Undergraduate Catalog

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

Office of the Provost,

Khalifa University

Academic Calendar

Fall Semester 2023

	Date	Event Name	Type
August	21	Faculty reporting	Academic
	22-25	New student orientation	Academic
	28	Classes begin - Fall	Academic
September	1	End of add/drop for UG & PG	Academic
	22	Run Census Report	Academic
	27	Prophet Birthday	Public Holiday
October	20	Mid-Grade Due Date	Academic
	29	Makeup Day as per 4th Dec Schedule	Academic
November	3	Last Day to withdraw with “W”	Academic
	5	Makeup Day as per 5th Dec Schedule	Academic
	12	Makeup Day as per 6th Dec Schedule	Academic
	19	Makeup Day as per 7th Dec Schedule	Academic
	13-17	Advisement Period for Spring 2024	Academic
	20-24	Early Registration for Spring 2024	Academic
December	1	Commemoration Day	Public Holiday
	2	National Day	Public Holiday
	4-12	No Classes	COP28 Students Participation
	8	Last day of classes	Academic
	11	Final Exam Begin & Thesis Submission	Academic
	22	Final Exam End	Academic
	25	Final Grades Due	Academic
	25	Winter Break	Academic

Spring Semester 2024

	Date	Event Name	Type
January	8	Faculty Reporting	Academic
	9-10	New Student Orientation	Academic
	15	Classes Begin	Academic
	19	End of add/drop UG & PG	Academic
February	9	Run Census Report	Academic
March	8	Mid-Grade Due Date	Academic
	22	Last day to Withdraw with “W”	Academic
	25-29	Spring Break	Academic
April	1-5	Advisement Period for Summer/ Fall 2024	Academic
	10-12	Eid El Fitr	Public Holiday
	15-19	Early Registration Summer /Fall 2024	Academic
May	3	Last day of Classes	Academic
	6	Final Exam Begin & Thesis Submission	Academic
	16	Final Exam End	Academic
	20	Final Grades Due	Academic
June	3	Summer 2024 - Classes Begin & Internship Begin	Academic
	5	End of add/drop for UG & PG	Academic

	17-19	Eid Al Adha	Public Holiday
	21	Mid-Grade Due Date	Academic
July	1	Last day to withdraw with “W” & Run Census Report	Academic
	15	Last day of Classes	Academic
	16	Final Exams Begin	Academic
	18	Final Exams Begin	Academic
	22	Final Grades Due	Academic

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

E-Mail Directory

Alumni Services
E-mail: kualumni@ku.ac.ae

Career Services
E-mail: careerservices@ku.ac.ae

Center for Teaching and Learning
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Counseling
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Emergency
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Facilities Management
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Graduate Admissions
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Graduate Student Accommodation
E-mail: pgr.life@ku.ac.ae

Graduate Studies Office
E-mail: gso@ku.ac.ae

Human Resources
E-mail: askhr@ku.ac.ae

Information Technology (IT)
E-mail: servicedesk@ku.ac.ae

Medical Clinic and Nurse
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E-mail: nurse.auh@ku.ac.ae

Registrar's Office
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Security
Telephone: +971 2 401 8100

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E-mail: ss.helpdesk@ku.ac.ae

Student Transportation
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University-Directory

Alumni Services
E-mail: kualumni@ku.ac.ae

Career Services
E-mail: careerservices@ku.ac.ae

Center for Teaching and Learning
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Counseling
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Emergency
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Postgraduate Admissions
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Registration Office
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Student Transportation
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The University

History of Khalifa University

In 2017, UAE President and Ruler of Abu Dhabi, His Highness Sheikh Khalifa bin Zayed Al Nahyan, issued a decree to merge Khalifa University of Science, Technology and Research, Masdar Institute of Science and Technology, and The Petroleum Institute under one university called Khalifa University of Science and Technology (Khalifa University).

Khalifa University is a comprehensive research-intensive university with three colleges, three research institutes, 18 research centers, and 36 departments covering a broad range of disciplines in science, engineering, and medicine. The internationally top-ranked university is the one university in the UAE with the research and academic programs that address the entire range of strategic, scientific and industrial challenges facing the UAE's knowledge economy transformation and our rapidly evolving world.

