analysis. Particular emphasis is placed on methods for analyzing categorical data. All methods are applied to real data sets using the open-source software R.

### MATH319 NUMERICAL ANALYSIS I (3-0-3)

Prerequisites: MATH204; MATH206; MATH214

This course introduces computer arithmetic and error analysis, numerical solution of linear and nonlinear algebraic equations, interpolation and least squares approimations, numerical integration and differentiation, eigenvalue problems, and an introduction to the numerical solution of ordinary differential equations. Emphasis is placed on efficient computational methods including the use of libraries and student written procedures in MATLAB.

### MATH320 MATHEMATICAL FOUNDATIONS OF GENERAL RELATIVITY (3-0-3)
Prerequisites: MATH204; MATH206; MATH231

This course introduces students to the tools of modern differential geometry, focusing on Riemannian and Lorentzian geometries. The course also covers covariant derivatives, tensors, curvature, and geodesic curves with emphasis on modern coordinate-free methods of computation. It presents physical models of general relativity, such as black holes, gravitational lensing and cosmological models.

### MATH324 REAL ANALYSIS I (4-0-4)
Prerequisites: MATH101; MATH112

This course gives students a thorough understanding of essential concepts in analysis such as real numbers, limits, continuity, and convergence of sequences and series. The course also covers a rigorous definition of derivative and construction of the Riemann integral and their properties including the Fundamental Theorem of Calculus. Students are required to read and write proofs using a precise knowledge of definitions and theorems.

### MATH333 APPLIED ENGINEERING MATHEMATICS (2-3-3)
Prerequisites: ENGR112; MATH204; MATH206

This course provides students with the numerical and analytical methods to solve mathematical models appearing in engineering science including, but not limited to, nonlinear equations, systems of algebraic equations, extrapolation, and ordinary differential equations. Applications will include wave motion and heat conduction. The course includes writing computer codes.

### MATH352 COMPLEX FUNCTIONS (3-0-3)
Prerequisite: MATH231

This course provides students with a sound knowledge of analytic functions of a complex variable, infinite series in the complex plane and theory of residues in relation to Fourier integrals and transforms. The students are introduced to several applications in engineering and science.

### MATH395 SPECIAL TOPICS IN MATHEMATICS: INTRODUCTION TO MANIFOLDS (3-0-3)
Prerequisite: MATH352

This course covers the fundamental principles of the theory of manifolds. In the first part of the course, the notions of topological space, continuity, compactness, boundedness, connectedness and convergence are introduced. Most topics focus on the study of smooth functions, vector fields and differential forms. An overview of integration on manifolds and the De Rham cohomology are also considered.

### MATH399 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.

### MATH410 INTRODUCTION TO TOPOLOGY (3-0-3)
Prerequisites: MATH231; MATH324

This course will introduce students to basic principles of point set topology. The course covers topological spaces, homeomorphisms, compactness, connectedness and metric spaces. It also prepares the students to undertake advanced courses in mathematics, such as algebraic topology, normed spaces and differential geometry.

### MATH411 MODERN ALGEBRA (3-0-3)
Prerequisite: MATH 315 or MATH 324

This course introduces basic concepts and properties of fundamental elements of modern algebra. Fundamental theorems are used to explain properties of groups, rings, and fields. Students read and write proofs using a precise knowledge of definitions and theorems. This course also presents applications of permutation groups to explain symmetries of regular polygons in geometry.

### MATH412 OPTIMIZATION (3-0-3)
Prerequisites: MATH204; MATH231; Senior Standing

This course introduces the main optimization techniques and their applications in physics, engineering, economics, and social sciences. After covering unconstrained optimization algorithms, the course presents methods to solve linear and nonlinear constrained optimization problems with a special focus on convex optimization.

### MATH413 GAME THEORY (3-0-3)
Prerequisite: MATH315

This course provides an extended treatment of methods and applications of game theory at an advanced undergraduate level. A distinction between competitive and cooperative games is presented, and mathematical theory of games and game theoretic analysis are applied. Applications in social sciences, economics and industry are developed from basic principles relying on saddle point theory and Nash equilibria concepts.

### MATH414 DISCRETE MATHEMATICS (3-0-3)
Prerequisite: MATH315

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.

### MATH415 DESIGN OF EXPERIMENTS (3-0-3)
Prerequisite: MATH318 or ISYE311

This course offers a review of various types of designs of experiments and their applications in different engineering fields. The course introduces analysis of variance, followed by an introduction to block designs, full factorial designs, 2-level full factorial and fractional factorial designs. Moreover, Taguchi methods and response surface methods are discussed.

### MATH416 SAMPLE SURVEY DESIGN AND ANALYSIS (3-0-3)

Prerequisites: MATH214; MATH245; Senior Standing

This course introduces the main techniques involved in survey design and analysis. The main sampling techniques are covered. The course reviews the main methods used in the analysis of surveys, such as regression, factor analysis and principal component analysis. Students design, pilot, and implement a survey, and then they select and use statistical software to analyze the results.

### MATH417 MEASURE AND PROBABILITY THEORY (3-0-3)

Prerequisites: MATH244; MATH324

This course introduces the fundamentals of measure and integration theory and progresses onto probability from a measure-theoretic point of view. It develops the Lebesgue integral along with the associated limit theorems. The course covers the Radon-Nikodym theorem and its applications to basic probability theory. This course also presents various forms of the central limit theorem, along with the theory of conditional expectation on sigma fields.

### MATH419 NUMERICAL ANALYSIS II (3-0-3)

Prerequisites: MATH316; MATH319

This course presents the theoretical and practical methods for numerical solution of ordinary and partial differential equations. It explores Runge-Kutta and multistep methods, as well as stability theory, stiff equations and boundary value problems. A short introduction to Galerkin approximations and finite element methods is also presented.

### MATH421 ECONOMETRICS (3-0-3)

Prerequisite: MATH317; MATH318

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.

### MATH422 STOCHASTIC DIFFERENTIAL EQUATIONS (3-0-3)

Prerequisite: MATH314 or MATH324

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.

### MATH423 FINANCIAL RISK ANALYSIS (3-0-3)

Prerequisites: MATH317; MATH318; MATH412

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.

### MATH424 OPTIMAL CONTROL THEORY (3-0-3)

Prerequisites: MATH214; MATH316; MATH412

This course provides an introduction to the basics of optimal control theory (deterministic and stochastic) through examples. The course further builds on standard differential linear system and optimization under constraints, to explore issues related to real-world problems modeled by differential equations.

### MATH425 FINANCIAL PORTFOLIO MANAGEMENT (3-0-3)

Prerequisites: MATH317; MATH318; MATH412

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.

### MATH426 FINANCE IN DISCRETE TIME (4-0-4)

Prerequisites: MATH214; MATH231; MATH243 or MATH245

The course gives a modern overview of the main concepts in mathematical finance in discrete-time stochastic models. The course will focus on the Cox-Ross-Rubinstein (binomial) model. Topics include no-arbitrage pricing of financial derivatives, replication, hedging, self-financed portfolios, risk-neutral probability measures, and the Black-Scholes-Merton option pricing models. European and American options in discrete time and the numerical algorithms for their evaluation will also be presented.

### MATH431 COMPUTATIONAL METHODS IN BIOLOGY (3-0-3)

Prerequisite: BMED211
Co-requisite: MATH419

This course presents an overview of important applications of computers to solve problems in biology. It is intended for undergraduate students with good computer programming experience. Major topics covered are computational molecular biology (analysis of protein and nucleic acid sequences), biological modeling and simulation including computer models of population dynamics, biochemical kinetics, cell pathways, neuron behavior, and mutation, development of models of physiological systems using the compartmental framework, partial differentiation and Taylor series in one and two dimensions, together with second order linear constant coefficient differential equations. This final part of the course introduces techniques to analyse and interpret the “classical” models of theoretical ecology. The associated practical concentrates on the Lotka-Volterra models of predator-prey dynamics and competition and finish with an overview of computational phylogenetics.

### MATH432 MATHEMATICAL MODELS IN BIOLOGY (3-0-3)

Prerequisite: MATH 204, MATH 206, MATH 242 or MATH 243 or MATH 244

This course applies mathematical theory and techniques to Biology and Biomedicine. The course focuses on continuous mathematical modelling techniques with applications to cell population dynamics, single cell decision-making, tissue pattern formation, and cancer modeling. The course introduces discrete probabilistic modelling techniques, such as cellular automata and Langevin equations, with a focus on cell migration and dynamics of bacterial colony and tumors.

### MATH433 BIOSTATISTICS (3-0-3)

Prerequisites: MATH318; BMED211

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.

### MATH434 BIOINFORMATICS (3-0-3)

Prerequisites: MATH433; BMED202

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.

### MATH435 MATHEMATICAL IMAGING (3-0-3)

Prerequisite: MATH317; MATH318; MATH412

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.

### MATH467 INTRODUCTION TO MATHEMATICS TEACHING (3-0-3)

Prerequisite: Junior Standing

This is the first course in a two-part sequence on introductory Mathematics Education for future teachers. This course introduces fundamental learning theories, learning design principles, teaching strategies, conceptual progression and planning and their implications for teaching and learning mathematics in cycle 2 and cycle 3 classrooms. The course will include a variety of reading tasks, exploration of instructional technology platforms, class discussions and activities, microteaching and other assignments.

### MATH468 TEACHING KEY CONCEPTS IN MATHEMATICS (3-0-3)

Prerequisite: MATH467

This is the second course in a two-part sequence on introductory Mathematics Education intended for future teachers. This course focuses on analyzing science pedagogy and practices for developing formative and summative assessments. This course also includes the development of practical investigation skills and teamwork issues. The course will include various reading tasks, class activities, and microteaching, involving practical work and other assignments.

### MATH485 NONLINEAR DYNAMICS

Prerequisite: MATH 204, MATH 206, MATH 231

This course introduces students to applications of nonlinear dynamical systems. Students learn to qualitatively describe the behavior of a solution of a dynamical system and identify various types of bifurcations in one- and two-dimensional systems. Moreover, students analyze limit cycles and their stability. Finally, this course offers students basic knowledge of Hamiltonian systems and integrability.

MATH497 SENIOR RESEARCH PROJECT I (3-0-3)
Prerequisite: Senior standing
MATH498 SENIOR RESEARCH PROJECT II (3-0-3)
Prerequisite: MATH497

Over the course of two semesters, students conduct a supervised research project. Projects involve the theoretical or computational investigation of a mathematical concept, the construction and solution of a model of a real-world problem, or the reading, understanding and expansion of an existing scholarly publication. Students summarize the final results of the research in the form of a written report as well as a public oral presentation.

**PGEG PETROLEUM GEOSCIENCES**
PGEG200 INTRODUCTION TO GEOLOGY AND GEOPHYSICS (2-3-3)
Prerequisite: None

An introduction to geology and geophysics, emphasizing the processes that form and shape Earth, petroleum geology and geophysics, and the geology of the UAE and the Middle East. Course topics include: origin of minerals and rocks; seismology; Earth's gravity; geomagnetism; geologic time; plate tectonics; structural geology; sedimentary transport and the depositional environments of reservoirs; geo-hazards; hydrology; economic geology. The course includes at least one all-day field trip.

PGEG210 EARTH MATERIALS (2-3-3)
Prerequisites: PGEG221; CHEM116

This course introduces the fundamentals of mineralogy, including systematic chemistry and crystallography and physical and optical properties of minerals, emphasizing the carbonate group and silicate minerals. Students learn to use the petrographic microscope and to describe and identify a variety of rock-forming minerals in hand samples and petrographic thin-sections.

PGEG220 GEOLOGY OF THE MIDDLE EAST (3-0-3)
Prerequisite: PGEG221

This course covers application of the principles of stratigraphy and age dating methods, first introduced in Introduction to Geology and Geophysics. The course introduces biologic evolution theory and covers the evolution of Earth's atmosphere and biosphere. The emphasis of the course is on the tectonic, stratigraphic, and geographic evolution of the Middle East, and particularly on paleo-environments, facies, and tectonic setting of UAE reservoir intervals. The principles of basin analysis, including the formation of organic-rich rocks and maturation of hydrocarbons, are introduced.

PGEG230 GEOLOGICAL MAPS (2-3-3)
Prerequisite: PGEG221

An ability to read, interpret and apply geological and topographic maps to the Earth System is fundamental to the Earth Sciences. The accurate collection, recording and interpretation of high-quality fieldwork data is essential to a geologist's understanding of Earth processes and environments. Through the application of practical exercises, students will learn to apply static two-dimensional representations in order to construct and understand three-dimensional sub-surface geometries. Students will learn to employ the primary data-gathering techniques used by geologists in the field and the reasons for these.

### PGEG300 MATLAB FOR EARTH SCIENTISTS (2-3-3)

Prerequisites: ENGR113; MATH231

The course introduces numerical methods to solve mathematical models relevant to earth sciences using MATLAB. The numerical methods include the matrix and iterative solvers for systems of linear equations, linear and nonlinear regressions, numerical differentiation and integration. These numerical methods are applied to common earth sciences problems such as heat flow, gravity, geomagnetic field and seismic waves.

### PGEG311 SEDIMENTARY PETROLOGY (3-3-4)

Prerequisite: PGEG200

Sedimentary Petrology is concerned with the origin of sediment and sedimentary rock. The course covers sedimentary processes, facies, and diagenesis. Emphasis is on petrographic analysis of microfacies and diagenesis and on carbonate reservoirs and source rocks. Students learn how to characterize reservoirs using limited subsurface information from petrographic thin sections and cores. The course includes a compulsory four-day local field trip.

### PGEG312 REFLECTION SEISMOLOGY (3-3-4)

Prerequisite: PGEG 221, PHYS 241, MATH 231

The course introduces fundamental wave theory and seismic data acquisition, processing, and visualization techniques to image and describe the underground. It includes laboratory work using seismic software and real-world seismic data. Students learn how to design acquisition systems, acquire data, and interpret a seismic reflection survey. In addition, students are required to conduct fieldwork in the UAE.

### PGEG321 STRUCTURAL GEOLOGY (3-3-4)

Prerequisites: PHYS121; PGEG221; PGEG230

Structural geology is the study of deformed rock. The course deals with the range of structures produced in rock by deformation; with the role of structures in trapping petroleum and their effect on production and with application of structural methods in E and P. Course topics include stress and strain; rheological behavior of rock; effects of time, temperature, and pressure on deformation; kinematic and dynamic analysis of deformed rock; the origin and mechanisms of fractures, faults, and folds; structural interpretation from seismic reflection, well, and other E&P data; mapping of subsurface structures from industry data; regional structural geology of the UAE. The course includes one three-day field trip.

### PGEG324 REMOTE SENSING FOR EARTH SCIENCES APPLICATIONS & GIS (2-3-3)

Prerequisites: PHYS122; MATH231

The course covers the basic principles and essential skills of remote sensing using image visualization, processing and GIS (Geographical Information System) for geological and/or environmental mapping. After completing the course, students should understand the physical principles of remote sensing and be familiar with the major remote sensing satellites and datasets. The students will learn the basic skills of image visualization, processing, interpretation and data manipulation for mapping. The course emphasizes the use of satellite images as essential information source for fieldwork.

### PGEG331 IGNEOUS AND METAMORPHIC PETROLOGY (2-3-3)
Prerequisite: PGEG210

The course provides an overview of igneous and metamorphic rocks as a background for discussing their origin and distribution in relation to plate tectonics. Students learn about igneous melt generation, evolution, and crystallization; mid-ocean ridge and subduction zone igneous processes; and metamorphic processes and occurrences. In the Petrology Laboratory, students learn to describe and classify different types of rocks in both hand specimens and thin sections.

### PGEG341 PALEONTOLOGY (2-3-3)
Prerequisite: PGEG220

Paleontology is the study of past life. The course covers the application of taxonomic procedures to the identification of fossils and the application of paleontology in paleo-environmental and bio-stratigraphic analysis. Students learn about the fundamental morphology, modes of life, evolutionary trends, and time ranges of major macrofossil and microfossil groups. The course includes at least one all-day field trip.

### PGEG351 APPLIED GEOPHYSICS (3-3-4)
Prerequisites: PGEG221; PHYS122

The course provides an introduction to the principles and methods involved in modern geophysical petroleum exploration. The course concentrates on physical principles survey techniques and interpretation of gravity, magnetics, electrical, and electromagnetics techniques. Students will learn about the equipment used, typical fieldwork design, numerical data corrections, and data processing for each survey method. The course includes at least 3 all-day field trips.

### PGEG361 SEDIMENTOLOGY AND STRATIGRAPHY (2-3-3)
Prerequisites: PGEG220; PGEG311

Stratigraphy instructs in the sedimentological and stratigraphic methods used to analyze and interpret sedimentary sequences. Students will learn to interpret physical processes and depositional environments from sedimentary structures and textures, and to apply sequence stratigraphic methods to interpret and model facies and sedimentary basin evolution. The course incorporates modern and ancient examples from the Middle East, particularly from the UAE. The course includes five days of fieldwork.

### PGEG371 DATA ANALYSIS AND GEOSTATISTICS (3-3-4)
Prerequisites: PGEG221; MATH231

This course introduces basic statistical concepts and methods used in geoscience. Students learn to apply statistical methods to interpret geoscience data and solve petroleum geoscience problems. The course concentrates on the analysis and processing of different kinds of geoscience data obtained from laboratory and field work.

### PGEG381 ROCK MECHANICS AND RESERVOIRS (2-3-3)
Prerequisite: PGEG321

This course builds on material introduced in PGEG321 and provides theoretical and practical introduction to basic physical and mechanical rock properties and their core-based measurements. Selected reservoir rock properties such as porosity, permeability, saturations, capillary pressures and relative permeability are introduced first. Then topics such as nature of rock, rock deformability, brittle and ductile behavior, rock stresses, stress transformations, rock strength and failure and rock testing methods are discussed. Concepts introduced in the classroom are reinforced through laboratory sessions.

### PGEG397 FIELD PETROLEUM GEOLOGY (0-0-4)
Prerequisites: PGEG321; PGEG361

Field Petroleum Geology is concerned with the study of lithologies and structures in the field. The course addresses vertical and horizontal variability in depositional facies and physical characteristics in reservoirs in three dimensions, and shows how physical variability affects petroleum capacity, flow, and production. Attention is paid to post-depositional diagenetic processes and their effect on reservoir evolution. Students make geological and petrophysical measurement of time and facies-equivalents to UAE carbonate reservoirs. The course includes two periods of two weeks of fieldwork, each followed by one week of data integration and report writing.

### PGEG398 GEOPHYSICS INTERNSHIP (1-0-1)
Prerequisites: PGEG312; PGEG351; PGEG361

Students are assigned to a variety of ADNOC's operating companies or geophysical service companies where they will work on short-duration projects allowing them to apply the acquire knowledge, gain practical experience and become acquainted with the industry's working environment. Each student is required to submit a written report and deliver a presentation on his/her work assignment.

### PGEG400 SEISMIC DATA ACQUISITION AND PROCESSING (2-3-3)
Prerequisites: MATH206; PGEG300; PGEG312

The course introduces fundamental wave theory and seismic data acquisition, processing, and visualization techniques to image and describe the underground. It includes laboratory work using seismic software and real-world seismic data. Students learn how to design acquisition systems, acquire data, and interpret a seismic reflection survey. In addition, students are required to conduct fieldwork in the UAE.

### PGEG401 PETROPHYSICS AND LOGGING (3-3-4)
Prerequisites: PGEG361; PGEG371

The course introduces well logging and laboratory techniques used to acquire and interpret petrophysical data for applications in the oil and gas industry. Students correlate between different petrophysical properties (porosity, permeability, density, resistivity, fluid saturation) and derive mechanical properties of rocks (stiffness, fractures) by applying several techniques.

### PGEG410 RESERVOIR GEOPHYSICS (2-3-3)

Prerequisites: PGEG351; PGEG400; PGEG401

The course provides an introduction to reservoir geophysics with emphasis on carbonate reservoirs. The course concentrates on the integration of seismic data, well data, and petrophysical data. Various aspects of the traditional approach of exploration geophysics as well as modern aspects of reservoir geophysics will be covered.

### PGEG412 SEISMIC REFLECTION INTERPRETATION (3-3-4)

Prerequisite: PGEG312
Co-requisite: PGEG461

The course covers principles and practices of seismic reflection interpretation. Course topics include: seismic interpretation theory and principles; picking wavelets; well to seismic ties; synthetic seismograms; fault identification; time-to-depth conversion; seismic stratigraphy; 3D seismic interpretation; seismic fracture analysis and interpretation; and seismic attributes. Students will learn how to interpret varieties of processed seismic data using seismic data interpretation software. Emphasis is on interpretation of carbonate strata.

### PGEG413 MICROPALEONTOLOGY (2-3-3)

Prerequisite: PGEG341

Micropaleontology is the study of microscopic fossil organisms. This course offers an overview of the most common microfossil groups. Identification techniques, stratigraphic distribution of the major microfossil groups and their relation with the sedimentary environments will be explained. The applications and uses of each microfossil group (biostratigraphy, paleogeography, paleoenvironmental, paleoclimatic reconstructions) will be explained. Emphasis will be given on shallow-marine unicellular microorganisms of the Mesozoic and Cenozoic.

### PGEG451 ENVIRONMENTAL GEOLOGY (3-0-3)

Prerequisites: PGEG221; CHEM116

This course deals with how people interact with Earth's natural systems. Environment profoundly controls social and economic systems but, simultaneously, humans are major agents of geologic change. The course covers natural hazards, landscape and soil characteristics, groundwater, surface water, climate change, and ethics of environmental issues, emphasizing the environment and environmental issues of the UAE. The course includes a one-day field trip.

### PGEG461 RESERVOIR CHARACTERIZATION PROJECT (2-6-4)

Prerequisite: PGEG361
Co-requisite: PGEG412

The course introduces and applies the principles and practices used to characterize petroleum reservoirs using core, structural, seismic, petrographic, and petrophysical data. Emphasis is on depositional geometries, petrophysical properties, and compartmentalization of carbonate reservoirs. Much of the coursework involves characterizing and designing a model of a UAE reservoir integrating multiple datasets.

### PGEG497 SENIOR RESEARCH PROJECT I (1-6-3)

Prerequisite: Senior Standing

This course comprises the development and initiation of an independent research project within the fields of the Earth Sciences. Prior to commencing the course, students must arrange for supervision from a Geosciences member of faculty and the topic of study must be approved by the Geosciences Program. The course comprises a significant taught component focusing on the methodologies and ethics of project proposal preparation. Following the preparation of the acceptance of the written proposal and the successful defence of the proposal presentation the student will commence work on the project.