Khalifa University's world-class faculty and state-of-the-art research facilities provide an unparalleled learning experience to students from the UAE and around the world. The university brings together the best in science, engineering and medicine in the UAE, to offer specialized degrees that can take promising high school graduates all the way to top-rated doctorate degree holders. It will continue to evolve with the UAE's rapidly developing national goals and needs and nurture the innovation ecosystem required for the country's targeted knowledge economy transformation.

The histories of the three merged institutions are integral to the vision and mission of the unified university. Khalifa University of Science, Technology and Research (KUSTAR) was inaugurated on 13 February 2007 by the President of the UAE, His Highness Sheikh Khalifa bin Zayed Al Nahyan, and had in its remit to provide Bachelor's, Master's and Doctoral-level education primarily in engineering and the sciences. The university opened its Abu Dhabi campus (now the Main Campus) in October 2008 to add to the campus in Sharjah (formerly Etisalat University College, EUC). The Sharjah branch campus, which has since closed, had a very proud history that stretched back to 1989.

The establishment of Masdar Institute of Science and Technology (MI) on 25 February 2007 as a graduate-only institute was part of a resource diversification plan for the Emirate of Abu Dhabi. Abu Dhabi's leadership views research and education in alternative energy fields as a cornerstone for the future development of the Emirate and expressed their commitment through the establishment of the Masdar Initiative, Masdar City, the Zayed Future Energy Prize (renamed Zayed Sustainability Prize), and the Masdar Institute.

The Petroleum Institute (PI) was established in 2000 through Emiri decree. Prior to the merger with KUSTAR and MI, it was financed and governed by a consortium of five major oil companies: ADNOC, Royal Dutch Shell, BP, Total S.A., and Japan Oil Development Company, a wholly owned subsidiary of INPEX. PI admitted its first students in the Fall of 2001 and offered Bachelor's and Master's programs, as well as a research program tailored to the needs of the oil and gas industry. The purpose of the PI, as part of Khalifa University, will continue to provide highly-trained engineers and geoscientists for the UAE oil, gas and broader energy industries.

University Vision and Mission Statement

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.

University Strategic Goals

As a world-class, research-intensive institution, Khalifa University 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.

Research

The KU research community responsibly manages funding, collaborations and research compliance in a manner consistent with international standards, and the mission and objectives of KU. The university provides support for the development, submission, and management of proposals and awards for both internal and external funding. KU's research priorities address specific industry and sector needs, technical platforms and expertise. These include clean and renewable energy, water and environment, hydrocarbon exploration and production, healthcare, aerospace, supply chain and logistics, advanced materials and manufacturing, robotics, AI and data science, information and communication technologies.

Licensure and Accreditation

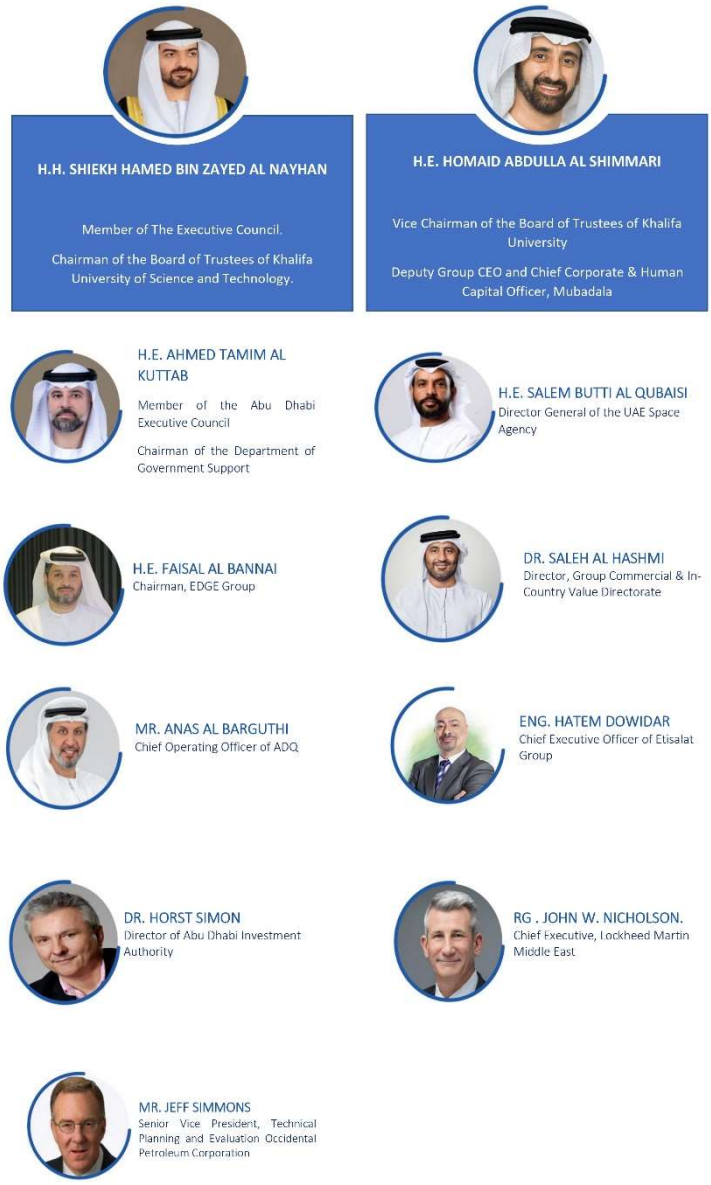
Khalifa University of Science and Technology, located in the Emirate of Abu Dhabi, is officially licensed by the Ministry of Education of the United Arab Emirates to award degrees/qualifications in higher education. All the academic programs offered by Khalifa University of Science and Technology are accredited by the Commission for Academic Accreditation (CAA) of the United Arab Emirates.

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

University Financial Resources

Khalifa University of Science and Technology is a not-for-profit, public institution. The core budget of the University is provided by the Government of the Emirate of Abu Dhabi. The University is a semi-government entity with an independent legal personality, financial and administrative independence, and full legal competence to practice its activities and achieve its objectives.

Board of Trustees



Chairman of the Board of Trustees of Khalifa University	H.H. Sheikh Hamed Bin Zayed Al Nahyan Member of the Abu Dhabi Executive Council
Vice Chairman of the Board of Trustees of Khalifa University	H.E. Homaid Abdulla Al Shimmari, Deputy Group CEO and Chief Corporate & Human Capital Officer, Mubadala
Member of the Board of Trustees of Khalifa University	H.E. Ahmed Tamim Al Kuttab, Member of the Abu Dhabi Executive Council Chairman of the Department of Government Support
Member of the Board of Trustees of Khalifa University	H.E. Salem Butti Al Qubaisi, Director General of the UAE Space Agency
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Member of the Board of Trustees of Khalifa University	Eng. Hatem Dowidar, Chief Executive Officer of Etisalat Group
Member of the Board of Trustees of Khalifa University	Dr. Horst Simon, Director of Abu Dhabi Investment Authority
Member of the Board of Trustees of Khalifa University	RG. John Nicholson, Chief Executive, Lockheed Martain Middle East
Member of the Board of Trustees of Khalifa University	Mr. Jeff Simmons, Senior Vice President, Technical Planning and Evaluation Occidental Petroleum Corporation

University Leadership

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President

Dr. Arif Sultan Al Hammadi
Executive Vice President

Dr. Bayan Sharif
Provost

Dr. Steven Wesley Griffiths
Senior Vice President, Research and Development

Dr. Ebrahim Al-Hajri
Senior Vice President, Support Services

Mr. Jalal El Jazzar
Senior Vice President, Finance and Investment

Dr. Yousof Al-Hammadi
Acting Senior Vice President, Academic and Student Services

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Vice President, Audit

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Vice President, Administration, Facilities and EHS

Mr. Esmaeel Abdulkarim Alahmed
Vice President, Procurement and Contracts

Mr. Fahem Salem Al Nuaimi
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Dr. David Sheehan
Dean of Science

Dr. Ehab El Sadaany
Acting Dean of Engineering

Dr. Senthil Kumar Rajasekaran
Acting Dean of Medicine and Health Sciences

Dr. Waleed Salem Alameri
Assistant Vice President, Student Affairs and Outreach

Dr. Mohamed Saeed Al Shehhi
Assistant Vice President, Strategic Enrollment Management