### PGEG498 SENIOR RESEARCH PROJECT II (1-6-3)

Prerequisite: PGEG497

This course involves completion of a project in the student's area of interest in some area of petroleum geology or geophysics. Students must have arranged for supervision from an instructor and the project must have been approved by the Petroleum Geosciences Program. The course consists mostly of independent project work.

### PGEG293/393/493 SPECIAL TOPICS IN PETROLEUM GEOSCIENCES (1-4 CREDIT HOURS, VARIABLE DEPENDENT ON CREDIT HOURS)

Prerequisites: To be determined by the program
Co-requisites: To be determined by the program
Restrictions: PGEG293 is open to Sophomore students and above, PGEG393 is open to Junior students and above, PGEG493 is open to Senior students only

The course offers content not included in existing courses. A student can take multiple Special Topics courses with different content for credit subject to program approval.

### PGEG394/494 RESEARCH TOPICS IN PETROLEUM GEOSCIENCES (1-4 CREDIT HOURS, VARIABLE DEPENDENT ON CREDIT HOURS)

Prerequisites: To be determined by the program
Co-requisites: To be determined by the program
Restrictions: PGEG394 is open to Junior students and above, PGEG494 is open to Senior students only.

The course focuses on research-driven topics. A student can take multiple Research Topics courses with different content for credit subject to program approval.

### PGEG396/496 INDEPENDENT STUDY IN PETROLEUM GEOSCIENCES (1-4 CREDIT HOURS, VARIABLE DEPENDENT ON CREDIT HOURS)

Prerequisites: To be determined by the program
Co-requisites: To be determined by the program
Restrictions: CGPA≥3.0, PGEG396 is open to Junior students and above, PGEG496 is open to Senior students only.

The course may offer content not included in existing courses in an independent study format based on a formal arrangement between the student and instructor. A student can take one or more Independent Study courses (up to 6 credits). Independent Study courses require prior approval of the Program Chair and Provost (or designee).

## PHYS PHYSICS

### PHYS103 ORIENTATION TO PHYSICS (2-3-1-4)

Prerequisite: None

This course aims to build enthusiasm and readiness for physics challenges by exploring the fields of physics and physics-related careers; introducing basic perspectives and strategies for success when approaching and solving problems and designing projects; and providing a basic introduction to computer programming. Course problems and projects will require students to work independently and also collaborate and function effectively in teams; make appropriate use of tools and software; and apply methods for effective communication of technical information.

### PHYS121 UNIVERSITY PHYSICS I (3-2-1-4)

Prerequisite: MATH111

This course gives a vector-based and calculus-based introduction to fundamental concepts in Newtonian mechanics, mechanical conservation laws, oscillations and waves. The course includes laboratory activities with experiments that demonstrate these fundamental concepts.

### PHYS122 UNIVERSITY PHYSICS II (3-2-1-4)

Prerequisites: PHYS121; MATH112

This course uses basic vector calculus and techniques of integration to determine the spatial and temporal distribution of charges, currents and electromagnetic fields. Basic elements of electricity and material properties and basic elements of electric circuits are also introduced. Electromagnetic waves and applications to physical optics are discussed. The course includes laboratory/studio activities, with experiments that cover the concepts discussed in the lectures.

### PHYS201 PHYSICS INSTRUMENTATION I (2-3-0-3)

Prerequisite: PHYS122

This course covers fundamental physics and engineering related to modern instrumentation and data acquisition. The topics covered by the course include the techniques and instruments used for AC and DC measurements, measuring physical properties such as displacement, speed, force, torque, temperature, and pressure. The course also introduces the design of a virtual instrument (VI), a measurement system, and data acquisition using LabVIEW.

### PHYS203 INTRODUCTION TO ASTRONOMY (3-2-1-4)

Prerequisite: PHYS121

This course is an introduction to astronomy. The topics cover different observational Instruments and techniques used in astronomy. Emphasis is placed on the structure and evolution of different objects in the solar system. The course introduces different types of galaxies in the universe as well as reviews formation of stars, their life cycles and classifications.

### PHYS211 COMPUTATIONAL PHYSICS (3-2-0-4)
Prerequisite: PHYS122

This course introduces numerical and computational tools that are used to simulate physical phenomena. Topics include Monte Carlo techniques, numerical differentiation and integration, and algebraic systems. The course includes a laboratory that covers the concepts discussed in the lectures, in which a strong emphasis will be given to computer exercises.

### PHYS213 UNIVERSITY PHYSICS III (3-2-4)
Prerequisite: PHYS122

This course is a survey of the advances of physics during the 20th century. It clarifies the two failures of classical physics occurring in the realms of very fast and very small systems. The course introduces concepts of quantum mechanics, solid state physics, nuclear and particle physics.

### PHYS231 OPTICS (3-3-0-4)
Prerequisite: PHYS122

This course covers the geometrical optics including ray-tracing, mirrors, lenses, stops, optical instruments, and wave optics including, interference, diffraction, Maxwell's equations, wave guides, polarization, absorption, scattering, and dispersion. The course includes a semester project and several laboratory demonstrations on the topics covered in the course.

### PHYS250 MATHEMATICAL PHYSICS (4-0-0-4)
Prerequisites: MATH204; MATH206; MATH231; PHYS122

This course covers important mathematical methods used in physics modeling and theory development. The course reviews and introduces topics such as series, matrix algebra, complex analysis, series and integral transforms, ordinary and partial differential equations in addition to introducing major topics in probability and statistics.

### PHYS295 INTRODUCTION TO QUANTUM MECHANICS FOR SCIENTISTS AND ENGINEERS (3-0-3)
Prerequisites: MATH204; MATH206; PHYS122

This course is designed to give undergraduate students in engineering and science an introductory background in modern physics and elementary quantum mechanics. The first part of the course will consider topics in modern physics that led to the development of quantum mechanics. The second part of the course will be devoted to introductory wave mechanics and quantum mechanics.

### PHYS311 INTERMEDIATE MECHANICS (3-0-0-3)
Prerequisites: PHYS213; PHYS250

This course gives a rigorous mathematical foundation to Newtonian mechanics, Lagrangian and Hamiltonian mechanics, linear oscillations, motion in non-inertial reference frames, systems of particles, rotations, and conservation laws.

### PHYS321 ELECTRICITY AND MAGNETISM I (4-0-0-4)
Prerequisite: PHYS250

This course provides a vector-calculus based theoretical introduction to the fundamental concepts of electrostatics and magnetostatics using grad, div and curl in Cartesian, cylindrical and spherical coordinate systems. Topics include the electric field, potential and electrostatics in the presence of matter. In magnetostatics, the magnetic field and vector potential are developed. Electromotive force and electromagnetic induction lead on to Maxwell's equations, which are discussed in detail.

### PHYS331 QUANTUM PHYSICS I (3-0-0-3)
Prerequisite: PHYS250
Co-requisite: PHYS321

This course gives an introduction to Quantum Mechanics. The need for a fundamental revision of physics is explained and the Schrodinger equation is introduced and applied. The full operator formalism and Dirac notation is introduced. These techniques are applied to some important systems such as the harmonic oscillator. Some important modern ideas such as entanglement and decoherence are introduced.

### PHYS340 THERMAL AND STATISTICAL PHYSICS (3-0-0-3)
Prerequisites: PHYS211; PHYS250

This course is designed for use in a typical introductory undergraduate course in thermodynamics and statistical mechanics, at the junior level. The course provides a balanced theoretical treatment of classical thermodynamics and then extends to statistical mechanics. Both the macroscopic and microscopic viewpoints are discussed in detail.

### PHYS350 INTRODUCTION TO NANOPHYSICS (3-0-0-3)
Prerequisite: PHYS122

This is an introduction to the key concepts and principles of the emerging field of Nanotechnology. The course is intended for a multidisciplinary audience with emphasis on the nanophysics. It will introduce topics such as size and scale dependent properties of Nanostructures, their synthesis, fabrication and characterization using Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Atomic Force Microscopy (AFM). Special focus will be given to nanoscale-devices and applications.

### PHYS351 ADVANCED LABORATORY I (1-5-0-3)
Prerequisite: PHYS331

This laboratory-course focuses on the advanced techniques and experiments drawn from the full range of physics classes. The student will understand the role of experimental design, advanced data analysis and reduction, error analysis, and the use of computers while investigating physical phenomena. In some experiments students apply what was learned in previous lectures and courses, but in some other experiments it is expected that student independently searches for theoretical information related to the experiment. You will often be expected to figure things out on your own in consultation with your lab partner and will be graded on the quality of those decisions.

### PHYS361 ENGINEERING PHYSICS I (2-4-0-3)
Prerequisite: MATH111

This is the first course in a two-semester sequence that helps students learn to deal with open-ended, applied physics design problems. The problems will involve researching context and background, development and comparison of alternative solutions, testing, use of feedback about solutions, appropriate use of tools and software, and effective communication of technical information orally, written, and through prototype demonstrations.

### PHYS362 ENGINEERING PHYSICS II (2-4-0-3)
Prerequisite: PHYS361

This is the second course in a two-semester sequence that helps students learn to deal with open-ended, applied physics design problems. The problems will involve researching context and background, development and comparison of alternative solutions, testing, iterative refinement, and use of feedback about solutions, team collaboration, workplace practices, appropriate use of tools and software, and effective communication of technical information orally, written, and through prototype demonstrations.

### PHYS363 PHYSICS INSTRUMENTATION II (2-3-0-3)
Prerequisite: PHYS201

This is a second course in instrumentation. The basic digital circuits used in instrumentation will be introduced using SIMULINK in addition to ADC and DAC applications. Magnetic, optical, and phase measurements are covered. It also covers the recent advances and applications of instrumentation and sensors in the industry. Smart sensors, wireless sensors, and wireless sensor networks are also introduced. The course includes a semester project and several demonstrations and simulations on the topics covered.

### PHYS381 INTRODUCTION TO BIOLOGICAL PHYSICS (3-0-0-3)
Prerequisite: PHYS250

This course presents the link between biological systems and physics. It also offers a scientific explanation to the formation of life based on the second law of thermodynamics. Emphasis is placed on the molecular diffusion and hydrophobic interactions to explain many processes within cells including the formation of cell membrane and protein folding.

### PHYS399 PHYSICS INTERNSHIP (0-0-0-1)
Prerequisite: A minimum of 70 credits earned by the end of the preceding Fall semester, including at least 24 credits in core major courses

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 designated internship supervisor who provides feedback to the university about the student's progress. The student must keep a detailed log book and prepare a formal report that documents the work undertaken during the internship period, and both 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 the supervising faculty member, with input from the internship supervisor.

### PHYS403 OBSERVATIONAL STELLAR AND GALACTIC ASTROPHYSICS (2-2-0-3)
Prerequisite: PHYS203

This course is an introduction to Observational and Stellar Astrophysics. Topics will cover the characteristics of stars and that of our galaxy the "Milky Way". We will take a deeper look into the innerworkings of stars, their structure and evolution, the death of stars: supernovae, planetary nebulae, white dwarfs, neutron stars, pulsars, binary stars, x-ray stars, and black holes. In addition to better understanding stars we will highlight the instrumentation and techniques that allows us to probe our galactic environment; interstellar medium, molecular clouds, HI and HII regions, star formation, element abundances, and, Galactic structure.

### PHYS412 ADVANCED MECHANICS (2-0-2-3)
Prerequisites: PHYS311

This is a continuation of PHYS311 Intermediate Mechanics, focusing on Newtonian, Hamiltonian, and Lagrangian formalisms of mechanics to explore advanced topics in mechanics and dynamics of particles and systems. Emphasis will be placed on nonlinear phenomena and chaos, coupled mechanical systems and their applications to real systems, wave mechanics, and special relativity and spacetime.

### PHYS420 ATOMIC AND MOLECULAR PHYSICS (3-0-0-3)
Prerequisite: PHYS331

This course gives an introduction to the basics of atomic and molecular structure, as a direct application to quantum mechanics. It includes topics such as the hydrogen and helium atoms, angular momenta, spin and group theory- the course will also deal with the electronic structure of atoms, diatomic and polyatomic molecules. It will finally present the different methods that are presently used to calculate the electronic structure of atomic and molecular species. A written paper/ group project about the structure of a molecule will be presented at the end of the course.

### PHYS422 ELECTRICITY AND MAGNETISM II (3-0-0-3)
Prerequisite: PHYS321

This course forms a direct continuation and expansion of electromagnetism from PHYS321 Electricity and Magnetism I. The subjects covered include conservation laws and electromagnetic waves in vacuum and materials, including absorption and dispersion. Potentials and their relation to fields are studied for static and moving charges. Electric and magnetic dipolar radiation is discussed in detail, followed by relativistic electrodynamics.

### PHYS431 SOLID STATE PHYSICS (3-0-1-3)
Prerequisites: PHYS321; PHYS331

This course represents an introductory survey of Solid-State Physics and will integrate theory with experimental results examples from textbook and references. The course will provide a valuable theoretical introduction and an overview of the fundamental applications of the physics of solids. This course includes theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors), based on the classical and quantum physics principles.

### PHYS432 QUANTUM PHYSICS II (3-0-1-4)
Prerequisite: PHYS331

This course builds on, and extends, the techniques learned in Quantum Physics I. Students will learn how to apply quantum mechanics to many-body systems and how to apply the standard approximation methods. An introduction to the quantum mechanics of light and atom-field interactions is given and applied to some important systems. This is then extended to examine how quantum mechanics can be applied to model open systems and includes an introduction to master equation techniques. Finally, the important topic of entanglement is addressed in detail.

### PHYS441 SPACE PHYSICS (2-2-0-3)
Prerequisite: PHYS403

This course is an introduction to cosmology. In this course we will probe the origins, structure, and evolution of the Universe - and how we came to know these details by understanding the techniques used in cosmology. We will explore the Astrophysical tools and techniques used to learn about the Universe. We will learn topics such the Thermal history of the Universe, the origin of all matter and the elements, cosmological distances and times, the expansion of space, dark matter and dark energy, the underlying structure of the universe and why it exists, and introduce some open questions in cosmology.

### PHYS450 NUCLEAR AND PARTICLE PHYSICS (3-0-0-3)
Prerequisite: PHYS331

This course serves as an introductory level nuclear and particle physics course. It covers important topics dealing with global properties of nuclei, radioactive decay and nuclear reactions, geometric shapes of nuclei, nuclear structure, fundamental forces and interactions (strong, electromagnetic, and weak), quark model, nucleons structure, force mediators, and applications of nuclear science such as cross section measurements and scattering (elastic and inelastic).

### PHYS452 ADVANCED LABORATORY II (1-5-0-3)
Prerequisite: PHYS351

Advanced Laboratory II is a course structured around experiments and laboratory work relevant to student interests. The course places high emphasis on the development of student's experimental skills, trouble-shooting and problem-solving skills, ability to handle sophisticated equipment, ability to handle different roles within a diverse team, analytical and modeling skills, and ability to present and explain scientific and technical work in various formats.

### PHYS471 PHYSICS EDUCATION PRACTICUM I (3-0-0-3)
Prerequisite: PHYS372

This is the first part of a two-course sequence providing students with practicum experiences in physics teaching. In this first practicum course, students will explore current topics in physics and science teaching while they explore and develop their teaching, presentation, and communication skills.

PHYS472 PHYSICS EDUCATION PRACTICUM II (1-0-0-3)
Prerequisite: PHYS471

This is the second part of a two-course sequence providing students with practicum experiences in physics teaching. In this second practicum course, students will explore current topics in physics and science teaching while improving their teaching, presentation, and communication skills.

PHYS482 INTRODUCTION TO MEDICAL PHYSICS (3-0-1-4)
Prerequisites: PHYS 213

The course provides the basic aspects of medical imaging physics, radiation oncology, radiation biology and dosimetry. The course discusses the physics of ionizing and non-ionizing radiations, applications in medical techniques such as x-ray, fluoroscopy, mammography, computed tomography, magnetic resonance imaging, nuclear medicine, and radiation therapy machine. The course also covers image quality parameters such as resolution, contrast, noise, MTF and artefacts in medical imaging.

PHYS497 SENIOR PROJECT I (0-0-0-3)
PHYS498 SENIOR PROJECT II (0-0-0-3)
Prerequisite: Senior Standing and PHYS321; PHYS331

Participation in team projects dealing with research and development of a new device or a system. Number of project will be offered each year by the faculty of Physics department, some of which will have a multidisciplinary nature. This will be an opportunity to exercise initiative, scientific judgment, self-reliance and creativity, in a team environment similar to Research and Development. The senior projects require students to draw upon their scientific background, experience, and other pertinent resources. Oral and written presentations are required.

**SCED SCIENCE EDUCATION**
SCED 467 INTRODUCTION TO SCIENCE TEACHING (3-0-3)
Prerequisites: Junior Standing, PHYS 122, and CHEM 116

This is the first course in a two-part sequence on introductory Science Education for students considering teaching chemistry and/or physics as a possible career. This course introduces some fundamental learning theories, learning design principles, teaching approaches, conceptual progression and planning and their implications for teaching and learning science in cycle 2 and cycle 3 classrooms. The course includes various reading and literature review tasks, class discussions and activities, microteaching, and other assignments.

SCED 468 ASSESSMENT AND PRACTICAL WORK IN THE SCIENCE CLASSROOM (3-0-3)
Prerequisites: SCED467

This is the second course in a two-part sequence on introductory Science Education intended for future chemistry and physics teachers. This course focuses on analyzing science pedagogy and practices for developing formative and summative assessments. This course also includes the development of practical investigation skills, including safely and teamwork issues. The course includes various reading and literature review tasks, class activities, and microteaching, involving practical work and other assignments.

**SDAS STUDENT DEVELOPMENT AND ACADEMIC SUCCESS**

SDAS 001 ACADEMIC SUCCESS I (1-0-1)

Prerequisites: None

This course delivers a blended learning experience designed to help students apply positive behavioral principles to their present and future studies. Students will develop the academic skills necessary to use university resources, critically assess their personal study habits, time management, and take responsibility for their own academic habits.

SDAS002 ACADEMIC SUCCESS II (1-0-1)

Prerequisites: SDAS001

This course reinforces behavior principles taught in SDAS001 through practical applications and activities. Students will reflect on their individual responsibility, setting of goals, development of personal strategies, and methods for mindfulness and self-renewal. They will demonstrate and practice academic skills related to time-management, organization and planning, note-taking and other study skills.

SDAS100 STUDENT DEVELOPMENT AND ACADEMIC SUCCESS (1-0-1)

Prerequisites: None

The purpose of this course is to provide students with success practical skills and habits that will promote life-long learning and future success. The course assists students to learn how to take responsibility of their learning, and understand themselves in relation to their skills, abilities, and learning styles.

SDAS300 STUDENT DEVELOPMENT AND ACADEMIC SUCCESS (1.5-0-0)

Prerequisites: Junior Standing

This course aims to equip learners with the mindset and skillset to use and apply for the world of work today and in the future. This will include end to end support via employability workshops, employability testing, access to online learning materials, group and one to one guidance via an employability & local labor market specialist. Workshops are designed to be interactive and activity based; they include CV writing, interview techniques, job search, the hidden job market, social media, and mindset.

**SPAN SPANISH**

SPAN101 ELEMENTARY SPANISH I (3-0-3)

Prerequisites: None

This course introduces students to the Spanish language and develops the ability to begin understanding and communicating in written and spoken language. Students will be able to introduce themselves and have a basic conversation, and understand and use functional language for survival in a Spanish-speaking country. The course will also introduce geographical, historical and cultural information about the Spanish-speaking world.

SPAN102 ELEMENTARY SPANISH II (3-0-3)
Prerequisites: SPAN101

This course builds upon SPAN101 to develop students' ability to communicate in Spanish. The course topics include: talking about past and future experiences; making social arrangements and future plans; describing people and places; asking for directions and buying tickets; going shopping; and, seeing a doctor. The course will also inform students about the history, geography and culture of the Spanish-speaking world. Students will complete level A1 of the Common European Framework (CEFR).

**PREPARATORY PROGRAM COURSES**

ENGL001 PREPARATORY ENGLISH 1 (14-0-14)
Prerequisite: IELTS 5, IBT TOEFL 61-69, or EmSAT 1100-1249

In this course, students will develop the English language skills needed to meet the requirements of ENGL 002. During the course, students will read general and academic texts and will listen to a variety of short conversations and lectures to help improve comprehension skills. Students will be expected to take notes and annotate academic texts, write short texts which require critical thinking based on course readings and lectures, present information orally, and develop test taking skills.

ENGL002 PREPARATORY ENGLISH 2 (14-0-14)
Prerequisite: Initial placement with IELTS 5.5, IBT TOEFL 70-78, ≥EmSAT 1399 or successful completion of ENGL 001 with 'C' or above.

In this course, students will develop the required English language proficiency for freshmen year entry. During the course, students will read a variety of texts to help improve their reading skills. They will also listen to different types of conversations and lectures to develop listening and note taking skills. In addition to the various types of input to which students will be exposed, they will be required to produce written texts of various genres and complete oral presentations. This course will also provide students with specific training on how to adequately meet the task demands presented in the IELTS or EmSAT exam.

ENGL003 PREPARATORY ENGLISH 3 (14-0-14)
Prerequisite: Successful completion of ENGL 002 and <IELTS 6.0 or <TOEFL iBT 79 or EmSAT <1400

ENGL 003 provides students with the language skills, enhanced knowledge of common topics, and test-taking strategies required to achieve the necessary requirements for transfer into freshman courses. The course is designed for students who have passed the ENGL 002 course, but have yet to reach the required proficiency exam score.

STEM001 STEM 1 (8-4-12)
Prerequisite: Students have achieved a minimum score of 50 but less than 80 on the Math 1 and 40 or better on the Math 2, Mathematics Entrance Exam.

This course is an introduction to university mathematics and sciences. This is a developmental pre-freshman level course covering mathematics, chemistry, and physics with an emphasis on their integration and application to engineering. The course is offered to prepare students for STEM 2 and their freshmen courses. The course delivers content using recent technology and hands- on techniques with an emphasis on self-study, context-rich problem solving, and study skills for university students.

STEM002 STEM 2 (9-3-12)
Prerequisite: Minimum score of achievement in each of the following EmSAT subjects: Math 1000, Physics 800, Computer Science 800, and 800 in one elective from Chemistry or Biology.

This course is an introduction to university mathematics and sciences. This is a developmental pre-freshman level course covering mathematics, chemistry, and physics with an emphasis on their integration and application to engineering. The course prepares students for their freshmen courses. The course delivers content using recent technology and hands-on techniques with an emphasis on self-study, context-rich problem solving, and study skills for university students.

## COLLEGE OF ENGINEERING COURSES

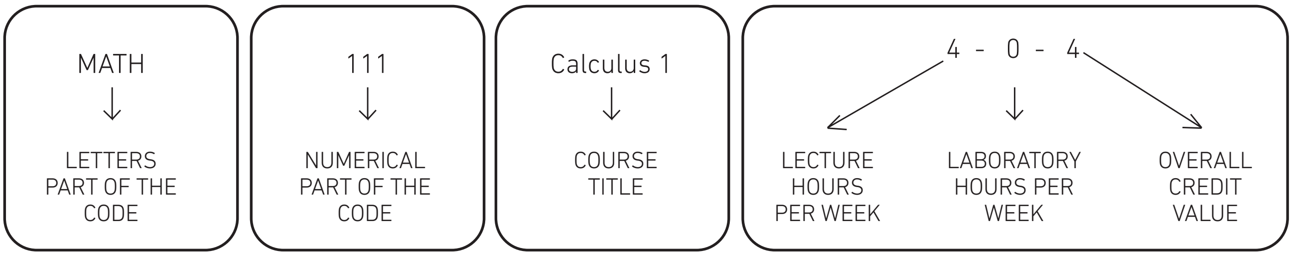
Course Title, Code and Credit Value

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; 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:



## AERO AEROSPACE ENGINEERING

### AERO 200 STATICS (3-0-3)

*(Cross listed with CIVE 200; MEEN 200)
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.

### AERO 201 ENGINEERING DYNAMICS (3-0-3)

*(Cross listed with CIVE 201; MEEN 201)
Prerequisite: AERO 200
Co-requisites: MATH 204; MATH 206

This course introduces rectilinear and curvilinear motion of particles and rigid bodies, kinematics and kinetics of particles and rigid bodies, rotational and translational motion of rigid bodies, principle of work and energy, and principle of impulse and momentum in particles and rigid body dynamics.

### AERO 215 INTRODUCTION TO AEROSPACE ENGINEERING (2-3-3)

Prerequisite: ENGR 111
Co-requisite: AERO 200

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 225 MECHANICS OF SOLIDS (3-3-4)

*(Cross listed with MEEN 325 and CIVE 225)
Prerequisite: AERO 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 unsymmetric 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, CHEM 115

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 320 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 321 AEROSPACE STRUCTURES (3-0-3)

Prerequisite: AERO 225

Basic concept 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 231; 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 204; MATH 206; 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, employing Matlab in modeling and response analysis of dynamical systems, applications.

### AERO 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisite: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### AERO 395 SPECIAL TOPICS IN AEROSPACE ENGINEERING (1 TO 3 CREDITS)

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 401 UAV MODELING AND CONTROL (3-0-3)
Prerequisites: MEEN 300 or (AERO/MEEN 201 & AERO 350/MEEN 356)

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.

### AERO 402 UAV SENSING (3-0-3)
Prerequisite: ECCE 300 or (ECCE 302 & (ECCE 356 or ECCE 370))
Note: Students can take ECCE 356 or ECCE 370 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.

### AERO 403 UAV NAVIGATION (3-0-3)
Prerequisite: AERO 401; AERO 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.

### AERO 404 UAV SYSTEMS (2-3-3)
Prerequisites: AERO 401, AERO 402
Co-requisite: AERO 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.

### AERO 415 AEROSPACE MATERIALS MANUFACTURING (3-0-3)
Prerequisites: AERO 225; 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 426 COMPOSITE MATERIALS DESIGN – TE (3-0-3)
Prerequisite: AERO 225/ MEEN 325/ CIVE 225

Overview of the reinforcements of composites, typical mechanical behavior of constituents and their properties, overview of manufacturing processes of composites, constitutive equation of linear elastic orthotropic materials, macro-mechanics of lamina, micro-mechanics of lamina, design principles of laminates, linear elastic analysis of composite beams, plates and stiffened panels, failure theories and strength analysis of a lamina.

### 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/MEEN 335

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/MEEN 240

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

Introduction and nomenclature, forces and moments acting on an aircraft during flight (straight and maneuver), inertial and non-inertial coordinate systems, longitudinal static stability, static margin, and trim settings, lateral static stability, directional static stability, derivation and linearization of the equations of motion of rigid aircraft in six degrees of freedom equations of motion solution, longitudinal and lateral-directional flight dynamics modes, dynamic stability, flying/handling qualities, aircraft response to different inputs, feedback control, and stability augmentation.

### AERO 461 AVIATION MANAGEMENT AND AIRWORTHINESS – TE (3-0-3)
Prerequisite: Senior standing

Product development, quality assurance, quality control and quality management, different organizational structures, strategic organizational analysis and design models. Airworthiness and certification, airworthiness regulations (FAR, JAR and EASA), type certification processes (EASA and FAA), civil aviation authorities and their roles, airplane flight manual, system design and safety, aviation security, and future trends in the aviation industry.

### 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 (0-6-3)
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 480 AEROSPACE VEHICLE PERFORMANCE (3-0-3)
Co-requisite: AERO 440

Morphology of aircraft and spacecraft. Performance analysis of fixed wing aircraft: drag estimation, propulsion, take-off, climb and landing, endurance, payload/range, maneuvers; operational economics. Performance analysis of rotor craft: rotor-blade motion, hovering and vertical ascent, forward flight, and autorotation. Rocket propulsion; escape velocity; orbital dynamics.

### AERO 485 SPACECRAFT DESIGN (3-0-3)
Prerequisite: AERO 350

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: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision 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 (1-6-3)
Prerequisite: Senior Standing and approval of department

Participation in team projects dealing with design and development of a product or a system, in accordance with project-specific objectives and constraints. Number of projects will be offered by the different engineering departments, some of which will be multi-disciplinary in nature. This will provide an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to the industry environment. The design projects require students to use engineering standards in their design process, developing suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

### AERO 498 SENIOR DESIGN PROJECT II (0-9-3)
Prerequisite: AERO 497
Continuation of AERO 497

## BMED BIOMEDICAL ENGINEERING

### BMED 202 BIOMEDICAL ENGINEERING FUNDAMENTALS (2-4-4)
Prerequisite: ENGR 111
Co-requisites: MATH 206, PHYS 122

Introduction to the conservation laws of mass, energy, charge, and momentum in biological systems. Conservation equations for mass, energy, charge and momentum will be derived and applied using basic mathematical principle and physical laws.

### BMED 211 HUMAN ANATOMY (3-3-4)

Prerequisites: MATH 112
Co-requisite: BIOL 101, BMED 202

The primary objective of this course is to provide the information of anatomical terminology. Students will then learn the microscopic anatomy of the following systems: skeletal, muscular, nervous, circulatory, respiratory, digestive, urinary, and reproductive.

### BMED 212 HUMAN PHYSIOLOGY AND MODELING (3-3-4)

Prerequisite: BMED 211

The primary objective of this course is to introduce to students on how the human organs function at a physiological level. Students will understand how these physiological systems integrate and react to each other to maintain the body.

### BMED 321 MECHANICS FOR BIOMEDICAL ENGINEERS (2-4-4)

Prerequisites: BMED 202; MATH 206

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 (2-2-3)

Co-requisites: MATH 206; BMED 212

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 CELL BIOLOGY (3-3-4)

Prerequisite: BMED 212
Co-requisite: CHEM 221 or CHEM 211

This course provides students with fundamental understanding of current topics and techniques in molecular biology, while developing skills in critical thinking and written expression/communication. 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, as well as from a technical laboratory-based applied perspective for using molecular biology as an experimental tool. The course should also fulfill the partial coverage of biology category in MCAT examination for MD program application.

### BMED 342 MOLECULAR GENETICS, TECHNOLOGIES AND TOOLS (3-3-4)

Prerequisite: BMED 341

The primary objective of this course is to introduce students to the fundamental concepts of genetics (from the work of Mendel to the current use of molecular techniques), and to emphasize the understanding of genes in the context of cells, tissues and systems. Topics covered throughout the course will include the fundamentals of genetics, epidemiology in the context of population genetics, genome technologies, genome sequencing and analysis tools, the roles of genetics in the etiology, pathophysiology, treatment of disease, as well as interpretation of and application of research data.

### 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 3)

Prerequisite: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### BMED 395 SPECIAL TOPICS IN BIOMEDICAL ENGINEERING (FROM 1 TO 3 CREDITS)

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 411 BIOMATERIALS (3-0-3)

Prerequisite: BMED 321
Co-requisites: BMED 341

Introduction to the field of biomaterials used in the design of medical devices, and to augment or replace soft and hard tissues. In-depth coverage will be focused on basic material sciences, bulk properties, characterization techniques, 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 application oriented topics in order to understand detailed characterization of biomaterials and it concludes with one major project (presentation in the end of the semester).

### BMED 412 REGENERATIVE MEDICINE (2-2-3)

Prerequisite: BMED 211
Co-requisites: BMED 341

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 (2-2-3)

Prerequisite: CHEM 211

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 (2-2-3)

Prerequisite: BMED 352; BMED 322

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 (2-2-3)

Prerequisite: BMED 322; 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 423 BIOROBOTICS AND MEDICAL DEVICE DESIGN (2-2-3)

Prerequisite: BMED 322; BMED 352

Fundamentals of Mechatronics. Interactions between surgical instruments and tissues. Intraoperative diagnostic technologies. Examples robots for diagnostics, surgery and therapy. Human-machine interfaces. Surgical navigators and tracking systems and simulators. Endoluminal devices. Instrumented catheters. Design requirements for orthopedic and cardiovascular devices. Extracorporeal Devices. Regulatory Affairs. Issues in medical device design. A design challenge based on real clinical needs.

### BMED 430 BIOINFORMATICS (2-2-3)

Prerequisite: ENGR 112, MATH 204; MATH 206

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 3)
Prerequisite: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision 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 SENIOR DESIGN PROJECT I (1-6-3)
Prerequisites: Senior standing and approval of department

Participation in team projects dealing with design and development of a product or a system, in accordance with project-specific objectives and constraints. Number of projects will be offered by the different engineering departments, some of which will be multi-disciplinary in nature. This will provide an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to the industry environment. The design projects require students to use engineering standards in their design process, developing suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

### BMED 498 SENIOR DESIGN PROJECT II (0-9-3)
Prerequisite: BMED 497
Continuation of BMED 497.

## CHEG CHEMICAL ENGINEERING

### CHEG 205 PRINCIPLES OF CHEMICAL ENGINEERING (3-0-3)
Co-requisites: PHYS 121; CHEM 116

Basic principles and calculations in chemical engineering. Processes and process variables. Introduction to the principles of conservation of mass and energy. Material and energy balances. Applications to chemical processing systems. Single and multi-phase systems. Balances on nonreactive and reactive processes.

### CHEG 210 INTRODUCTION TO BIOCHEMICAL ENGINEERING (3-0-3)
Prerequisite: CHEG 205

Chemical engineers working in the process industries are making increased use of biological systems for production and environmental management. To optimize these processes, chemical engineers need to understand the fundamentals of biological processes and their applications. This course is designed to teach chemical engineers key modelling aspects associated with biochemical processes such as enzymatic reaction kinetics, cell growth models, chemostat, etc. Moreover, key principles of biomolecular sciences such as the basic structure and function of biomolecules/biomacromolecules, immobilized enzyme, cellular functions and genetic engineering will be covered.

### CHEG 213 EXPERIMENTAL DESIGN (3-0-3)
Prerequisite: MATH 231

This course would develop the ability to design experiments, analyze and interpret data to make decisions by applying statistical tools. The course starts with description of random variables and probability distributions. The use of statistical decision-making tools, empirical models to optimize engineering systems are covered prior to application of designed experimentation. Finally application of statistical process control in manufacturing process to ensure product quality.

### CHEG 230 CHEMICAL ENGINEERING THERMODYNAMICS I (3-0-3)
Prerequisites: CHEG 205
Co-requisites: PHYS 122

Fundamentals of classical thermodynamics for application to chemical engineering processes and systems. Application of first and second laws to the analysis of thermodynamic cycles and processes; volumetric and thermodynamic properties of liquids and gases; heat effects.

### CHEG 232 FLUID MECHANICS (3-3-4)
Prerequisite: CHEG 205

The course aims to develop a working knowledge of fluid mechanics through the theories, applications and experiments of transport processes and fluid flows in chemical engineering science. The course focuses on the fundamentals of macroscopic fluid phenomena and their practical applications in chemical engineering systems.

### CHEG 312 NUMERICAL METHODS FOR CHEMICAL ENGINEERS (3-0-3)
Prerequisite: MATH 206; ENGR 113

This course gives an extensive and broad introduction to the numerical solution of problems that a chemical engineer is most likely to encounter. The emphasis is to develop skills in logical thinking through designing mathematical and numerical solutions to chemical engineering problems. Materials to be covered include but not limited to: Systems of linear and non-linear algebraic equations; numerical integration; numerical solution of ODEs; and finite differences to solve elliptic and parabolic PDEs.

### CHEG 324 MASS TRANSFER (3-0-3)
Prerequisite: CHEG 335

The fundamentals of separation processes of interest to the chemical industry are covered. The principles of diffusion and convective mass transfer in gas, liquid, and solids are reviewed. The general mass and energy balances are established for continuous-contact and equilibrium-staged processes. The applications of these fundamentals and the concepts of vapor-liquid to the unit operations of absorption are discussed.

### CHEG 325 FUNDAMENTALS OF NANOTECHNOLOGY (3-0-3)
Prerequisite: PHYS 122

Introduction to the fundamental principles which govern materials, products and process design in nanotechnology and nanoengineering, covering applications which include chemical, mechanical, environmental, electronics, and biological fields.

### CHEG 332 CHEMICAL ENGINEERING THERMODYNAMICS II (3-3-4)
Prerequisite: CHEG 230

Fundamentals of classical thermodynamics for application to chemical engineering processes and systems. Thermodynamic solution theory; multiphase equilibria of ideal and non-ideal systems, chemical reaction equilibria and topics in phase equilibria.

### CHEG 335 HEAT TRANSFER (3-3-4)
Prerequisite: CHEG 230; CHEG 232

Theory and applications of thermal energy transport: conduction, convection and radiation. Fundamentals of microscopic phenomena and application to macroscopic systems. Relevant aspects of computer-aided process simulation.

### CHEG 340 CHEMICAL EXTRACTION OF METALS (3-0-3)
Prerequisite: CHEG 230

The course relates to the field of chemical extractive metallurgy. Topics will include, thermodynamics and kinetics of chemical metallurgical processes, theoretical and practical aspects of the extraction processes for common metals with emphasis on iron/steel, and aluminum. The course takes most of its examples from the extraction of iron/steel and aluminum, but aspects of other metals, notably, copper, gold, lead and zinc, are also considered.

### CHEG 341 ELECTROCHEMICAL ENGINEERING (3-0-3)
Prerequisites: CHEG 230

This course presents the basic concepts of electrochemistry science as well as an overview of electrochemical engineering applications focusing on renewable energy (fuel-cells, batteries, supercapacitors) and industrial procedures (electrosynthesis).

### CHEG 350 MATERIALS SCIENCE & ENGINEERING (3-0-3)
Prerequisites: CHEM 116 ; PHYS 122

Introduction to materials science and engineering. Metals, alloys, ceramics, polymers, and composites; inter-atomic bonding, crystal structure and defects; diffusion, nucleation and microstructure; phase diagrams and phase transformations; mechanical properties; material failure; corrosion and degradation.

### CHEG 380 INTRODUCTION TO POLYMER SCIENCE AND ENGINEERING (2-3-3)
Prerequisites: CHEM 211

Definitions, industry overview, nomenclature, basic organic chemistry of polymers, polymerization, molecular weight and molecular weight distribution. Basic polymer structure and thermo mechanical behaviour and structure property relationship. Mechanical properties, definitions, viscoelasticity, other mechanical properties. Basic rheology and introduction to polymer processing techniques, recycling. Concepts will be reinforced by the laboratory component of the course.

### CHEG 381 POLYMER CHEMISTRY AND REACTION ENGINEERING (3-0-3)
Prerequisites: CHEM 211

This course introduces the chemistry of polymerization and the polymer manufacturing process. It begins with basic concepts about polymers and polymerization and covers each major type of polymerization with relevant kinetics. The qualitative effect of reactor design on polymer manufacture is discussed as well as actual polymer manufacturing processes including those taking place in the UAE.

### CHEG 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)
Prerequisites: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### CHEG 395 SPECIAL TOPICS IN CHEMICAL ENGINEERING (FROM 1 TO 3 CREDITS)
Prerequisite: Topic specific

This course mainly deals with new trends in Chemical Engineering and emerging technologies. Course is repeatable if title and content differ.

### CHEG 412 PROCESS DYNAMICS & CONTROL (3-3-4)
Prerequisite: CHEG 443; CHEG 312

Mathematical modeling and analysis of transient systems. Applications of control theory to response of dynamic chemical engineering systems and processes.

### CHEG 415 COMBUSTION AND AIR POLLUTION CONTROL (3-0-3)
Prerequisite: CHEG 324; CHEG 335

This course presents the fundamentals of air pollution impact on the environment. Topics covered include hydrocarbon fuel energy, the different combustion devices and systems, pollutant emission predictions from chemical equilibrium and ideal flow reactors, design of flues and chimneys, atmospheric dispersion models, air pollution sampling and measurement, and air pollution control methods and equipment. Applications in the petroleum industry are stressed.

### CHEG 416 CORROSION ENGINEERING (3-0-3)
Prerequisite: Senior Standing

This course presents fundamental material on corrosion and oxidation thermodynamics and electrochemical thermodynamics. The course then describes commonly encountered corrosion environments and discusses typical forms of corrosion encountered in each environment typical to the petroleum industry. Methods of corrosion control are then described, and the course concludes with a description of important corrosion and oxidation monitoring techniques.

### CHEG 423 GAS PROCESSING ENGINEERING (2-3-3)
Prerequisite: CHEG 332; CHEG 324

An overview of natural gas industry, from wellhead to market place. Process flow diagram of gas plant. 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.

### CHEG 424 PETROLEUM REFINING AND PROCESSING (3-0-3)
Prerequisite: CHEG 324

Characterization of crude oil. Petroleum products and refinery configuration. Basics on heterogeneous catalysis. Unit operations of petroleum refining including distillation, catalytic cracking, reforming, hydrotreating and hydrocracking, coking and gas treatment. Gasoline components. Refinery products and economics. Manufacture of petrochemical feedstocks from petroleum and petroleum products. Environmental control. Refinery safety measures and handling of hazardous materials. Quality control of products.

### CHEG 430 BIOSEPARATION ENGINEERING (3-0-3)
Prerequisite: CHEG 210

The course provides an insightful overview of the fundamentals of biochemical product recovery and purification. The topics include downstream processing unit operations that are used to isolate and purify biologically-derived chemicals, such as filtration, centrifugation, chromatography, extraction, electrophoresis, crystallization, and cell disruption for intracellular product recovery.

### CHEG 432 FOOD ENGINEERING AND TECHNOLOGY (3-0-3)
Prerequisite: CHEG 210

This course focuses on the basic concepts of food engineering. It provides an overview of food processes, preservation, packaging, food laws, related hazards, and safety topics. The course also covers physical properties of food, food rheology, thermal and no-thermal food processing operations, and recent technologies, such as freeze concentration, osmotic dehydration, and active packaging.

### CHEG 443 REACTION ENGINEERING (3-3-4)
Prerequisite: CHEG 332; CHEM 211

Applications of the fundamentals of thermodynamics, physical chemistry, and organic chemistry to the engineering of reactive processes. Reactor design; acquisition and analysis of rate data; heterogeneous catalysis. Relevant aspects of computer-aided process simulation.

### CHEG 470 INDUSTRIAL CATALYSIS (3-0-3)
Prerequisite: CHEG 230

The course presents basic concepts of catalysis and reviews different categories of catalysts with industrial importance in energy, environment, oil and gas processing as well as in petrochemical and other chemical commodities manufacturing. The core of the course is focused on heterogeneous catalysis and to a lesser extent on homogeneous catalysis. Catalytic materials, their properties and preparation, catalyst characterization and selection, adsorption and surface reaction mechanisms, and catalytic reactor design are covered.

### CHEG 472 WATER TREATMENT AND MEMBRANE PROCESSES (3-0-3)

Prerequisite: CHEG 324

This course deals with the fundamental principles and practical applications of membrane processes in water treatment facilities. The topics covered in this course are water chemistry, membrane structure and performance, membrane transport, concentration polarization, membrane fouling and fouling characterization in relation to water engineering. Applications of nano-filtration), ultra- filtration, micro-filtration, reverse osmosis, and electro- dialysis membranes in various water treatment plants are covered.

### CHEG 485 SEPARATION PROCESSES (3-3-4)

Prerequisite: CHEG 324

This course presents an overview of all industrially relevant separation processes, including equilibrium based separations (distillation, absorption, extraction), rate-controlled separation processes (adsorption, drying, crystallization, membrane separation) and mechanical separations (filtration, sedimentation). The contents would cover fundamentals, mass and energy balances, and sizing of equipment.

### CHEG 488 POLYMER PROPERTIES (3-0-3)

Prerequisite: CHEG 380

Review and discussion of the properties of polymers with emphasis on structure-property correlations. The principles and practical applications of the main techniques used for characterization of the mechanical, physical, and transport properties will be discussed. Some applications of polymers in relationship to their properties are illustrated.

### CHEG 491 INDEPENDENT STUDY II (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisites: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### CHEG 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.

### CHEG 497 SENIOR DESIGN PROJECT I (2-3-3)

Prerequisite: CHEG 213; CHEG 324; Senior Standing

The students learn the design process including problem definition and analysis; process synthesis, process simulation and modeling; safety and environmental protection in design; written and oral communication for design reports. A significant portion of the term work will be devoted to a group design project, culminating in a preliminary design proposal that will be presented to the department.

CHEG 498 SENIOR DESIGN PROJECT II (3-0-3)
Prerequisite: CHEG 497

Students continue studying the design process including equipment cost estimation, manufacturing cost, and profitability analysis, process optimization, material selection, energy, safety, and environmental considerations. A significant portion of the term work will be devoted to the group design project started in Senior Design Project I, culminating in a final design report that will be presented to the department.

## CIVE CIVIL ENGINEERING

CIVE 180 ENGINEERING GRAPHICS AND VISUALIZATION (3-0-3)
Prerequisite: ENGR 113

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 200 STATICS (3-0-3)
*(Cross listed with AERO 200; MEEN 200)
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.

CIVE 201 ENGINEERING DYNAMICS (3-0-3)
*(Cross listed with AERO 201; MEEN 201)
Prerequisite: CIVE 200
Co-requisites: MATH 204; MATH 206

This course introduces rectilinear and curvilinear motion of particles and rigid bodies, kinematics and kinetics of particles and rigid bodies, rotational and translational motion of rigid bodies, principle of work and energy, and principle of impulse and momentum in particles and rigid body dynamics.

CIVE 225 MECHANICS OF SOLIDS (3-3-4)
(Cross listed with AERO 225 and MEEN 325)
Prerequisite: CIVE 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; factor of safety in design, deformation of axially loaded members; symmetric and unsymmetric 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 310 GEOMATICS (2-3-3)
Co-requisites: CIVE 18

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 & 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 231

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 the design of steel 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 (3-0-3)

Prerequisite: CIVE 310

This course is an introduction to transportation engineering with emphasis on operation, design, and planning of transportation infrastructure including highway and arterial roads, signalized intersections. Various issues related to transportation such as congestions, public transit, smart intersections, and autonomous vehicles are also discussed.

### CIVE 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisites: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### CIVE 395 SPECIAL TOPICS IN CIVIL ENGINEERING (FROM 1 TO 3 CREDITS)

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 442 DESIGN OF CONCRETE STRUCTURES (3-0-3)

Prerequisites: CIVE 336

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 442

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

Analysis of unit operations for coagulation, sedimentation, filtration and disinfection for treatment of drinking water. Introduce the chemistry of drinking water treatment processes. Analyze 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 WATER RESOURCES MANAGEMENT (3-0-3)
Prerequisites: CIVE 335; CIVE 370

A comprehensive introduction to hydraulics, groundwater, and surface water hydrology, statistical hydrology, deterministic hydrology, climatology, GIS, remote sensing, fundamentals of planning and management as well as other courses dealing with the general field of water resources.

### CIVE 469 AIR POLLUTION CONTROL (3-0-3)
Prerequisites: CHEM 115; AERO/CIVE/MEEN 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 PAVEMENTS DESIGN AND MAINTENANCE – TE (3-0-3)
Prerequisites: CIVE 336

The course will focus on the (i) basic characteristics of a pavement structure, (ii) modes of failure for flexible and rigid pavements, (iii) fundamental properties of pavement materials for structural design purposes, (iv) heavy vehicle loads and analysis of the stress and strain distribution in multilayer pavement systems, and (v) fundamentals of the state-of-the-art pavement design methodology.

### CIVE 473 STRUCTURAL DESIGN OF BUILDINGS (3-0-3)
Prerequisites: CIVE 341; CIVE 442

This course is to understand the design of multi-storey buildings in reinforced concrete and steel building by means of computer-aided analysis and design. It covers response of multi-storey buildings to vertical and horizontal loads and includes a computer-aided design of 3D multi-storey concrete building.

### CIVE 475 EARTH STRUCTURES: EMBANKMENTS, SLOPES & BURIED STRUCTURES (3-0-3)
Prerequisites: CIVE 338

Analysis of lateral earth pressures, slope stability, and stresses on buried structures, design of cantilever retaining walls, mechanically stabilized earth (MSE) 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: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision 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 (1-6-3)

Prerequisite: Senior standing and (CIVE 332/ CIVE 335/ CIVE 338/ CIVE 341/ CIVE 370/ CIVE 380)

Participation in team projects dealing with design and development of a component or a structural system, in accordance with project-specific objectives and constraints. Number of projects will be offered by the different engineering departments, some of which will be multi-disciplinary in nature. This will provide an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to the industry environment. The design projects require students to use engineering standards in their design process, developing suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

### CIVE 498 SENIOR DESIGN PROJECT II (0-9-3)

Prerequisite: CIVE 497

Continuation of CIVE 497.

## COSC COMPUTER SCIENCE

### COSC 101 FOUNDATIONS OF COMPUTER SCIENCE (2-1-3)

Prerequisites: ENGR 112

The course provides a comprehensive high-level introduction to computer science. It exposes students to variety of topics from computer science and its applications, including: system software, computer network, cloud computing, databases, artificial intelligence & machine learning, and information security. Python programming language and basics of web development will be also covered.

### COSC 201 COMPUTER SYSTEMS ORGANIZATION (2-3-3)

Prerequisites: COSC 101

This course provides a basic understanding of the fundamental logical organization of a computer (its parts and their relationship) and how it actually works; exposure to a central processor's native language, and to basic computer components and basic architectures for high performance design. Topics include: Von Neumann architecture, C programming (low-level aspects), data representation, computer arithmetic, assembly language programming, digital logic design, registers, instruction counter, processor architecture, pipelining, memory hierarchies, caching, virtual memory, interrupts, input and output, buses.

### COSC 301 AUTOMATA, COMPUTABILITY, AND COMPLEXITY (2-2-3)

Prerequisites: COSC 101, MATH 234

This course is about fundamental ideas in the theory of computation, including formal languages, computability and complexity. In this standard computer science course, the students will gain the proficiency in the concepts of automata, formal languages, grammar, algorithms, computability, decidability, and complexity.

### COSC 310 DATA STRUCTURES (2-3-3)

Prerequisites: ECCE 230, MATH 234

Review of object-oriented design. Analysis of algorithm complexity. Fundamental data structures: Concept of Abstract Data Types (ADTs), Queues, Stacks, Lists, Trees; Java Collections Framework. Fundamental computing algorithms: binary search trees, hash tables, heaps, balanced trees, sorting algorithms, searching algorithms.

### COSC 312 DESIGN AND ANALYSIS OF ALGORITHMS (2-2-3)

Prerequisites: COSC 301, COSC 310

This course covers the most important algorithm strategies and solution techniques, independent of programming language or computer hardware. Topics include: Big-O notation; worst and average case analysis; recurrences and asymptotics; efficient algorithms for sorting, searching, and selection; algorithm design techniques: divide-and-conquer, dynamic programming, greedy algorithms, randomization; algorithms for fundamental graph problems; string algorithms; and numerical methods.

### COSC 320 CONCEPTS OF PROGRAMMING LANGUAGES (2-3-3)

Prerequisites: COSC 301

This course provides the students with a basic understanding and appreciation of the various essential programming-languages constructs, programming paradigms, evaluation criteria and language implementation issues. The topics covers concepts from imperative, object-oriented, functional, logic, and concurrent programming. These concepts are illustrated by examples from varieties of languages such as Pascal, C, C++, C#, Java, Python, Lisp, Scheme, Haskell, Prolog. Some basic aspects of compiler design like lexical and syntax analysis will also be covered.

### COSC 330 INTRODUCTION TO ARTIFICIAL INTELLIGENCE (2-3-3)

Prerequisites: COSC 310 or 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, decision tree, Bayes classifier, machine learning, game theory, reinforcement learning, and fuzzy logic.

### COSC 340 INTRODUCTION TO COMPUTER SECURITY (2-2-3)

Prerequisites: 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.

### COSC 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisites: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### COSC 395 SPECIAL TOPICS IN COMPUTER SCIENCE (FROM 1 TO 3 CREDITS)

Prerequisite: Topic specific

This course mainly deals with new trends in Computer Science and emerging technologies. Course is repeatable if title and content differ.

### COSC 401 COMPUTATIONAL SOCIAL SCIENCE (2-3-3)

Prerequisites: COSC 312, COSC 410

The course is concerned with using computational approaches to study social phenomena and address important questions in social science. The course provides an overview of the computational social science field and use of data science techniques for computational social research. The course covers various techniques for data analysis of digital traces of people in social media, telecommunication and clickstreams as well as web-based social experiments that can be conducted at a large scale. The topics covered include overview of computational social science, data analysis of digital traces and clickstreams, design of social web-based experiments, data analysis of mobile phones and wearable sensors data, data analysis of social media data, and data science crowdsourcing techniques.

### COSC 410 PARALLEL AND DISTRIBUTED COMPUTING (2-3-3)

Prerequisite: COSC 312, ECCE 354

This course covers a broad range of topics related to parallel and distributed computing, including parallel and distributed architectures and systems, parallel and distributed programming paradigms, parallel algorithms, and scientific and other applications of parallel and distributed computing. Course topics include: concepts of parallelism, parallelism in Python, multi-threading, networks and MPI for cluster computing, fork-join parallelism, shared-memory concurrency control, and practical parallel/distributed programming applications.

### COSC 412 NUMERICAL COMPUTING (2-3-3)
Prerequisite: COSC 312

This course is an introduction to numeric and algorithmic techniques used for the solution of a broad range of mathematical problems, with an emphasis on computational issues. It covers basic concepts and methods in numerical analysis: Analysis of round off errors using floating-point arithmetic; Solution of non-linear equations in one variable; Polynomial interpolation and approximation; Numerical differentiation and integration; Initial-value problems for ordinary differential equations; Direct methods for solving linear systems; Singular-value approximation; and Optimization.

### COSC 430 DATA ANALYTICS (2-3-3)
Prerequisite: COSC 330; MATH 242/ 243
Co-requisite: COSC 434

This course covers various contemporary techniques in data analytics, which encompasses a broad set of computational and statistical methods and tools needed to draw insights from the growing amounts of data. Overall topics include: data acquisition, scraping, cleaning, manipulation; predictive data analysis; exploratory data analysis; statistical modeling of data; and communication of results via data visualization. The course will include significant programming in Python, and will introduce the statistical programming language R.

### COSC 432 ALGORITHMIC ROBOTICS (2-3-3)
Prerequisite: COSC 330

In this course, fundamental disciplines of modern robotics are introduced: mechanics, control, and computing. These components are integrated to analysis, design, and control of mobile robots and manipulators to serve engineering or scientific needs. Students will learn: how to use mathematical methods to model mobile robots and manipulators and to plan their motion; how to process sensor information to form a perception of the environment; and how to implement algorithms through computer systems to achieve autonomy.

### COSC 433 NEURAL NETWORKS (3-0-3)
Prerequisite: COSC 330

Introduction to neural networks, neural networks applications, architecture types, supervised reinforcement and unsupervised learning, training algorithms and optimization, operators and processes in neural networks, deep learning methods, temporal problems and recurrent neural networks, Hebbian learning and auto-associative memories, competition mechanisms and self-organized neural networks, reinforcement learning systems.

### COSC 434 INTRODUCTION TO MACHINE LEARNING (2-3-3)
Prerequisites: COSC 330, MATH 204, MATH 243/242

This course covers various contemporary techniques in machine learning. Overall topics include: classes of machine learning (supervised, unsupervised), feature engineering and selection, logistic regression, non-parametric methods, non-parametric methods, GMM and EM algorithms, neural networks, support vector machine, k-means and hierarchical clustering, etc. The course will use Python machine learning libraries extensively.

### COSC 440 DIGITAL FORENSICS (2-3-3)
Prerequisite: COSC 340

This module gives an introduction to principles, techniques, and tools to perform digital forensics, which encompasses the recovery and investigation of material found in digital devices in relation to cybercrime and other crimes where digital evidence is relevant. Students will learn evidence extraction and analysis on UNIX/Linux, Windows, and macOS systems, networks, web applications, and mobile devices; and gain exposure to available tools. Some legal/ethical aspects of digital forensics will also be discussed.

### COSC 442 APPLIED CRYPTOGRAPHY (2-3-3)
Prerequisite: COSC 340

This course builds upon the cryptography concepts covered in the course "Introduction to Computer Security" and it presents security protocol designs and advanced topics in applied cryptography. We cover a comprehensive set of topics including cryptographic protocol design, zero knowledge proofs, multi-party encryption protocols, blockchain technology, encrypted machine learning, and secure hardware technologies.

### COSC 452 HUMAN-COMPUTER INTERACTION (3-0-3)
Prerequisite: ECCE 336

This course provides an introduction to and overview of the field of human-computer interaction (HCI). HCI Theories Principles and Guidelines will be covered including HCI Design and principles of user interface design. In addition, the different types of user interface evaluation techniques will be covered including expert reviews, predictive models and usability testing. Students will work on team project to design, implement and evaluate computer interfaces.

### COSC 454 COMPUTER GRAPHICS (3-0-3)
Prerequisite: COSC 312

This course will provide a comprehensive introduction to basic computer graphic technology in both theory and practice. Focusing on geometric intuition, it will provide the necessary information to understand how 2D and 3D synthetic images are modelled and generated using the complementary approaches of ray tracing and rasterization. Topics covered include introduction to graphics, mathematical foundations of graphics, raster images, ray tracing and shading, viewing transformations and projection, the graphics pipeline, surface shading, texture mapping, curves, computer animation, etc.

### COSC 460 BIOINFORMATICS AND GENOMIC DATA SCIENCE (2-3-3)
Prerequisite: COSC 312, COSC 410

This course introduces Computer Science students to bioinformatics, the scientific discipline at the intersection of Computer Science and Molecular Biology/Genetics. It aims to make sense at Big Data generated in biotechnology, first and foremost sequential data such as DNA and protein sequences. A central focus of this course is to bridge the gap between existing algorithms to the development of the next generation bioinformatics tools by understanding the algorithmic underpinnings incl. computational complexity, common data representations and file formats as well as state of the art storage strategies. The course will cover common sequence analysis techniques, phylogeny, common data formats and storage techniques and cutting edge topics such as CRISPR and Deep Learning.

### COSC 462 MOBILE AND WEB APPLICATIONS DEVELOPMENT (2-3-3)
Prerequisite: COSC 310

This practical-oriented course will enable the students to understand the fundamental concepts of web services and web & mobile app development. The techniques to design and develop static and interactive websites using HTML5, CSS3, Javascript, and other tools like JQuery, web-APIs, JSON, AJAX, etc. will be included. For the Android Platform, the app development including graphics and multimedia ones using Android Studio IDE will be discussed. For the iOS Platform, the app development techniques using iOS SDK with Swift and XCode will be covered.

### COSC 464 NATURAL LANGUAGE PROCESSING (2-3-3)
Prerequisite: COSC 330, COSC 410

The course will provide a broad introduction to the field of Natural Language Processing or NLP, loosely defined as the study of systems and algorithms that can comprehend, communicate in or analyze data in human language. Students will gain a good understanding of the different problems faced by NLP systems, methods for addressing these problems, and their relative advantages or disadvantages. The class will devote significant time to recent data-driven approaches, in particular neural-network and/or deep learning methods that can be trained (rather than manually programmed) using labeled text corpora.

### COSC 491 INDEPENDENT STUDY II (VARIABLE COURSE CREDITS FROM 1 TO 3)
Prerequisite: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### COSC 495 SPECIAL TOPICS IN COMPUTER SCIENCE
Prerequisite: Topic specific

This course mainly deals with new trends in Computer Science and emerging technologies. Course is repeatable if title and content differ.

## ECCE ELECTRICAL AND COMPUTER ENGINEERING

### ECCE 200 FUNDAMENTALS OF ELECTRONIC SYSTEMS (3-3-4)
Prerequisite: PHYS 122
Restrictions: This course is for non ECE students only.

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 applications. Description of Small signal amplifier circuits and operational amplifiers. Binary system and basic logic gates. Design of simple combinational and sequential logic circuits.

### ECCE 210 DIGITAL LOGIC DESIGN (3-3-4)

Prerequisite: ENGR 112 or ENGR 113

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 221 ELECTRIC CIRCUITS I (3-3-4)

Co-requisites: MATH 232; PHYS 122

Physical principles underlying the modeling of circuit elements. Basic circuit elements: resistance; inductance, capacitance, independent and controlled sources, and op-amps. Circuit analysis techniques, steady-state and transient responses, first-order circuits, complex numbers, sinusoidal steady-state analysis, sinusoidal steady-state power calculations, and balanced three-phase circuits.

### ECCE 222 ELECTRIC CIRCUITS II (3-3-4)

Prerequisite: ECCE 221
Co-requisite: MATH 206

Time-domain transient analysis, Laplace transform, s-domain circuit analysis, State variable circuit analysis, frequency selective circuits, first order passive filters, Bode diagrams, two-port networks, Mutual inductance and transformers.

### ECCE 230 OBJECT-ORIENTED PROGRAMMING (3-3-4)

Prerequisite: ENGR 112 or ENGR 113

The course covers the foundation of object oriented concepts and programming. Basic Object Oriented Programming (OOP) concepts, such as, objects, classes, methods, parameter passing, information hiding, inheritance, exception handling and polymorphism. The course also covers Java language elements and characteristics, including data types, operators, control structures, search and sort algorithms.

### ECCE 300 SIGNALS, CIRCUITS AND COMMUNICATIONS (3-0-3)

Pre-requisites: MATH 206; MATH 204
Restrictions: Students majoring in Electrical Engineering or Computer Engineering are not allowed to take this course.

Continuous-time signal characteristics. Fourier transform and its applications. Steady state analysis of Resistive, RC, RL, and RLC circuit. Transient analysis of simple electric circuits with RC and RL Analog filter. Semiconductor devices and operational-amplifier. Digital logic system. Communications systems. OSI model. Communication network topology. Performance metrics of communication systems. PCM, data encoding and digital modulations. Multiple access techniques.

### ECCE 302 SIGNALS AND SYSTEMS (3-0-3)

Prerequisites: MATH 232; MATH 204
Co-requisite: ECCE 221

Time/space-domain analysis of analog and discrete signals: basic signals, properties and operations. Frequency analysis of signals: Fourier series and transform, Laplace transform, sampling and reconstruction and z-transform. Time/space-domain analysis of signal processing systems: properties, block diagrams, differential/difference equations, state-space model of LTI systems, impulse response, and convolution. Frequency analysis of signal processing systems: frequency response (gain and phase), transfer function, z-transfer function, stability analysis, Fundamentals of analog filter design.

### ECCE 312 ELECTRONIC CIRCUITS AND DEVICES (3-3-4)

Prerequisite: ECCE 221

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.

### ECCE 316 MICROPROCESSOR SYSTEMS (3-3-4)

Prerequisites: ECCE 210

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 232
Co-requisite: MATH 206

Review of Vector analysis, Electrostatics (Electric fields, boundary value problem), Magneto statics (magneto static fields, magnetic force), Maxwell's Equations, Plane Wave propagation, Transmission lines.

### ECCE 322 ELECTRICAL MACHINES (3-3-4)

Prerequisites: ECCE 221; ECCE 320

Magnetic circuit concepts and materials, transformer analysis and operation, steady state analysis of rotating machines. Study of the basic machine types: dc, induction and synchronous. A laboratory is integrated into the course; the focus of the laboratory is on the characteristics of machines and transformers.

### ECCE 323 FEEDBACK CONTROL SYSTEMS (3-3-4)

Prerequisite: ECCE 302

Systems modelling using ordinary differential equations and transfer functions is presented. Modelling of electrical, mechanical, electromechanical, and fluid systems is discussed. System performance and error analysis. Feedback control analysis techniques using root locus and frequency response (Bode and Nyquist) are introduced for systematic stability analysis of systems. Lag/lead controller design, PID controller design. Introduction to State-space controller design.

### ECCE 326 INTRODUCTION TO SEMICONDUCTOR DEVICES (3-0-3)

Prerequisites: ECCE 312

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 offers insight into the internal workings of the "building-block" device structures such as the pn-junction diode, BJT, and MOSFET. The course also introduces optoelectronics, discusses current technological issues, and feature modern devices.

### ECCE 330 SYSTEM ANALYSIS & SOFTWARE 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 234

Review of object-oriented design. Learning the Standard Template Library (STL) data structures and algorithms with practical examples. 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 or ENGR 113
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, 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. Deadlock management. Memory management and virtual memory. Device management. File management. OS Security and Protection.

### ECCE 356 COMPUTER NETWORKS (3-3-4)

Prerequisite: ECCE 210

Introduction to computer networks. 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. Principles of 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 232 and MATH 243
Co-requisite: ECCE 302

Analysis and transmission of signals. Introduction to random processes. Linear and Non-linear Modulation: DSB-AM, DSB-SC, SSB-SC, Frequency/Phase Modulation (FM/PM). Noise effects in communication systems. Pulse Code Modulation (PCM) baseband modulation scheme. Basics of baseband pulse transmission and detection. Multiplexing: Frequency & Time Division Multiplexing. Basics principles of telephony.

### ECCE 362 DIGITAL COMMUNICATIONS I (2-3-3)

Prerequisite: ECCE 360

Introduction to Digital Communication. Spectral Density Autocorrelation. Bandwidth of Digital Data. Baseband Systems. Formatting Textual Data, Messages, Characters, and Symbols. Sources of Corruption. Pulse Code Modulation. Uniform and Nonuniform Quantization. Baseband Modulation. Source Coding. Signals and Noise. Detection of Binary Signals in Gaussian Noise. Intersymbol Interference (bandwidth limited channels). Pulse shaping. Eye diagrams. Equalization. Digital Bandpass Modulation Techniques. Detection of Signals in Gaussian Noise. Coherent Detection. Noncoherent Detection. Complex Envelope. Error Performance for Binary Systems in AWGN channels.

### ECCE 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisite: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### ECCE 395 SPECIAL TOPICS IN ELECTRICAL AND COMPUTER ENGINEERING (FROM 1 TO 3 CREDITS)

Prerequisite: Topic specific

This course mainly deals with new trends in Electrical/ Computer Engineering and emerging technologies. Course is repeatable if title and content differ.

### 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. Introduction to RF filters design. Designing filters using CAD packages.

### ECCE 402 DIGITAL SIGNAL PROCESSING (3-0-3)

Prerequisite: ECCE 302

This combined theory and practical course introduces the principles of digital signal processing (DSP). It includes introduction to discrete-time signals and systems, sampling, A/D conversion, aliasing, the z-transform, discrete Fourier transform, fast Fourier transform, Models of digital filters, FIR filter design, and IIR filter design. MATLAB hands-on sessions form an integral part of this course.

### ECCE 404 MICROWAVE CIRCUITS AND DEVICES (3-0-3)

Prerequisite: ECCE 312

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

### ECCE 406 INSTRUMENTATION AND MEASUREMENTS (2-3-3)

Prerequisites: ECCE 302; ECCE 312

The course provides an introduction to measurement and instrumentation. The covered topics include static and dynamic characteristics of measurement systems; accuracy of measuring systems; measurement error and uncertainty quantification; noise and noise reduction techniques; sensing elements, signal conditioning and processing elements; measurement system analysis, design, and applications.

### 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 analog circuit modeling. CMOS device characterization. CMOS building blocks. Two-stage CMOS amplifiers. High-performance op-amps. Introduction to Switched-Capacitor Circuits. CAD simulation software tools for analog circuit design.

### ECCE 420 INDUSTRIAL AUTOMATION (3-0-3)
Prerequisite: ECCE 406

Principles of industrial automation with emphasis on oil and gas industries. Topics on sensors, actuators, field devices, signal conditioning, PLCs, and ladder logic programming are covered in theory and practice. Different types of closed loop controllers, system modeling, SCADA, and DCS are also addressed.

### ECCE 421 POWER SYSTEM ANALYSIS (3-0-3)
Prerequisite: ECCE 222; ECCE 322

This course is designed to address some of the concerns and challenges faced by utilities and network operators to ensure effective and reliable delivery of electrical power to all sectors of society. It provides an introduction to power systems analysis techniques under steady state conditions, including modelling of power system components (generators, transformers, transmission lines, etc.), real and reactive power flows in balanced three-phase systems, single-line diagrams, the per-unit system, and load-flow calculations. An introduction to power system fault calculations is also given, considering both balanced and unbalanced fault conditions using symmetrical components analysis.

### ECCE 422 HIGH VOLTAGE ENGINEERING (3-0-3)
Prerequisite: ECCE 320

The course provides the fundamental concepts and methods for generation and measurement of ac, dc, and impulse high voltages and high currents. It includes basic concepts of electrical insulation requirements, over voltages and principles of overvoltage protection in power systems, high voltage testing techniques and associated standards. An introduction to basic conduction and breakdown mechanisms in gases, solids and liquids is given. An overview of overhead line insulators (material, shape, performance), and underground cables (single and three-core cables, electrical stresses; equivalent circuits) is also provided.

### ECCE 423 POWER ELECTRONICS (3-0-3)
Prerequisites: ECCE 222

The course covers the operation and analysis of power semiconductor converters (AC-DC, DC-DC, and DC-AC) and their various configurations; Switching losses, thermal and protection circuits; continuous and discontinuous current operations; power quality issues; effect of overlap; and introduce different applications for power electronics.

### ECCE 424 ELECTRICAL POWER DISTRIBUTION SYSTEMS (3-0-3)
Prerequisite: ECCE 421

Electric power distribution system planning, design and operations; load characteristics and distribution transformers; design of sub-transmission lines and distribution substations; primary and secondary feeder design considerations; distribution system voltage regulation, protection and reliability; distributed generation and smart grid application.

### ECCE 425 POWER SYSTEM STABILITY AND CONTROL (3-0-3)
Prerequisites: ECCE 322; 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 ELECTRIC DRIVES AND RENEWABLE RESOURCES (3-0-3)
Prerequisite: ECCE 322; ECCE 423

The course covers the basic principles of electric drives and their main components; applications of power semi-conductor devices on motion control of DC and AC electric drives; principles of operation of different renewable energy resources; main components and grid integration aspects of wind and solar photovoltaic (PV) energy conversion systems.

### ECCE 427 POWER SYSTEM PROTECTION AND RELAYS (3-0-3)
Prerequisite: ECCE 421

The principles behind the protection of electric power systems; the role of relaying theory, relaying fundamentals, voltage and current transformers, transformer protection, line protection, distribution system protection, distance protection, rotating machinery protection and pilot line protection.

### ECCE 428 MODERN CONTROL SYSTEMS (3-0-3)
Prerequisite: ECCE 323

Design of modern control systems using matrix approach and the linear systems tools in Matlab; examples from electrical and mechanical engineering; realization techniques; discretization of continuous systems; controllability, observability and their Gramians, other dynamical system properties; pole-placement; disturbance rejection; Lyapunov stability; state estimation; introduction to multivariable systems; introduction to intelligent control systems.

### ECCE 429 DIGITAL CONTROL SYSTEMS (3-0-3)
Prerequisite: ECCE 323

This course is concerned with the analysis and design of closed-loop systems that contain a digital computer. Distinction is emphasized between a purely digital system and a continuous system that may be sampled to emulate a digital system. Topics covered include sampling, signal conversion and processing (hold devices; z-transform; state variable technique; pole-assignment and state estimation; stability of digital control systems; digital simulation and redesign; time and frequency domain analyses; digital filter structures and microcomputer implementation of digital filters.

### 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 336

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, inter-process 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

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 354; ECCE 356

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 449 IOS APP DEVELOPMENT (3-0-3)
Prerequisite: ECCE 230

This course will instruct students on the fundamentals of mobile computing and mobile application development using Apple's iOS SDK. An introduction to the Objective-C programming language, including object-oriented design, and the model-view-controller pattern, will be covered. Using iOS APIs and tools, such as Xcode, students will be able to create fully-featured iPod Touch, iPhone, and iPad applications. User interface and application design considerations specific to mobile technologies will also be explored.

### 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 360

Overview of Wireless Communications Including Standards. Characterization of Wireless Channels. Bandpass Transmission Techniques for Wireless Communications. Receiver architecture and performance over Fading Channels and Diversity Techniques. Fundamentals of Cellular Communications. Orthogonal Frequency Division Multiplexing.

### ECCE 461 ADVANCED DIGITAL COMMUNICATIONS (3-0-3)
Prerequisites: ECCE 360

Spread spectrum techniques: Direct sequence (DS) and frequency hopping (FH). Multi user communications: Code division multiple access (CDMA), time division multiple access (TDMA), spatial division multiple access (SDMA), random access techniques (ALOHA), carrier sense multiple access (CSMA). Synchronization: time, frequency, phase, frame, network. Channel estimation and equalization techniques. Adaptive communications: Adaptive power, digital modulation and coding.

### ECCE 462 COMMUNICATION SYSTEMS DESIGN AND PROTOTYPING (2-3-3)
Prerequisite: ECCE 362

Overview of system design and prototyping techniques. Using computer simulation (Simulink/Matlab, LabVIEW) to design and evaluate the performance of communication systems. Overview of hardware prototyping using SDR and FPGA. Transmitter/receiver design, simulation and implementation: modulation, pulse shaping, RF up-conversion, RF down-conversion, sampling, matched filtering, channel estimation, synchronization, detection.

### ECCE 463 INFORMATION AND CODING THEORY (3-0-3)
Prerequisite: ECCE 362

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), Channel coding Techniques: Block and convolution codes, interleaving, puncturing, the bandwidth efficiency plane, the error probability planes.

### ECCE 470 ANTENNAS AND PROPAGATION (3-0-3)

Prerequisite: ECCE 320

Antenna fundamentals, Radiation from a short current dipole, far field approximation, Radiation pattern, 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, Evolving antenna technologies and applications; fundamental design concepts of reconfigurable and conformal antennas, UWB MIMO antennas, antennas for: cognitive radio, propagation at THz and mm-wave, antennas for nano-communications, and biomedical applications

### ECCE 472 OPTICAL COMMUNICATIONS AND NETWORKS (3-0-3)

Prerequisite: ECCE 320

Elements of optical communication systems; 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, Optical communication networks

### ECCE 481 WIRELESS SENSOR NETWORKS AND INTERNET OF THINGS – TE (2-3-3)

Prerequisite: ECCE 360; ECCE 316

Wireless sensor networks (WSN), sensor nodes, sensor network applications, design challenges, performance metrics, medium access control, data routing, sensor localization, time synchronization, energy constraints, power management, Internet of Things (IoT), Ardruino, XBee, Raspberry Pi.

### ECCE 484 SATELLITE AND SPACE COMMUNICATIONS (3-0-3)

Prerequisite: ECCE 360

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: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### ECCE 495 SPECIAL TOPICS IN ELECTRICAL AND COMPUTER ENGINEERING

Prerequisite: Topic specific

This course mainly deals with new trends in Electrical/ Computer Engineering and emerging technologies. Course is repeatable if title and content differ.

ECCE 497 SENIOR DESIGN PROJECT I (1-6-3)
Prerequisites: ECCE 312, ECCE 316 and Senior Standing

Participation in team projects dealing with design and development of a product or a system, in accordance with project-specific objectives and constraints. A number of projects will be offered by the different engineering departments, some of which will be multi-disciplinary in nature. This will provide an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to the industry environment. The design projects require students to use engineering standards in their design process, developing suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

ECCE 498 SENIOR DESIGN PROJECT II (0-9-3)
Prerequisite: ECCE 497

Continuation of ECCE 497.

## 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 the engineering design process under the concept of collaborative project-based learning. Solutions to engineering problems are developed through a process that has a number of phases, starting with problem statement and culminating in feasible conceptual design, leading to the actual design of the best design alternative. The latter transforms the abstract ideas to physical and tangible components, subsystems and holistic systems, analyzing and testing the embodied design to ensure the provision of the optimum outcome from the adopted solution. The course also addresses the social and environmental aspects of engineering design and engineering ethics.

ENGR 112 INTRODUCTION TO COMPUTING USING C++ (3-1-2-4)
Prerequisite: None

Introduction to computer systems. Overview of programming environments. Imperative programming: data types, conditional expressions and statements, repetitive structures, arithmetic and logic operators, functions, arrays, strings, structures, files.

ENGR 113 INTRODUCTION TO COMPUTING USING MATLAB (3-1-2-4)
Prerequisite: None

Introduction to computer systems. Overview of programming principles using MATLAB. Overview of programming environments. Imperative programming: data types, conditional expressions and statements, repetitive structures, arithmetic and logic operators, scripts, functions, arrays, strings, structures. Input/Output and files.

ENGR 295 SPECIAL TOPICS IN ENGINEERING (1 TO 3 CREDITS)
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 395 SPECIAL TOPICS IN ENGINEERING (1 TO 3 CREDITS)
Prerequisite: Junior 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 399 ENGINEERING INTERNSHIP (1-2 CREDITS)
Prerequisites: SDAS 300, Sophomore Standing, and Approval of Department

Students are required to spend a minimum of 8 continuous weeks for each credit 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.

### ENGR 455 FINITE ELEMENT ANALYSIS (3-0-3)
Prerequisite: MATH 204; MATH 206; AERO/CIVE/MEEN 200

An introduction to the basic theory of finite element analysis (FEA) with emphasis on stress analysis of trusses, beams, frames, 2D and axisymmetric structures; integration of the FE method into thermal analysis; assessment of the accuracy of FE predictions; computational exercises using commercially available FE software.

## 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 INDUSTRIAL & SYSTEMS ENGINEERING (3-0-3)
Prerequisites: MATH 112; ENGR 112

This course provides an introduction and overview of various domains in industrial & systems engineering. Students will become familiar with common IE applications including planning & control in manufacturing, operations research, simulation, quality, ergonomics, engineering economics, supply chains and Systems engineering terms, standards, and procedures and acquire knowledge and skills necessary to engineer complex, multi-disciplinary systems.

### ISYE 251 OPERATIONS RESEARCH I (4-0-4)
Prerequisite: MATH 204

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 242

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 EWMA), process and improvement with design of experiments, system reliability, availability, maintenance with the use of relevant engineering standards.

### ISYE 331 STOCHASTIC PROCESSES (3-0-3)
Prerequisite: MATH 204; MATH 206; ISYE 341

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 201; MATH 242

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 AND OPERATIONS MANAGEMENT (3-0-3)
Prerequisite: MATH 242; ISYE 251

This course introduces students to concepts of operations management in manufacturing and service industries. The course covers various operations management tools and methods, such as forecasting, inventory management, lean, scheduling, material and capacity planning, to address how firms can effectively design their operations to match supply with demand under different circumstances. The course also includes an overview of integrated production planning and control systems, including MRP, MRP II and ERP.

### ISYE 352 LEAN MANUFACTURING (3-0-3)

Prerequisite: ISYE 271 or MECH 270

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. Students apply a wide range of design principles, based on appropriate engineering standards to common workplace settings.

### ISYE 361 DATA AND INFORMATION ENGINEERING (3-0-3)

Prerequisite: ISYE 201

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 362 SYSTEMS PROJECT MANAGEMENT (3-0-3)

Prerequisite: BUSS 201

This course presents a systems approach to managing engineering projects. The course objectives include: gain understanding of essential principles associated with effective project management, application of systems engineering and leadership principles in the day-to-day business environment, acquire skills in defining, planning, initiating and monitoring systems based engineering projects using proven techniques and commonly available computer software tools.

### ISYE 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisites: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### ISYE 395 SPECIAL TOPICS IN INDUSTRIAL AND SYSTEMS ENGINEERING (1 TO 3 CREDITS)

Prerequisites: Junior standing and Course Specific

This course mainly deals with new trends in Industrial and Systems Engineering and emerging technologies. Course is repeatable if title and content differ.

### 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 311

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 351

This course introduces supply chain and logistics concepts integrating theory and methods developed in courses such as production, operations and inventory management and Operations Research. The course emphasis is on understanding the role of supply chains for competitive advantage, when and how these concepts are applied to improve the distribution of goods and services, as well as on using mathematical programming and optimization methods for their adequate implementation.

### ISYE 431 TIME SERIES FORECASTING (3-0-3)
Prerequisites: MATH 242

The objective of this course is to teach the students how to model and forecast time series data, using specialized statistical techniques and software. The emphasis will be on the time domain. Topics include: regression analysis, exponential smoothing methods, stationarity, time series specification, decomposition and the Box-Jenkins methods, ARMA/ARIMA, SARIMA models, model estimation, multi-step ahead forecast and forecast error. This course will provide students with hands-on experience in techniques for modeling and prediction of time series.

### 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 242

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 simulation topics focusing on agent-based simulation models and analysis techniques. Topics include large-scale and complex industrial systems; input modeling, output analysis, sensitivity analysis, design of experiments (Taguchi methods), comparison of alternative system configurations.

### ISYE 440 FUNDAMENTALS OF BUSINESS ANALYTICS (3-0-3)

Prerequisite: ISYE 311
The course covers the tools and methods used in analytics at a practical level. Applications of machine learning methods will be emphasized in various business and engineering fields. Students will learn to visualize, analyze data and forecast trends. The course will be based on "R" software which is a programming language and software environment for statistical computing and graphics.

### ISYE 444 HEALTHCARE ANALYTICS AND MANAGEMENT (3-0-3)

Prerequisite: MATH 242, ISYE 351

The aim of this course is to teach healthcare analytics and management tools/methods and apply them to support decision-making in diverse healthcare contexts. Leveraging techniques from industrial engineering and operations research, analytics and accompanying technology are introduced to apply for healthcare planning, control and decision making. Key topics include predictive analytics, process improvement, supply chain and inventory management, risk management, quality and safety.

### ISYE 445 SIX-SIGMA METHODOLOGY & APPLICATIONS (3-0-3)

Prerequisite: MATH 242

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 242

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 352

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 242; 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: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### ISYE 495 SPECIAL TOPICS IN INDUSTRIAL AND SYSTEMS ENGINEERING (3-0-3)

Prerequisites: Topic Specific

This course mainly deals with new trends in industrial and systems engineering and emerging technologies. Course is repeatable if title and content differ.

ISYE 497 SENIOR DESIGN PROJECT (1-6-3)
Prerequisites: ENGR 111; ISYE 311; ISYE 341; and Senior Standing

Participation in team projects dealing with design and development of a product, process, or a system. Number of projects will be offered by the different departments, some of which will be multi-disciplinary in nature. The design projects require students to apply a systems approach in solving a real world problem. Students will draw upon their engineering background, experience, and other pertinent resources. The projects require a) addressing constraints (including economic, environment, social, political, health and safety, manufacturability, sustainability) and b) identifying and applying the relevant engineering standards. Oral and written presentations are required. Some teams receive an assignment with industry clients.

ISYE 498 SENIOR DESIGN PROJECT II (0-9-3)
Prerequisite: ISYE 497

Continuation of ISYE 497.

## MEEN MECHANICAL ENGINEERING

MEEN 180 COMPUTER AIDED DESIGN (2-3-3)
Prerequisite: None

This course introduces students to key concepts, techniques and applications of a Computer Aided Design (CAD) 3D Solid Modeling. Course emphasizes graphics communication and its role in engineering design. Relevant ANSI/ASME and ISO standards for producing technical drawings are introduced. Topics include projections and visualization, 3-D computer modeling, building computer assembly models, multiviews, section views, dimensioning, tolerancing and engineering drawings.

MEEN 200 STATICS (3-0-3)
*(Cross listed with AERO 200; CIVE 200)
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.

MEEN 201 ENGINEERING DYNAMICS (3-0-3)
*(Cross listed with AERO 201; CIVE 201)
Prerequisite: ENGR 200
Co-requisites: MATH 204; MATH 206

This course introduces rectilinear and curvilinear motion of particles and rigid bodies, kinematics and kinetics of particles and rigid bodies, rotational and translational motion of rigid bodies, principle of work and energy, and principle of impulse and momentum in particles and rigid body dynamics.

MEEN 225 ENGINEERING MATERIALS (3-3-4)
Prerequisites: CHEM 115; PHYS 121

This course introduces the three primary groups of engineering materials and the relationship between the structural elements of these materials and their properties. Atomic structure and inter-atomic bonding in metals, ceramics and polymers are discussed. Imperfections in crystal structure, diffusion, phase transformations, and microstructure are studied in relationship to material properties such as tensile strength, hardness, fatigue, and creep.

### MEEN 240 THERMODYNAMICS (3-0-3)
Prerequisite: PHYS 121

This course introduces the concept of energy and the laws governing the transfer and transformations of energy. Emphasis is placed on the thermodynamic properties of pure substances, the first and second law analyses of closed and open systems, and the concept of entropy and its applications to the analysis of such systems.

### MEEN 300 SYSTEM DYNAMICS AND CONTROL (3-0-3)
Prerequisite: MATH 204; MATH 206
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.

### MEEN 325 MECHANICS OF SOLIDS (3-3-4)
(Cross listed with AERO 225 and CIVE 225)
Prerequisites: 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; factor of safety in design, deformation of axially loaded members; symmetric and unsymmetric 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.

### MEEN 335 FLUID MECHANICS (3-3-4)
Prerequisite: MATH 231
Co-requisite: MEEN 240

This course introduces students to concepts relating to fluids and examines the forces on them. Conservation of mass, momentum, and energy are introduced using differential and integral formulations. Introduce inviscid and viscous flows, laminar and turbulent flows and dimensional analysis. Calculations of pressure drop in internal flows and lift and drag forces over immersed bodies.

### MEEN 343 HEAT TRANSFER (3-3-4)
Prerequisites: MATH 231; MEEN 240
Co-requisite: MEEN 335

This course covers the fundamental mechanisms and concepts of heat transfer. Steady and transient conduction, convective heat transfer and the Reynolds analogy, free and forced convection for laminar and turbulent flows, and heat exchangers are covered. Radiative heat transfer is introduced.

### MEEN 350 DYNAMIC SYSTEMS AND VIBRATION (3-0-3)
Prerequisites: PHYS 122; MATH 206; MEEN 201

Mathematical modeling of mechanical, electrical, hydraulic, 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.

### MEEN 356 COMPUTER-CONTROLLED SYSTEMS (3-3-4)
Prerequisite: MEEN 350

This course introduces control of mechanical, electrical and electromechanical systems, feedback control in mechatronic systems, prototype systems, transient response analyses and servomechanism, root locus method, frequency response techniques, state-space representation. Controller specifications, design and architectures; PID and alternative controller design. Digital filters and principles of Digital Signal Processing, digital controllers. Data acquisition and real-time control, computer-aided control system design and simulation. Industrial control applications.

### MEEN 360 COMPUTATIONAL METHODS FOR MECHANICAL ENGINEERS (3-0-3)
Pre-requisite: ENGR 113; MATH 204
Co-requisite: MATH 206

Understand the concept of numerical methods and their application in solving computational problems related to mechanical engineering using MATLAB.

### MEEN 370 INTRODUCTION TO MANUFACTURING PROCESSES (3-3-4)
Co-requisite: MEEN 325

Introduction to basic manufacturing processes, including casting, forming, material removal, joining, forming of plastics and composites, powder metals, and ceramics processes. Additionally, design for manufacturing and assembly (DFMA) methodologies and rapid prototyping are introduced.

### MEEN 380 INTRODUCTION TO POLYMER SCIENCE AND ENGINEERING (3-0-3)
Prerequisites: CHEM 115; PHYS 122

This course introduces fundamentals, properties and applications of polymers. Classification of polymers, polymer formation, polymer structure, characterization, and the relationship between structure and properties are covered. Mechanical properties of polymers are discussed in relationship to their application as engineering materials. The influence of the various stages of polymer processing on properties of the end product is emphasized.

### MEEN 387 MACHINE ELEMENT DESIGN (2-3-3)
Prerequisites: MEEN 325

Design and analysis of machine components 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. Computer aided engineering (CAE) is also introduced in laboratory sessions.

### MEEN 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)
Prerequisite: Approval of department and junior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### MEEN 395 SPECIAL TOPICS IN MECHANICAL ENGINEERING (3-0-3)
Prerequisites: Junior Standing and Topic Specific

This course mainly deals with new trends in mechanical engineering and emerging technologies. Course is repeatable if title and content differ

### MEEN 405 VIBRATION ANALYSIS (3-0-3)
Prerequisite: MEEN 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.

### MEEN 410 VISCOUS AND BOUNDARY LAYER FLOWS (3-0-3)
Prerequisite: MEEN 335

This course covers differential analysis of viscous fluid flow, exact solutions of the Navier-Stokes equations, laminar and turbulent boundary layers, Blasius and Von Karman integral solutions, the Polhausen method, and flow separation.

### MEEN 420 MATERIALS: STRENGTH AND FRACTURE (3-0-3)
Prerequisite: AERO/MEEN 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.

### MEEN 421 MECHANICS OF DEFORMABLE SOLIDS (3-0-3)
Prerequisite: MEEN 325

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.

### MEEN 422 FATIGUE AND FRACTURE ANALYSIS (3-0-3)
Prerequisite: MEEN 325

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.

### MEEN 423 PHYSICAL METALLURGY (3-0-3)

Prerequisite: MEEN 225

This course introduces students to the processing, structure, and properties of metals, and their correlations. The course includes the fundamental elements of structure, thermodynamics and phase diagrams and diffusion. The fundamental principles are applied to the study of steels including alloying elements in steels, the heat treatment of steel, isothermal and continuous cooling transformation diagrams and hardenability.

### MEEN 435 TURBOMACHINERY (3-0-3)

Prerequisite: MEEN 335

This course covers the fundamentals of turbo machines analyses, velocity triangle method, similarity laws, performance characteristics, applications and selection of turbo machines for a variety of engineering situations such as pumping, gas compression and power production.

### MEEN 439 KINEMATICS AND DYNAMICS OF MACHINES (3-0-3)

Prerequisite: MEEN 350 or AERO 350 or MEEN 300

This course introduces fundamentals of kinematics of linkages, cams, gears and gear trains. It also covers position, velocity, and acceleration analysis of machines, static and dynamic force analysis of mechanisms.

### MEEN 441 APPLIED THERMODYNAMICS (3-0-3)

Prerequisite: MEEN 240

This course introduces the concept of exergy, the application of the first and second law of thermodynamics to gas (Brayton-based) and vapour (Rankine-based) power cycles, combined gas/vapour cycles, co-generation, and heat pump and refrigeration cycles (vapour compression, absorption and gas refrigeration cycles). Mixtures of perfect gases and vapours are also introduced, as well as psychometry, stoichiometry and combustion.

### MEEN 446 INTERNAL COMBUSTION ENGINES (3-0-3)

Prerequisite: MEEN 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.

### MEEN 450 VEHICLE ENGINEERING (3-0-3)

Prerequisites: MEEN 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.

### MEEN 454 REFRIGERATION, AIR CONDITIONING AND CRYOGENICS (3-0-3)
Prerequisite: MEEN 343

This course covers psychometrics and psychometric processes applied to air conditioning, principles of indoor air quality control, air conditioning equipment, simple and advanced vapour compression refrigeration and absorption cycles, evaluation of building heating and cooling loads, and principles of cryogenics and their application to gas liquefaction.

### MEEN 465 BIOENGINEERING (3-0-3)
Prerequisite: MEEN 325, MEEN 335, MEEN 225

This is an introductory course to bioengineering. Basic mechanical description of the hierarchical structure of an organism: molecules, membranes, cells, muscles, skeleton, and locomotion, will be covered. The biomechanics of respiratory and circulatory systems will also be covered.

### MEEN 484 MECHATRONICS (2-3-3)
Prerequisites: MEEN 350 OR AERO 350 OR MEEN 300

Principles of mechatronic systems, modeling, time & frequency domain analysis. Electronic components in mechatronic systems. Sensors, actuators, microcomputers, programming. Signal measurement, A/D and D/A conversion, quantization. Analog signal processing and digital circuits. Digital circuits, including Boolean algebra and logic networks, Flip-Flops, TTL and CMOS, integrated circuit system design. Feedback control in mechatronic systems, mechatronic control system design and experiments.

### MEEN 485 INTRODUCTION TO ROBOTICS (3-0-3)
Prerequisite: MEEN 350 OR AERO 350 OR MEEN 300

The course covers the theory and practice of the modeling and control of robotic devices. This includes kinematics, statics, and dynamics of robots, manipulator Jacobian, singularity analysis and manipulability. Motion planning and control of robotics systems will be covered. Including hybrid motion/force control. Different case studies will be presented to support hands-on experiments.

### MEEN 486 SUSTAINABLE ENERGY (2-3-3)
Prerequisite: MEEN 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.

### MEEN 487 ADVANCED MECHATRONICS (3-0-3)
Prerequisite: MEEN 484, ECCE 300 or ECCE 302

This course deals with advanced mechatronic systems design and recent developments from first principles to practical applications. Detailed descriptions of the mathematical models of complex mechatronic systems, developed from fundamental physical relationships, are built on to develop innovative solutions with particular emphasis on physical model-based control strategies. Sensor fusion approaches, system integration, programing languages and implementation.

### MEEN 488 MECHATRONICS SYSTEMS DESIGN (2-3-3)
Prerequisite: MEEN 485
Co-requisite: MEEN 487

Design and/or implement a product or system. The course uses case studies to overview design process of mechatronics systems, actuator types, sizing and selection, measurement systems and transducers selection, control system algorithms and selection of physical controllers, and case studies of various mechatronics systems. The students use this knowledge to design and implement their specific project.

### MEEN 489 KINEMATICS AND DYNAMICS OF MACHINES (3-0-3)
Prerequisite: MEEN 350 or AERO 350 or MEEN 300

This course introduces students to mobility analysis, kinematics of mechanisms, vector methods of analysis of plane mechanisms, synthesis of plane linkages, force analysis of mechanisms, static and dynamic balancing of machines, and analysis and synthesis of cams. Modern engineering tools for mechanisms modelling, simulation and analysis will be used.

### MEEN 491 INDEPENDENT STUDY II (VARIABLE COURSE CREDITS FROM 1 TO 3)
Prerequisites: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### MEEN 495 SPECIAL TOPICS IN MECHANICAL ENGINEERING (3-0-3)
Prerequisites: Topic Specific

This course mainly deals with new trends in mechanical engineering and emerging technologies. Course is repeatable if title and content differ

### MEEN 497 SENIOR DESIGN PROJECT I (1-6-3)
Prerequisite: Senior Standing
Co-requisites: MEEN 350; MEEN 370; MEEN 387

Participation in team projects dealing with design and development of a product or a system, in accordance with project-specific objectives and constraints. Number of projects will be offered by the different engineering departments, some of which will be multi-disciplinary in nature. This will provide an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to the industry environment. The design projects require students to use engineering standards in their design process, developing suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

### MEEN 498 SENIOR DESIGN PROJECT II (0-9-3)
Prerequisite: MEEN 497

Continuation of 497

## NUCE NUCLEAR ENGINEERING

### NUCE 301 RADIATION SCIENCE AND HEALTH PHYSICS (3-0-3)

Prerequisites: PHYS 122; ((MATH 204 & MATH 206) (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 304 EVALUATIVE METHODS FOR NUCLEAR NON-PROLIFERATION AND SECURITY (3-0-3)

Prerequisite: MATH 242 or MATH 243

This course provides the key elements related to nuclear non-proliferation and security such as, legal framework, operational interactions, and physical protection system design and evaluation methods. Topics include international and national legal framework regulating nuclear non-proliferation and security, threat assessment, detection and response to criminal or unauthorized acts involving nuclear and other radioactive material, nuclear material accountancy, containment and surveillance, as well as international and state-level approaches to safeguarding nuclear materials.

### NUCE 401 INTRODUCTION TO NUCLEAR REACTOR PHYSICS (3-0-3)

Co-requisite: NUCE 301 or equivalent

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: (MEEN 240 and MEEN 335) OR NUCE 303; NUCE 401
Note: Students can either take NUCE 402 or NUCE 403 but not both

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: (MEEN 240 and MEEN 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.

**PEEG PETROLEUM ENGINEERING**

PEEG 218   RESERVOIR ROCK PROPERTIES (2-3-3)
Prerequisite: ENGR 111

Theoretical introduction to basic rock properties and their core-based measurements determined by conventional and special core analysis. It will be discussed how to obtain reliable core analysis data and the specific topics include porosity, permeability, Darcy's law with applications/limitations, saturations, wettability, capillary pressure, relative permeability, resistivity, compressibility and the effect of stresses on rock mechanical properties. Laboratory experiments will reinforce concepts discussed in the classroom.

PEEG 219   RESERVOIR FLUID PROPERTIES (2-3-3)
Prerequisite: PEEG240 (or MEEN 240), CHEM 116

The theoretical and laboratory parts of this course cover the basic characterization of reservoir fluids, their properties, their determination and their measurement. Topics covered include phase behaviour, density, saturation pressures, gas-oil ratios, shrinkage, oil and gas formation factors, viscosity and the compositional analysis of oil, gas, and brine.

PEEG 252   STATICS AND MECHANICS OF MATERIALS FOR PE (3-0-3)
Prerequisite: MATH 112; PHYS 121

A combined course of Statics and Strength of Materials for petroleum engineering. Forces, force couples, resultants, free body diagrams, equations of equilibrium and internal/external forces are first covered in statics and then applied to problems of stress analysis and deformations in deformable bodies under axial, torsional, bending and combined loading in the mechanics of materials part. Stress tensor is introduced and the significance of elastic parameters is highlighted. Stress transformation equations, experimental methods of measuring rock strength, and failure criteria are also discussed.

PEEG 302   FLUID MECHANICS AND HEAT TRANSFER (3-0-3)
Prerequisite: PEEG 240 or MEEN 240

This course introduces the principles of momentum transfer and overall mass, energy and momentum balances including an introduction to multiphase flow in pipes. Topics also include the principles of steady-state and unsteady-state heat transfer. Specific applications such as measurement of fluid flow, pumps, gas-moving equipment, prediction of pressure drop in pipes, restrictions and manifold systems, heat exchangers, and thermal gradient and heat transfer in oil and gas wells are stressed.

### PEEG 314 WELL LOGGING (3-0-3)
Prerequisite: PEEG 218, PHYS 122
Co-requisite: PEEG 322

This course provides an introduction to the various well logging methods, tools and their principles of operation with emphasis on the relationship between measurements and reservoir petrophysical properties. Conditions and limitations for applications of various logs are discussed. Graphical and analytical methods used to determine formation composition, contents, and its potential for production are developed and applied to create graphs and log traces, and determine reservoir parameters.

### PEEG 315 RESERVOIR CHARACTERIZATION (2-3-3)
Prerequisites: PEEG 219, PEEG 314, PGEG 311

Students learn how to integrate geological, geophysical, petrophysical and engineering data, using geostatistical tools and workflows, to characterize the reservoir and build a 3D static model, to be used in subsequent reservoir simulation studies. They will also learn how to use Petrel software to load, process, interpret and visualize the reservoir in three-dimensions and carry out uncertainty analysis on volumetrics using Monte Carlo simulation.

### PEEG 322 DRILLING ENGINEERING I (2-3-3)
Prerequisite: PEEG 252
Co-requisite: PEEG 314

This is an introductory level drilling course which introduces rotary drilling process and basic drilling rig components to the students who have no prior knowledge on oil well drilling technology. Hands on laboratory testing of drilling fluids will be covered. At the end of the course the students should be able to assess formation pressures and fracture strengths; design mud programs and casing shoe depths; design basic components of a drilling rig to meet a given and be familiar with popular drilling problems.

### PEEG 326 DRILLING ENGINEERING II (2-3-3)
Prerequisites: PEEG 302; PEEG 322

This is an advanced level drilling course designed for students who have prior knowledge of drilling fundamentals. The course covers a range of topics from casing and cementing technology, hydraulics, directional drilling, and well control. Upon completing this course, the students should be able to select casing grades for a given well data, formulate, design and analyze cementing operations as well as directional drilling data analysis. Hands on practical sessions on drilling simulators will be covered.

### PEEG 331 RESERVOIR ENGINEERING I (3-0-3)
Prerequisite: PEEG 218; PEEG 219; PEEG 302

This course presents the students with material balance, the derivation and application of zero-dimension reservoir models for practical reservoir management and performance prediction. The subject of oil or gas initial and remaining reserve will be covered, in relation with initial hydrocarbon in place through the concept of unit recovery, recovery efficiency and recovery factor. The course will also present the different types of hydrocarbon reservoirs, with their possible oil and gas drive mechanisms.

### PEEG 336 WELL TESTING (3-0-3)

Prerequisites: PEEG 331, PEEG 314, MATH 206

This course covers theoretical development of flow equations governing well testing in oil and gas wells. Line source analytical solutions of flow equations will be covered concentrating on semi-log analysis and type-curve matching. The principle of superposition will also be discussed. Production capacity of a well and pressure derivative analysis will be introduced.

### PEEG 341 COMPLETION AND WORKOVER (3-0-3)

Prerequisite: PEEG 322

The course presents different well completions and workover techniques in a comprehensive method. The well completions for varying field conditions are discussed, including technical and economic considerations. Downhole components and design of tubing string for most types of well are discussed. The methods of opening the formation with the wellbore for production are detailed with types of perforation techniques. Workover procedures including remedial cementing, well stimulation methods are taught with required design procedures.

### PEEG 360 PETROLEUM ECONOMICS & RISK ANALYSIS (4-0-4)

Prerequisite: HUMA 150

The objective is to develop students' expertise in the area of economics and risk/uncertainty analysis and their relation to decision making processes in the petroleum industry. It introduces students to the concept of business economics implemented in the modern petroleum industry. This approach improves students' skills in utilizing all available information about the project and related economic influences in depicting a realistic projection of the project worth and the chances of business success.

### PEEG 391 INDEPENDENT STUDY I (VARIABLE COURSE CREDITS FROM 1 TO 3)

Prerequisite: Junior standing and approval of the department

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### PEEG 394 RESEARCH TOPICS IN PETROLEUM ENGINEERING (ROM 1-3 CREDITS)

Prerequisite: Junior standing and approval of the department

The course focuses on research-driven topics. A student can take multiple Research Topics courses with different content for credit subject to program approval.

### PEEG 395 SPECIAL TOPICS IN PETROLEUM ENGINEERING (FROM 1-3 CREDITS)

Prerequisites: Junior standing and Topic Specific

This course mainly deals with new trends in petroleum engineering and emerging technologies. Course is repeatable if title and content differ.

### PEEG 420 WELL TREATMENT (3-0-3)
Prerequisites: PEEG 341; Senior standing

This course discusses the causes of production impairment and methods of improving well productivity using established well treatment methodologies. Two important area of a production system will be covered, the near wellbore formation (formation damage issues) and the production system (wellbore to separator, flow assurance issues). Topics include loss of productivity due to formation damage, asphaltene, wax and inorganic solid deposition along with detail mitigation methods. The course will also cover chemical based treatment methods to control/shut-off excessive water and gas production and injection water profile control. A significant part of the course will focus on diagnosis of problem, selection and application of chemicals, tools and hardware and designing specific well treatment operations.

### PEEG 423 HORIZONTAL AND MULTILATERAL WELL TECHNOLOGY (3-0-3)
Prerequisite: PEEG 326

This is a comprehensive course designed to familiarize petroleum-engineering students with the benefits and design of horizontal and multilateral wells. The topics covered include key details of drilling and completion of horizontal and multilateral wells, such as planning, drilling, surveying, tubular selection, failure analysis, cutting transport, hole-stability, cementing, centralizer spacing, etc. Students work on design examples and utilize an industry software package.

### PEEG 424 UNDERBALANCED DRILLING TECHNOLOGY (3-0-3)
Prerequisite: PEEG 326

This course is designed to familiarize students with the five popular UBD techniques. These are Air/Natural Gas Drilling, Mist Drilling, Foam Drilling, Gasified Liquid Drilling and Flow Drilling. Benefits and limitations of each technique along with the design principles and operational procedures are discussed. Common problems pertinent to each technique and recommended procedures are also discussed.

### PEEG 425 PRESSURE CONTROL (3-0-3)
Prerequisite: PEEG 326

This course is designed to introduce fundamental well control principles, procedures and control equipment to the students who have completed their basic drilling engineering courses. Students will learn concepts of formation pressure, static and dynamic well bore pressures; primary and secondary well control, shut in procedures; kick circulation procedures; well control equipment and alleviate kick circulation problems. Students will also have hands on training and an IWCF-type practical exam on the PI Drilling Simulators.

### PEEG 434 RESERVOIR ENGINEERING II (4-0-4)
Prerequisite: PEEG 315; PEEG 331; MATH 206

Key reservoir parameters required to calculate recovery factor, mobilization, sweep efficiencies, fractional flow analysis, and heterogeneity interaction and their influence on recovery factor are fully covered. General principles relating to SCAL properties and volumetric sweep that should be considered in planning secondary recovery, EOR and IOR processes are reviewed. Introduction to reservoir simulation principles is also discussed.

### PEEG 437 NATURAL GAS ENGINEERING (3-0-3)
Prerequisite: PEEG 331

This course covers gas reservoirs rock and fluid Properties, including Darcy and non-Darcy flow phenomena near gas wells. Gas reserves estimation using linearized MBE and Decline Curve Analysis will be evaluated. Decline curves analysis of Arps and Fetkovich will be studied. Gas flow and gas well testing to evaluate reservoir characteristics will be covered, considering the pressure solution, p2 solution, real gas pseudo pressure solution of the gas transient flow equation. Deliverability of gas wells will be determined using multi-rate draw down testing, flow after flow testing, isochronal testing, and modified isochronal testing. Prediction of future performance and ultimate recovery form gas reservoirs will be studied.

### PEEG 442 SURFACE PRODUCTION FACILITIES (3-0-3)
Prerequisite: PEEG 302

This course covers the description, applications, design, analysis, and operational issues of surface production facilities. Topics include Wellhead choke, 2-phase, and 3-phase separation, emulsion treatment, desalting, oil stabilization, water treatment, gas dehydration and sweetening, and storage. Principles governing the flow of oil, gas, and water in the surface production system will be covered. Surface production problems (corrosion and environmental) and safety issues are also included.

### PEEG 445 PRODUCTION ENHANCEMENT (3-0-3)
Prerequisites: PEEG 341, PEEG 443

This course discusses the causes of production impairment and methods of improving well productivity. Topics include loss of productivity due to formation damage, solids deposition, excessive water and gas production, and bottlenecks in the production system; and production enhancement by matrix treatments, remedial cementing and production profile control. De-bottlenecking of the production system through Nodal analysis of the production system is also covered.

### PEEG 447 PRODUCTION ENGINEERING (3-0-3)
Prerequisites: PEEG 331, PEEG 341

This course utilizes the Total System Analysis technique for the design and performance analysis of the production system starting from the reservoir through the wellbore to the production separator. Topics include inflow performance relationships (IPR), vertical lift performance (VLP) for multiphase flow in vertical and inclined pipes, overall well performance evaluation considering various nodes within the production system. Artificial lift techniques of gas lift and electrical submersible pumps (ESP) are also taught. The course also includes surface production facilities for handling and separation of oil, gas, and water.

### PEEG 456 PETROLEUM RELATED ROCK MECHANICS (3-0-3)
Prerequisites: PEEG 252

Rock mechanics principles and topics such as nature of rock, rock deformability and rock stress, engineering properties of rocks from laboratory testing, and the effect of factors such as pore pressure, temperature and time on rock behavior are covered. Rock strength and failure and mathematical approaches to stress-strain analysis in rocks will be discussed together with applications such as borehole stability analysis and reservoir compaction.

### PEEG 491 INDEPENDENT STUDY I (FROM 1-3 CREDITS)
Prerequisite: Approval of department and senior standing

This course gives an upper level undergraduate student the opportunity to participate in an individual or group project, study, or research activity under the supervision of a faculty member. A formal report is required.

### PEEG 494 RESEARCH TOPICS IN PETROLEUM ENGINEERING (FROM 1-3 CREDITS)
Prerequisite: Senior standing and approval of the department

The course focuses on research-driven topics. A student can take multiple Research Topics courses with different content for credit subject to program approval.

### PEEG 495 SPECIAL TOPICS IN PETROLEUM ENGINEERING (FROM 1-3 CREDITS)
Prerequisites: Senior standing and Topic Specific

This course mainly deals with new trends in petroleum engineering and emerging technologies. Course is repeatable if title and content differ.

### PEEG 497 SENIOR DESIGN PROJECT I (3-0-3)
Prerequisites: PEEG 322, PEEG 315, PEEG 336, PEEG 360
Co-requisites: PEEG 434, PEEG 447

This is the first course in a sequence of two courses; Design Project I (DP I) and Design Project II (DP II). DP I covers up to Drilling & Completion design and the rest is covered in DP II (PEEG 498). This is a team-based design project pertaining to field development plan of a hydrocarbon reservoir, incorporating realistic design constraints, and engineering ethics. The steps involve reservoir description and volumetric evaluations, development planning, drilling and completion design, estimation of fluid production rates, surface facility design, and economic analysis. A reservoir management and surveillance strategy for long term production sustenance is also included.

### PEEG 498 SENIOR DESIGN PROJECT II (3-0-3)
Prerequisites: PEEG 497

Petroleum Engineering Design Project II (PEEG 498) is a continuation of PEEG-497. After completing the first 3 modules, i.e. reservoir description and volumetric evaluations, development planning, drilling and completion design, students are required to complete the remaining three modules, namely, reservoir development and management strategies, designing an oil, gas and water separation and processing facilities and finally perform a comprehensive economic analysis of the project, with due consideration of the realistic engineering constraints, as well as the issues relating to safety and ethics in oilfield operations.

## ADDITIONAL COURSES
### PHED 110 BEGINNER VOLLEYBALL (0-3-1) – WOMEN ONLY
Prerequisite: None

This is an introductory course in the fundamentals of volleyball developed for students with limited or no prior experience in playing volleyball. The course will cover volleyball techniques for serving, passing, setting, spiking, and blocking. Students will learn being part of a team, understand and apply volleyball rules and regulations, scoring techniques and court strategy for playing the game.

### PHED 125 BEGINNER FOOTBALL (0-3-1) – MEN ONLY

Prerequisite: None

This is an introductory football course for students with limited or no prior experience in playing football. The course will explore individual skills, techniques and strategies. Students will also learn being part of a team, understand and apply football rules and regulations and refereeing principles for playing the game.

### SDAS 100 STUDENT DEVELOPMENT AND ACADEMIC SUCCESS (1-0-1)

Prerequisite: None

The purpose of this course is to provide students with practical skills and habits that will promote life-long learning and future success. The course assists students to learn how to take responsibility of their learning, and understand themselves in relation to their skills, abilities, and learning styles..

### SDAS 300 CAREER DEVELOPMENT (0-1.5-0)

Prerequisite: Junior Standing

This course aims to equip learners with the mindset and skillset to use and apply for the world of work today and in the future. This will include end to end support via employability workshops, employability testing, access to online learning materials, group and one to one guidance via an employability & local labor market specialist. Workshops are designed to be interactive and activity based; they include CV writing, interview techniques, job search, the hidden job market, social media, and mindset.

# COLLEGE OF ART AND SCIENCES FACULTY LISTING

# A

**Abbas, Elrashid Yousif, Ph.D.**
Omdurman Islamic University, Sudan, 2007. Senior Lecturer of Humanities & Social Sciences.

**Abbedrabo, Sufian, Ph.D.**
New Jersey Institute of Technology, USA, 1998. Associate Professor of Physics.

**Abdeljabbar, Alrazi, Ph.D.**
University of South Florida, USA, 2012. Assistant Professor of Mathematics.

**Abi Jaoude, Maguy, Ph.D.**
University of Claude Bernard Lyon 1, France, 2011. Associate Professor of Chemistry.

**Abo Salem, Yousef, Ph.D.**
BUID Birmingham University, UK, 2013. Senior Lecturer in Mathematics.

**Abu Haija, Mohammad, Ph.D.**
Technical University of Berlin, Germany, 2006. Associate Professor of Chemistry.

**Ajhar, Hakim, Ph.D.**
McGill University, Canada, 2000. Associate Professor of Humanities & Social Sciences.

**Al-Arydah, Mo'tassem, Ph.D.**
University of Ottawa, Canada, 2009. Assistant Professor of Mathematics.

**Al Busaeedi, Abdulla, M.A.**
University of Yarmouk, Jordan 1997. Lecturer in Humanities & Social Sciences.

**Al Hanai, Mariam, M.S.**
Marquette University, USA, 1984. Lecturer in Mathematics.

**Al-Homouz, Dirar, Ph.D.**
University of Houston, USA, 2007. Associate Professor of Physics.

**Ali, Mohammed, Ph.D.**
University of Oxford, UK, 2003. Professor of Earth Sciences.

**Al-Khaleel, Mohammad, Ph.D.**
McGill University, Canada, 2007. Assistant Professor of Mathematics.

**Allred, Jessica, M.S.**
City College of New York, USA, 2011. Lecturer in English.

**Al Suwaidi, Aisha, D.Phil.**
University of Oxford, UK, 2012. Associate Professor of Earth Sciences.

**Al Suwaidi, Mohamed, Ph.D.**
Colorado School of Mines, USA, 2015. Assistant Professor of Earth Sciences.

**Ameur, Ahmed, M.S.**
University of Central Florida, USA, 2003. Lecturer in Mathematics.

**Anderson, Alliya, M.A.**
University of San Francisco, USA, 2007. Lecturer in English.

**Andrew, Matthew, M.A.**
Macquarie University, Australia, 2010. Lecturer in English.

**Anjum, Dalaver, Ph.D.**
University at Albany SUNY, USA, 2002. Assistant Professor of Physics.

**Archbold, Ricardo, D.B.A.**
Nova Southeastern University, USA, 2004. Assistant Professor of Humanities & Social Sciences.

**Ashraf, Syed Salman, Ph.D.**
North Carolina State University, USA, 1999. Professor of Chemistry and Acting Chair of Biology.

**Ayish, Nader, Ph.D.**
George Mason University, USA, 2003. Assistant Professor of English.

**Aynedjian, Hagop, M.S.**
Université Paul Sabatier – Toulouse III, France, 2005. Senior Lecturer in Physics.

**Al Deaibes, Mutasim, Ph.D.**
University of Manitoba, Canada, 2016. Assistant Professor of English.

**Al-Sarairah, Eman Yousef, Ph.D.**
University of Manchester, UK, 2007. Senior Lecturer in Mathematics.

## B

**Babula, Michael, Ph.D.**
Goldsmiths, University of London, UK, 2006. Assistant Professor of Psychology (Humanities & Social Sciences).

**Bassous, Jad,**
Engineering Degree in Computer Science, Electronics, and Robotics, 1992, Ecole Supérieure d'Informatique-Electronique-Automatique, Paris, France, Senior Lecturer.

**Batic, Davide, Ph.D.**
Regensburg University, Germany, 2005. Associate Professor of Mathematics.

**Bennell, Robert, Ph.D.**
Cranfield University (Royal Military College of Science), UK, 1996. Associate Professor of Mathematics.

**Bildsten, Meriem, M.Sc.**
Uppsala University of Sweden, 2015. Lecturer in Chemistry.

**Blouin, Denis, M.S.**
Laval University, Canada, 1989. Lecturer in Mathematics.

**Bouchaala, Fateh,**
PhD in Geoscience Marine, University of Western Brittany, France. Assistant Professor of Earth Sciences.

**Bouzidi, Youcef, Ph.D.**
University of Alberta, Canada, 2003. Associate Professor of Earth Sciences.

**Bowman, Melanie, MBA,**
University in Canberra, Australia, 2014. Lecturer in Humanities & Social Sciences.

**Bradley, Curtis, Ph.D.**
Rice University, USA, 1997. Associate Professor in Physics and Associate Dean of Undergraduate Studies.

**Bsoul, Labeeb, Ph.D.**
McGill University, Canada, 2003. Professor and Acting Chair of Humanities & Social Sciences.

**Burkett, Theodore, Ed.D.**
University of Exeter, UK, 2017. Senior Lecturer in English and Director of Preparatory Program.

## C

**Cammidge, Tiffany, M.Ed.**
University of Toronto, Canada, 2012. Lecturer in English.

**Cannon, Brendon, Ph.D.**
University of Utah, USA, 2009. Assistant Professor of Humanities & Social Sciences.

**Carbonell, Curtis, Ph.D.**
Florida State University, USA, 2008. Associate Professor and Chair of English.

**Ceriani, Andrea, Ph.D.**
University of Pavia, Italy, 2000. Associate Professor of Earth Sciences.

**Consigli, Giorgio, PhD**
1997 University of Essex, Associate Professor of Mathematics.

## D

**Dalton, David, M.A.**
University of Sheffield, UK, 1994. Senior Lecturer in English.

**Das, Gobind, Ph.D.**
Università degli Studio di Trento, Italy 2004. Associate Professor of Physics.

**Decarlis, Alessandro, Ph.D.**
University of Pavia, 2006. Assistant Professor of Earth Sciences.

**Daw Elbait, Gihan, Ph.D.**
Technische Universität Dresden, Germany, 2009, Senior Lecturer in Biology.

**Deveci, Tanju, Ph.D.**
Ankara University, Turkey, 2011. Associate Professor of English.

**Dib, Khalid, Ph.D.**
North Dakota State University, USA, 1999. Senior Lecturer in Mathematics.

**Dimmitt, Nicholas, Ph.D.**
University of Southern California, USA, 1994. Associate Professor of Humanities & Social Sciences.

## E

**El Gamal, Glenda, Ed.D.**
University of New England, Australia, 2018. Senior Lecturer in English.

**El Jammal, Hussam, M.E.E.**
University of Arkansas, USA, 1998; M.S. Delaware State University, USA, 1994. Senior Lecturer in Physics.

**Elkadi, Mirella, Ph.D.**
University of Lausanne, Switzerland, 1993. Associate Professor and Associate Chair of Chemistry.

**El-Kork, Nayla, Ph.D.**
Universite de Lyon, France, 2009. Associate Professor of Physics.

**El-Maarry, Mohamed Ramy, PhD**
Goettingen University, Associate Professor of Earth Sciences and Director, Khalifa University Space and Planetary Science Center.

**El-Sokkary, Wael, M.A.**
University of Maryland Baltimore County, USA, 2003. Lecturer in English.

**Elyana, Imad, M.Sc.**
University of Texas, USA, 2002. Senior Lecturer in Mathematics.

## F

**Fernandes, Ryan,**
Ph.D. University of Kentucky, USA, 1991. Associate Professor of Mathematics.

## G

**Gabor, Adriana, Ph.D.**
University of Twente, Netherlands, 2002. Assistant Professor of Mathematics.

**Gacesa, Marko, Ph.D.**
University of Connecticut, USA. 2010. Assistant professor in Physics.

**Galadari, Abdulla, Ph.D.**
University of Aberdeen, UK, 2013. Assistant Professor of Humanities & Social Sciences.

**Garvey, Kevin, M.A.**
University of Surrey, UK, 1998. Lecturer in English.

**Gebrehiwot, Berihu. Ph.D.**
University of Milan, Italy, 2010. Assistant Professor of Mathematics.

**Guha, Partha, D.Phil.**
Oxford University, UK, 1996, Professor of Mathematics.

**Gupta, Vinay, Ph.D.**
MDS University, India, 1997. Assistant professor of Physics.

## H

**Habib, Maha, Ph.D.**
University of Exeter, UK, 2013. Assistant Professor of Humanities & Social Sciences.

**Hachem, Mayssa, PhD**
National Institute of Applied Sciences of Lyon, France, 2015. Assistant Professor of Chemistry.

**Hasheem, Nabee, M.Sc.**
Bangalore University, India, 1983. Lecturer in Physics.

**Hassan, Asli, Ph.D.**
University of Maryland Baltimore County, USA, 2011. Assistant Professor of English.

**Hassan, Jamal, Ph.D.**
University of Waterloo, Canada, 2006. Associate Professor of Physics.

**Hassan, Shabir, Dr. Sc.**
University of Zurich, Switzerland, 2015. Assistant Professor of Biology.

**Hatzikirou, Haralampos, Ph.D.**
Technische Universität Dresden, Germany, 2009. Associate Professor of Mathematics.

**Hennhoefer, Dominik, Ph.D.**
University of Heidelberg, Germany, 2013. Assistant Professor of Earth Sciences.

**Hjouj, Fawaz, Ph.D.**
Southern Illinois University, USA, 2004. Senior Lecturer in Mathematics.

**Hunaini, Enaam Subhi, M.A.**
Indiana University, USA, 2002. Lecturer in English.

## J

**Jabri Pickett, Joud, M.A.**
University of Southern Queensland, Australia, 2009. Lecturer in English.

**James, Joann Alison,**
Doctor of Education University of Bath, UK, 2021. Senior Lecturer in English.

**Jouini, Mohamed Soufiane, Ph.D.**
University of Bordeaux, France, 2009. Associate Professor of Mathematics.

## K

**Kavazovic, Zanin, Ph.D.**
Laval University, Quebec, Canada, 2011. Assistant Professor of Mathematics.

**Khamsi, Mohamed Amine, Ph.D.**
University of Paris 6, France, 1987. Professor of Mathematics.

**Kirane, Mokhtar, D.Sc.**
University of Annaba, Algeria, 1990. Professor of Mathematics.

**Kourakis, Ioannis, Ph.D.**
Université Libre de Bruxelles, Belgium, 2002. Associate Professor of Mathematics.

**Koyi, Hemin, PhD.,**
Uppsala University, 2021, Chair and Professor of Earth Sciences.

**Kucukalic, Lejla, Ph.D.**
University of Delaware, USA, 2006. Assistant Professor of English.

**Kusmartsev, Fedor, Ph.D. L D**
Landau Institute for Theoretical Physics, Russia, 2021. Professor of Physics.

## L

**Lim, Hwee Ling, Ph.D.**
Murdoch University, Australia, 2007. Associate Professor of English.

**Ling, Szu Szu, Ph.D.**
The National University of Malaysia, Malaysia, 2018. Senior Lecturer in Chemistry.

**Luckachan, Gisha, Ph.D.**
Cochin University of Science and Technology, India, 2008. Lecturer in Chemistry.

**Laadhari, Aymen, Ph.D.**
University of Grenoble and French National Center for Scientific Research, France, 2011. Assistant Professor of Mathematics.

## M

**Maalej, Nabil, Ph.D.**
University of Wisconsin-Madison, 1994. Associate Professor in Physics.

**Martin, Neville, M.Sc.**
Newcastle Upon Tyne Polytechnic, UK, 1984. Lecturer in Mathematics.

**McDermott, Mary, M.Sc.**
University College Galway, Ireland, 1983. Lecturer in Chemistry.

**Midraj, Jessica, Ph.D.**
Indiana State University, USA, 1999. Assistant Professor of English.

**Mohamed, Sharmarke, Ph.D.**
University College London, UK, 2011. Associate Professor of Chemistry.

**Mohideen, Mohammed Infas. Ph.D.**
University of St. Andrews, UK, 2011. Assistant Professor of Chemistry.

**Morad, Sadoon, Ph.D.**
Uppsala University, Sweden, 1983. Professor of Earth Sciences.

**Moran, Valentine, M.B.A.**
Heriot-Watt University, UK, 2001. Senior Lecturer in Humanities & Social Sciences.

**Mughrabi, Asma, M.Sc.**
University of Jordan, Jordan, 2005. Senior Lecturer of Mathematics.

**Muschert, Glenn, Ph.D.**
University of Colorado, USA, 2002. Professor of Humanities & Social Sciences.

## N

**Nazzal, Samah, Ph.D.**
University of Alabama, USA, 2010. Senior Lecturer in Physics.

**Nwayhed, Nadia, M.A.**
American University of Beirut, Lebanon, 2008. Lecturer in Mathematics.

## O

**Omer, Amani, Ph.D.**
University of Manchester, UK, 2004. Assistant Professor of Humanities & Social Sciences.

**Oral, Sevket Benhur, Ph.D.**
Iowa State University, USA, 2007. Assistant Professor of English.

**Osman, Wael Mohammed, Ph.D.**
University of Tokyo, Japan, 2014. Assistant Professor of Biology.

**Overstreet, Matthew, Ph.D.**
University of Pittsburgh, USA, 2018. Assistant Professor of English.

**Okorie, Idika E., Ph.D.**
University of Manchester, UK, 2020. Senior Lecturer in Mathematics.

**Oueis, Emilia, Ph.D.**
University of Rouen, France, 2013. Assistant Professor of Chemistry.

## P

**Patole, Shashikant, Ph.D.**
Sungkyunkwan University (SKKU), South Korea, 2010. Assistant Professor of Physics.

**Pereira, Mauro, PhD.**
University of Arizona, USA, 1992. Professor and Chair of Physics.

**Pitsalidis, Charalampos, Ph.D.**
Aristotle University of Thessaloniki, Greece, 2014. Assistant professor of Physics.

**Porcu, Emilio. Ph.D.**
University of Milano Bicocca, Italy, 2014. Professor of Mathematics.

**Price, Gareth, Ph.D.**
University of Bath, UK, 1984. Professor and Chair of Chemistry.

## Q

**Qattan, Issam, Ph.D.**
Northwestern University, USA, 2005. Associate Professor of Physics.

**Qurashi, Ahsan Al Huq,**
Ph.D. Chonbuk National University Jeonju, South Korea. 2008 Associate Professor of Chemistry

## R

**Raja, Aamir, Ph.D.**
University of Canterbury, New Zealand, 2013. Assistant Professor of Physics.

**Reppas, Dimitrios, Ph.D.**
University of Maryland, USA, 2012. Assistant Professor of Humanities & Social Sciences.

**Rezeq, Moh'd, Ph.D.**
University of Ottawa, Canada, 2002. Associate Professor of Physics.

**Riahi, Mohamed Kamel, Ph.D.**
Pierre et Marie Curie University, France, 2012. Assistant Professor of Mathematics.

**Richards, Selena Elizabeth, Ph.D.**
University of Hull, UK, 2008. Assistant Professor of Chemistry.

**Rossiter, Ash, Ph.D.**
University of Exeter, UK, 2014. Assistant Professor of Humanities & Social Sciences.

## S

**Shariff, M.H.B.M., Ph.D.**
University of Newcastle Upon Tyne, UK, 1985. Professor of Mathematics.

**Sheehan, David, D.Sc.**
National University of Ireland, 2009; Ph.D. Trinity College Dublin, Ireland, 1985. Dean of the College of Arts & Sciences and Professor of Biochemistry.

**Shetty, Dinesh, PhD**
Seoul National University, Seoul, Republic of Korea 2011 Assistant Professor of Chemistry.

**Sim, Li-Chen, D.Phil,**
University of Oxford, UK, 2005. Assistant Professor of Humanities & Social Sciences.

**Singh, Nirpendra, Ph.D.**
Indian Institute of Technology Roorkee, India, 2007. Assistant Professor of Physics.

**Siraki, Arby, Ph.D.**
University of Ottawa, Canada, 2012. Assistant Professor of English.

**Sivasankaran, Anoop, Ph.D.**
Glasgow Caledonian University, UK, 2010. Assistant Professor of Mathematics.

**Steuber, Thomas, Ph.D.**
University of Cologne, Germany, 1989. Professor of Earth Sciences and Associate Dean for Research.

**Stitou, Samira, M.S.**
University of Toronto, Canada, 1998. Lecturer in Mathematics.

**Subhiyyah, Hazim, M.Sc.**
Northeastern University, USA, 1999. Senior Lecturer in Physics.

**Susanto, Hadi. PhD.**
University of Twente, Netherlands, 2006. Professor of Mathematics.

## T

**Tajdin, Mustapha, Ph.D.**
Al-Karawiyyin University, Morocco, 2000. Assistant Professor of Humanities & Social Sciences.

**Temouri, Yama Ph.D.**
Aston University, United Kingdom, 2008. Associate Professor of Humanities & Social Sciences.

**Thoudam, Satyendra, Ph.D.**
Radboud University, Netherlands, 2012. Assistant Professor of Physics.

**Tyler, Robert,**
University of Melbourne (Australia), 2000. Associate Professor of Humanities & Social Sciences.

## U

**Umar, Abdullahi, Ph.D.**
University of St. Andrews, UK, 1992. Professor of Mathematics.

## V

**Vaccino, Silvia. Ph.D.**
University of Pennsylvania, USA, 2020. Senior Lecturer in English.

**Vliet, Arjen, Ph.D.**
Hamburg University, Germany, 2014. Assistant professor of Physics.

## W

**Wijeweera, Albert, Ph.D.**
University of Tennessee, USA, 2004. Associate Professor of Humanities & Social Sciences.

**Wyatt, Mark, Ph.D.**
University of Leeds, UK, 2008. Associate Professor of English.

**Wollenberg, Alexander, P.h.D.**
National University of Singapore,2011. Associate Professor of Humanities & Social Sciences.

## Y

**Yates, Athol, Ph.D.**
Australian National University, Australia, 2011. Assistant Professor of Humanities & Social Sciences.

**Yildiz, Ibrahim, Ph.D.**
University of Miami, US, 2008. Associate Professor of Chemistry.

**Young, David Anthony, M.A.**
University of Limerick, Ireland, 2001. Lecturer in English.

**Yousef, Ahmed, Ph.D.**
University of Western Ontario, Canada, 2009. Associate Professor of Biology and Acting Program Director, Pre-Medicine Bridge Program.

## Z

**Zeidan, Mohammed, Ph.D.**
University of Canterbury, New Zealand, 2016. Senior Lecturer in Physics.

**Zhao, Ruikun, Ph.D.**
University of East Anglia, UK, 2013. Senior Lecturer in Chemistry.

**Zhou, Bing, Ph.D.**
University of Adelaide, Australia, 1998. Associate Professor of Earth Sciences.

**Zikkos, Elias, Ph.D.**
University of Cyprus, Cyprus, 2005. Senior Lecturer in Mathematics.

**Zubelli, Jorge, Ph.D.**
University of California, Berkeley, USA, 1989. Professor and Chair of Mathematics.

# COLLEGE OF ENGINEERING
## FACULTY LISTING

# A

**Abualrub, Rashid, PhD,**
Louisiana State University, 2004; Professor of Mechanical Engineering

**Abu-Nada, Eiyad, PhD,**
New Mexico State University, USA, 2001; Associate Professor of Mechanical Engineering

**Abu Zahra, Mohammed, PhD,**
Delft University of Technology, 2009; Professor of Chemical Engineering

**Addad, Yacine, PhD,**
University of Manchester, UK, 2005; Associate Professor of Nuclear Engineering and Deputy Director, Emirates Nuclear Technology Center (ENTC)

**Afgan, Imran, PhD,**
University of Manchester, UK, 2007; Associate Professor in Mechanical Engineering

**Ahmad, Jamal, PhD,**
North Carolina State University, 1993; Professor in Mechanical Engineering.

**Ait Abderrahmane, Hamid PhD,**
Concordia University, Canada, 2009; Assistant Professor of Mechanical Engineering

**Ajaj, Rafic, PhD,**
Swansea University, UK, 2013; Associate Professor of Aerospace Engineering

**Alameri, Saeed, PhD,**
Colorado School of Mines, USA, 2015; Assistant Professor of Nuclear Engineering

**Alameri, Waleed S., PhD,**
Colorado School of Mines, USA, 2015; Associate Professor of Petroleum Engineering and Assistant Vice President, Student Affairs & Outreach

**Alawadi, Khaled, PhD,**
University of Texas, Austin; Associate Professor of Civil Infrastructure and Environmental Engineering

**Alblooshi, Hanifa, PhD,**
UAE University, UAE, 2014; Assistant Professor of Chemical Engineering

**Al Ali, Khalid, PhD,**
Tokyo University of Technology, Japan, 2014; Assistant Professor of Chemical Engineering

**Al Amoodi, Nahla, PhD,**
University of Minnesota, USA, 2016; Assistant Professor of Chemical Engineering

**Al-Azzam, Anas, PhD,**
Concordia University, Montreal, Canada, 2010; Associate Professor of Mechanical Engineering

**Al-Durra, Ahmed, PhD,**
The Ohio State University, 2010; Professor in Electrical Engineering and Computer Science and Associate Provost for Research

**Al-Dweik, Arafat, PhD,**
Cleveland State University, USA, 2001; Professor of Electrical Engineering and Computer Science

**Alfantazi, Akram, PhD,**
Queen's University, Canada, 1994; Professor in Chemical Engineering.

**Al Ghaferi, Amal, PhD,**
University of Pittsburgh, USA; Associate Professor of Mechanical Engineering

**Al Hajaj, Ahmed, PhD,**
Imperial College London, 2014; Assistant Professor of Chemical Engineering

**Al Hajri, Ebrahim, PhD,**
University of Mary Land, USA, 2009, Associate Professor of Mechanical Engineering

**Alhammadi, Khalid, PhD,**
North Carolina State University, USA, 2006, Assistant Professor II of Electrical Engineering and Computer Science

**Al-Hammadi, Ali, PhD,**
Rice University, USA, 2016; Assistant Professor of Chemical Engineering

**Al-Hammadi, Yousof, PhD,**
the University of Nottingham, UK, 2010; Associate Professor of Electrical Engineering and Computer Science and Assistant Vice President, Graduate Studies

**Al Hosani, Khalifa, PhD,**
The Ohio State University, 2011; Associate Professor of Electrical Engineering and Computer Science

**Al Hseinat, Emad, PhD,**
University of Edinburgh, 2013; Assistant Professor of Chemical Engineering

**Al Jaafari, Khaled, PhD,**
Texas A&M University, US, 2016; Assistant Professor of Electrical Engineering and Computer Science

**Al Kaabi, Ahmed, PhD,**
Colorado School of Mines, USA, 2015; Assistant Professor of Nuclear Engineering

**Al-Khateeb, Ashraf, PhD,**
University of Notre Dame, USA, 2010; Assistant Professor of Aerospace Engineering

**Al Khazraji, Saeed, PhD,**
Case Western Reserve University; Associate Professor of Chemical Engineering

**Al Kobaisi, Mohammed, PhD,**
Colorado School of Mines, 2010; Assistant Professor in Petroleum Engineering

**Al Maskari, Fahad, PhD,**
University of Manchester, 2010; Assistant Professor of Aerospace Engineering and Director of Engagement under External Relations in the Office of the Executive Vice President.

**Al Mansoori, Ali, PhD,**
Imperial College London, 2006; Professor in Chemical Engineering and Associate Provost for Education

**Al Marzooqi, Faisal, PhD,**
Masdar Institute of Science and Technology, Abu Dhabi, 2015; Assistant Professor of Chemical Engineering

**Al Marzouqi, Hasan, PhD,**
Georgia Institute of Technology, 2014; Assistant Professor in Electrical Engineering and Computer Science

**Al Moosa, Nawaf, PhD,**
Georgia Institute of Technology, USA, 2014; Assistant Professor of Electrical Engineering and Computer Science

**Al-Qutayri, Mahmoud, PhD,**
University of Bath, UK, 1992; Professor of Electrical Engineering and Computer Science, Associate Provost for Academic Operations

**Al-Safar, Habiba, PhD,**
University of Western Australia, Australia, 2011; Director of Khalifa University Center for Biotechnology

**Al Salami, Yousuf, PhD,**
Khalifa University of Science and Technology; Assistant Professor of Electrical Engineering and Computer Science

**Al Sayari, Naji, PhD,**
University of Manchester, 2011; Associate Professor in Electrical Engineering and Computer Science

**Al Sawalhi, Jamal, PhD,**
Purdue University, 2014, Assistant Professor in Electrical Engineering and Computer Science

**Al Shalabi, Emad, PhD,**
University of Texas - Austin, USA, 2014, Assistant Professor of Petroleum Engineering

**Al Shehhi, Aamna, PhD,**
Masdar Institute of Science and Technology with assistance from Massachusetts Institute of Technology, UAE, 2017; Assistant Professor of Biomedical Engineering

**Al Shehhi, Maryam, PhD,**
Masdar Institute, UAE, 2017; Assistant Professor in Civil Infrastructure and Environmental Engineering

**AlShehhi, Mohamed, PhD,**
University of Maryland, USA, 2009; Associate Professor of Mechanical Engineering and Assistant Vice President, Strategic Enrollment Management

**Alshoaibi, Ahmed, PhD,**
Colorado School of Mines, USA, 2008; Associate Professor of Chemical Engineering and the Senior Vice President of Academic and Student Services in Khalifa University

**Al Shudeifat, Mohammad, PhD,**
New Mexico State University, USA, 2010, Associate Professor of Aerospace Engineering

**Al Sumaiti, Ameena, PhD,**
University Of South Florida, USA, 2015, Associate Professor of Electrical Engineering and Computer Science

**Altunaiji, Ahmed, PhD,**
Khalifa University of Science and Technology, 2014; Assistant Professor of Electrical Engineering and Computer Science

**Al Wahedi, Khaled, PhD,**
Imperial College London, 2000; Assistant Professor in Electrical Engineering and Computer Science

**Al Wahedi, Yasser, PhD,**
University of Minnesota, 2015; Assistant Professor in Chemical Engineering.

**Al Zaabi, Omar, PhD,**
Pennsylvania State University, University Park, USA; Assistant Professor of Electrical Engineering and Computer Science

**Ali, Mohamed, PhD,**
University of Michigan, 1997; Associate Professor of Mechanical Engineering

**Ali, Nazar, PhD,**
University of Bradford, UK, 1991; Associate Professor of Electrical Engineering and Computer Science

**Amer, Saed, PhD,**
Tennessee State University, 2012, Assistant Professor in Industrial and Systems Engineering.

**An, Heungjo, PhD,**
Texas A&M University, USA, 2011, Assistant Professor of Industrial and Systems Engineering

**Arafat, Hassan, PhD,**
University of Cincinnati, 2000; Professor of Chemical Engineering and Senior Director, RIC in Graphene & 2D Materials (RIC-2D)

**Arif, Muhammad, PhD,**
Curtin University, Australia, 2017; Assistant Professor in Petroleum Engineering

**Askar, Khalid, PhD,**
University of Florida, 2014; Assistant Professor of Mechanical Engineering

**Aung, Zeyar, PhD,**
National University of Singapore, Singapore, 2006, Associate Professor of Electrical Engineering and Computer Science

## B

**Banat, Fawzi, PhD,**
McGill University, University of Jordan, 1995; Professor in Chemical Engineering and Chair of Chemical Engineering.

**Barada, Hassan, PhD,**
Louisiana State University, USA, 1989; Professor and Associate Provost for Faculty Affairs

**Barkat, Braham, PhD,**
Queensland Institute of Technology, Australia, 2000; Associate Professor in Electrical Engineering and Computer Science

**Barsoum, Imad, PhD,**
Royal Institute of Technology, Sweden, 2008; Associate Professor in Mechanical Engineering.

**Beig, Balanthi, PhD,**
Indian Institute of Science, India, 2004, Associate Professor of Electrical Engineering and Computer Science

**Belhaj, Hadi, PhD,**
Dalhousie University, Halifax, 2004; Associate Professor in Petroleum Engineering.

**Berrouk, Abdallah Sofiane, PhD,**
The University of Manchester, 2007,; Associate Professor in Chemical Engineering.

**Boiko, Igor, DSc, PhD,**
Tula State University, 2009; Professor Electrical Engineering and Computer Science

**Bouabid, Ali, PhD,**
University of Virginia, 2013, Assistant Professor of Industrial and Systems Engineering.

**Bouabid, Ali, PhD,**
University of Virginia, 2013, Assistant Professor of Industrial and Systems Engineering.

**Butt, Haider, PhD,**
University of Cambridge, UK, 2012, Associate Professor of Mechanical Engineering

**Byon, Young-Ji, PhD,**
University of Toronto, Canada, 2011; Assistant Professor of Civil Infrastructure and Environmental Engineering

## C

**Calvet, Nicolas, PhD,**
Perpignan Via Domitia, 2010; Assistant Professor of Mechanical Engineering

**Cantwell, Wesley, PhD,**
Imperial College, UK, 1985, Professor of Aerospace Engineering and Associate Dean for Research

**Chan, Vincent, PhD,**
University of Pennsylvania, 1997; Professor of Chemical Engineering

**Chandrasekar, Srinivasakannan, PhD,**
Indian Institute of Technology, 1993, India; Professor in Chemical Engineering.

**Chiesa, Matteo, PhD,**
Norwegian University of Science and Technology; Professor of Mechanical Engineering.

**Cho, Chung Suk, PhD,**
University of Texas, USA, 2000; Assistant Professor of Civil Infrastructure and Environmental Engineering

**Choi, Daniel, PhD,**
University of California, USA; Associate Professor of Mechanical Engineering

## D

**Damiani, Ernesto, PhD,**
Università degli Studi di Milano, Italy, 1994; Professor of Electrical Engineering and Computer Science

**Dias, Jorge, PhD,**
University of Coimbra, Portugal, 1994; Professor of Robotics/ Electrical Engineering and Computer Science
Dumée Ludovic, PhD, Victoria University, 2012, Assistant Professor of Chemical Engineering

## E

**Elbassioni, Khaled, PhD,**
Rulgers University, USA, 2002, Professor of Electrical Engineering and Computer Science

**EL-Fouly, Tarek H.M., PhD,**
University of Waterloo, Canada, 2008; Associate Professor of Electrical Engineering and Computer Science

**El Fadel, Mutasem, PhD,**
Environmental Engineering, Stanford University 1991, Professor and Chair of Civil Infrastructure and Environmental Engineering.

**El-Khasawneh, Bashar, PhD,**
University of Illinois at Urbana-Champaign, 1998, USA; Associate Professor of Practice of Mechanical Engineering

**El-Khazali, Reyad, PhD,**
Purdue University, USA, 1992; Associate Professor of Electrical Engineering and Computer Science

**El Moursi, Mohamed, PhD,**
University of New Brunswick, 2005; Professor of Electrical Engineering and Computer Science.

**El Rich, Marwan, PhD,**
École Polytechnique de Montréal, 2005; Associate Professor of Mechanical Engineering

**Elfadel, Ibrahim, PhD,**
Massachusetts Institute of Technology, 1993; Professor of Electrical Engineering and Computer Science

**El-Sadaany, Ehab Fahmy, PhD,**
University of Waterloo, 1998, Professor in Electrical Engineering and Computer Science

**Eveloy, Valerie, PhD,**
Mechanical Engineering, Dublin City University, 2003; Associate Professor in Mechanical Engineering.

## F

**Fantino, Elena, PhD,**
Universita degli Studi di Padova; Associate Professor of Aerospace Engineering

**Foulon, Francois, PhD,**
University of Paris, France, 1989; Professor and Chair of Nuclear Engineering and Director, Emirates Nuclear Technology Center (ENTC)

## G

**Gardi, Alessandro, PhD,**
RMIT University, Australia, 2017; Assistant Professor of Aerospace Engineering

**Ghosh, Bisweswar, PhD,**
Nagpur University, India, 1995; Associate Professor in Petroleum Engineering

**Goharzadeh, Afshin, PhD,**
University of Le Havre, 2001; Associate Professor in Mechanical Engineering.

**Goonetilleke, Ravindra S., PhD,**
State University of New York at Buffalo, 1990; Professor of Industrial and Systems Engineering

**Goussis, Dimitris, PhD,**
University of California, Los Angeles, 1986; Professor of Mechanical Engineering

**Griffiths, Steven, PhD,**
Massachusetts Institute of Technology, USA, 2002, Professor of Practice of Chemical Engineering and Senior Vice President, Research and Development

## H

**Hadjileontiadis, Leontios, PhD,**
Aristotle University of Thessaloniki, Greece, 1997; Professor and Chair of of Biomedical Engineering.

**Harid, Noureddine, PhD,**
University of Wales, Cardiff UK, 1991; Associate Professor in Electrical Engineering and Computer Science

**Haroun, Mohammed, PhD,**
University of Southern California, 2009; Associate Professor in Petroleum Engineering.

**Hasan, Shadi, PhD,**
Concordia University; Associate Professor of Chemical Engineering and Director, Center for Membranes & Advanced Water Technology

**Henschel, Andreas, PhD,**
Massachusetts Institute of Technology, USA, 2010, Associate Professor of Electrical Engineering and Computer ScienceHughes, Michael, PhD, University of Wales Bangor, UK, 1995; Professor of Biomedical Engineering

**Hussain, Irfan M.A, PhD,**
University of Siena, Italy, 2017; Assistant Professor in Mechanical Engineering

## I

**Islam, Mohammed Didarul, PhD,**
University of the Ryukyus, 2007; Assistant Professor of Mechanical Engineering

## J

**Janajreh, Isam, PhD,**
Virginia Tech University; Professor of Mechanical Engineering

**Jarrar, Firas, PhD,**
University of Kentucky, 2009; Assistant Professor of Mechanical Engineering

**Javed, Sajid, PhD,**
The Kyungpook National University, Republic of Korea; Assistant Professor of Electrical Engineering and Computer Science

**Jayaraman, Raja, PhD,**
Texas Tech University, USA, 2008; Assistant Professor of Industrial and Systems Engineering

**Jelinek, Herbert, PhD,**
University of Sydney, Australia, 1996; Associate Professor in Biomedical Engineering

**Jiju, Antony, PhD,**
University of Portsmouth, England, 1997, Professor of Industrial and Systems Engineering

**Jimaa, Shihab, PhD,**
Loughborough University, UK, 1989; Associate Professor of Electrical Engineering and Computer Science

**Joon Yoon, Ho, PhD,**
KAIST, Korea, 2010; Assistant Professor of Nuclear Engineering.

## K

**Kappos, Andreas, PhD,**
Aristotle University of Thessaloniki, Greece, 1986; Professor in Civil Engineering.

**Karanikolos, Georgios, PhD,**
University at Buffalo, New York, 2005; Associate Professor in Chemical Engineering.

**Karki, Hamad, PhD,**
Tokyo University of Technology, Japan, 2008, Associate Professor of Mechanical Engineering

**Khadkikar, Vinod, PhD,**
École de technologie supérieure, 2008; Professor of Electrical Engineering and Computer Science

**Khalaf, Kinda, PhD,**
Ohio State University, USA, 1998; Associate Professor of Biomedical Engineering

**Khalil, Maryam Tariq, PhD,**
University of Minnesota, 2015, The Petroleum Institute; Assistant Professor in Chemical Engineering.

**Khan, Kamran Ahmed, PhD,**
Texas A&M University, USA, 2011; Associate Professor of Aerospace Engineering

**Khandoker, Ahsan, PhD,**
Muroran Institute of Technology, Japan, 2004; Associate Professor of Biomedical Engineering

**Khonji, Majid, PhD,**
University of Leeds, UK, 2015, Assistant Professor of Electrical Engineering and Computer Science

**Khousa, Mohammed, PhD,**
Missouri University of Science and Technology, 2009; Associate Professor of Electrical Engineering and Computer Science

**Kishida, Tadahiro, PhD,**
University of California, Davis, 2008; Assistant Professor of Civil Infrastructure and Environmental Engineering

**Kohli, Nupur,**
Aston university, UK, 2015; Assistant Professor, Biomedical Engineering

**Kong, Peng-Yong, PhD,**
National University of Singapore, Singapore, 2002; Associate Professor of Electrical Engineering and Computer Science

**Kui, Cheng Chin,PhD,**
University of New South Wales, 2011; Associate Professor of Chemical Engineering.
Kyritsis, Dimitrios, PhD Princeton University, USA, 1998, Professor and Chair of Mechanical Engineering

## L

**Lanotte, Michele, PhD,**
Politecnico di Torino, Italy, 2014, Assistant Professor of Civil Infrastructure and Environmental Engineering

**Lee, Sung Mun, PhD,**
Texas A and M University, USA, 2005; Assistant Professor of Biomedical Engineering

**Liao, Kin, PhD,**
Virginia Tech University, USA, 1995, Professor of Aerospace Engineering

**Liatsis, Panagiotis, PhD,**
University of Manchester institute of Science and Technology UK, 2002; Professor of Electrical Engineering and Computer Science.

## M

**Maalouf, Maher, PhD,**
University of Oklahoma, USA, 2009; Assistant Professor of Industrial and Systems Engineering

**Mao, Samuel Sheng, PhD,**
University of California at Berkeley, USA, 2000; Senior Director of Masdar Institute, and Professor of Practice in Mechanical Engineering

**Mayyas, Ahmad T.H, PhD,**
Clemson University, South Carolina, USA, 2012, Assistant Professor in Industrial and Systems Engineering

**Meribout, Mahmoud, PhD,**
University of Technology of Compiegne, 1994; Professor in Electrical Engineering and Computer Science

**Mezher, Toufic, PhD,**
George Washington University; Professor of Industrial and Systems Engineering and Acting Associate Dean of Undergraduate Studies

**Mittal, Vikas, PhD,**
Swiss Federal Institute of Technology, 2006; Associate Professor of Chemical Engineering

**Mizouni, Rabeb, PhD,**
Concordia University, Canada, 2007; Associate Professor of Electrical Engineering and Computer Science

**Mohammad, Baker, PhD,**
University of Texas at Austin, USA, 2008; Professor of Electrical Engineering and Computer Science

**Muhaidat, Sami,**
PhD, University of Waterloo, Canada, 2006; Professor of Electrical Engineering and Computer Science

**Mylonakis, George, PhD,**
State University of New York at Buffalo, USA, 1995, Professor of Civil
Infrastructure and Environmental Engineering

## N

**Nashef, Enas,**
PhD, University of South Carolina, 2004; Professor of Chemical Engineering

**Nayfeh, Ammar, PhD,**
Stanford University, USA, 2006; Associate Professor of Electrical Engineering and Computer Science

**Nogueira, Ricardo,**
HDR, PhD, Pierre et Marie Curie University, 2004; Professor of Chemical Engineering

## O

**Omar, Mohammed, PhD,**
University of Kentucky; Professor,Chair of Industrial and Systems Engineering and Acting Dean of College of Engineering

**Otrok, Hadi, PhD,**
Concordia University, Canada, 2008; Professor of Electrical Engineering and Computer Science

## P

**Palmisano, Giovanni,**
PhD, University of Palermo; Associate Professor of Chemical Engineering

**Parezanovic, Vladimir,**
Ecole Polytechnique – ParisTech, France, 2011; Assistant Professor of Aerospace Engineering

**Polychronopoulou, Kyriaki, PhD,**
University of Cyprus, Cyprus, 2005; Professor of Mechanical Engineering

**Pappa, Anna Maria**
Assistant Professor, Biomedical Engineering

**Puthal, Deepak, PhD,**
Faculty of Engineering and IT, University of Technology Sydney (UTS); Assistant Professor of Electrical Engineering and Computer Science

## R

**Rahman, Motiur, PhD,**
University of New South Wales, 2002; Associate Professor in Petroleum Engineering

**Raj Gupta, Abhijeet, PhD,**
University of Cambridge, 2010; Associate Professor of Chemical Engineering

**Rao, Sanjeev, PhD,**
University of Auckland, 2009; Assistant Professor of Aerospace Engineering

**Randelovic, Dragana, MSc,**
University of NIS, Serbia, 2008, Lecturer of Civil Infrastructure and Environmental Engineering

**Renda, Federico, PhD,**
Scuola Superiore Sant'Anna, Italy, 2014; Associate Professor of Mechanical Engineering

**Rodgers, Peter, PhD,**
University of Limerick, 2000; Professor in Mechanical Engineering and Acting Director, Research Laboratories.

**Rodriguez, Jorge, PhD,**
University of Santiago de Compostela, Spain, 2006; Associate Professor of Chemical Engineering

## S

**Sabatini, Roberto, PhD,**
Cranfield University, UK; Professor of Aerospace Engineering

**Saijini, Abdulrahim,**
University of Cambridge; Assistant Professor of Biomedical Engineering

**Salah, Khaled, PhD,**
Illinois Institute of Technology,USA, 2000; Professor of Electrical Engineering and Computer Science

**Saleh, Hani, PhD,**
University of Texas at Austin, USA, 2009; Professor of Electrical Engineering and Computer Science

**Sanduleanu, Mihai, PhD,**
University of Twente, 1999; Associate Professor of Electrical Engineering and Computer Science

**Sassi, Mohamed, PhD,**
University of California Berkeley, 1990; Professor of Mechanical Engineering and Chair of Petroleum Engineering

**Schiffer, Andreas, DPhil,**
University of Oxford, UK, 2014, Assistant Professor of Mechanical Engineering

**Seneviratne, Lakmal, PhD,**
Kings College, London, UK,1985; Professor and Director of Robotics Institute of Mechanical Engineering

**Sharif, Bayan, PhD,**
University of Ulster, N Ireland, 1988; Provost and Professor of Electrical Engineering and Computer Science

**Shoufan, Abdulhadi, PhD,**
Technische Universitaet Darmstadt, Germany, 2007; Associate Professor of Information Security

**Simsekler, Mecit, PhD,**
University of Cambridge, 2014; Assistant Professor of Industrial and Systems Engineering

**Singh, Shakti, PhD,**
Purdue University, USA, 2010; Senior Lecturer of Electrical Engineering and Computer Science

**Sleptchenko, Andrei, PhD,**
University of Twente, 2002; Assistant Professor of Industrial and Systems Engineering

**Sofotasios, Paschalis, PhD,**
University of Texas at Arlington; Associate Professor of Electrical Engineering and Computer Science

**Stouraitis, Athanasios, PhD,**
University of Florida, USA, 1986; Professor of Electrical Engineering and Computer Science

**Swei, Sean Shan-Min,**
PhD, Purdue University, USA, 1993; Acting Chair and Professor of Practice in Aerospace Engineering

**Svetinovic, Davor,**
PhD, Delft University of Technology, Netherlands, 2009, Associate Professor of Electrical Engineering and Computer Science

## T

**TaeYeon, Kim,**
PhD, Duke University, 2007; Assistant Professor of Civil Infrastructure and Environmental Engineering

**Taha, Kamal,**
PhD, University of Texas at Arlington, USA, 2010; Associate Professor of Electrical Engineering and Computer Science

**Tardy, Blaise, PhD,**
Assistant Professor of Chemical Engineering

## U

**Umer, Rehan, PhD,**
University of Auckland, New Zealand, 2008, Associate Professor of Aerospace Engineering

## V

**Vahdati, Nader, PhD,**
University of California Davis, 1989; Associate Professor in Mechanical Engineering.

**Van Der Merwe, Riaan,**
King Abdullah University of Science and Technology, 2014; Assistant Professor of Civil Infrastructure and Environmental Engineering

**Vega, Maria Lourdes, PhD,**
Universidad de Sevilla, 1995; Professor of Chemical Engineering and Acting Senior Director, Petroleum Institute under Research and Development

**Viegas, Jaime, PhD,**
University of Porto, 2010; Associate Professor of Electrical Engineering and Computer Science

## W

**Wang, Kean, PhD,**
University of Queensland, 1998; Associate Professor of Chemical Engineering

**Werghi, Naoufel, PhD,**
University of Strasbourg, France, 1996; Professor of Electrical Engineering and Computer Science

## Y

**Yeob Yeun, Chan, PhD,**
Royal Holloway, University of London, UK, 2000; Associate Professor of Electrical Engineering and Computer Science

**Yi, Yongsun, PhD,**
University of Notre Dame, USA, 2010, Associate Professor of Nuclear Engineering

**Yildiz, Banu Sizirici, PhD,**
Florida International University, USA 2009, Assistant Professor of Civil Infrastructure and Environmental Engineering

**Yit Fatt, Yap, PhD,**
Nanyang Technological University, 2007; Associate Professor of Mechanical Engineering

## Z

**Zahawi, Bashar, PhD,**
Newcastle University, UK, 1988; Professor of Electrical Engineering and Computer Science

**Zaki, Wael, PhD,**
Ecole Polytechnique, Paris, France, 2006; Professor of Mechanical Engineering

**Zeineldin, Hatem, PhD,**
University of Waterloo, 2006; Professor and Acting Chair of Electrical Engineering and Computer Science

**Zemerly, Mohamed-Jamal, PhD,**
University of Birmingham, UK, 1989; Associate Professor of Electrical Engineering and Computer Science

**Zhang, Tiejun, PhD,**
City University of Hong Kong, 2008; Professor of Mechanical Engineering and Acting Associate Dean of Graduate Studies

**Zheng, Lianxi, PhD in Physics,**
University of Hong Kong, China (2001); Professor of Mechanical Engineering

**Zou, Linda, PhD,**
Monash University, 1998; Professor of Civil Infrastructure and Environmental Engineering
Zweiri, Yahya, PhD, King's College London, UK, 2003; Associate Professor of Aerospace Engineering

ku.ac.ae