Dr. Abdulla Khaleifa Al Hefeiti
Assistant Vice President, Libraries

Dr. Ali Al Mansoori

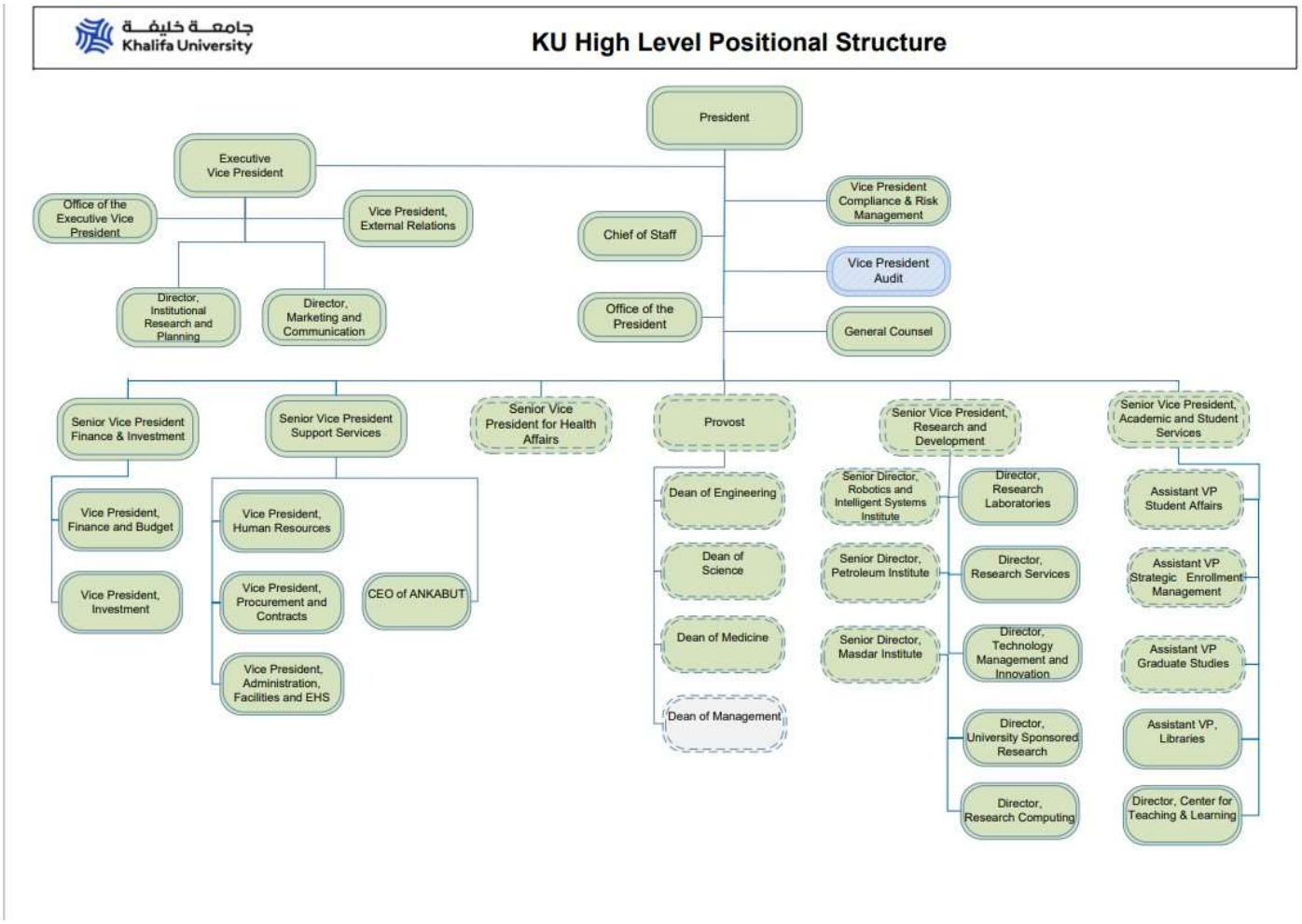
Associate Provost for Education

Dr. Hassan Barada
Associate Provost for Faculty Affairs

Dr. Mahmoud Al Qutayri
Associate Provost for Academic Operations

Dr. Ahmed Al Durra
Associate Provost for Research

Organizational Structure



University Facilities

Main Campus

Banking Services

A number of ATMs are provided on the Main Campus for the convenience of students, faculty, and staff. The ATMs are located in the G-Building and near the E-Building reception area.

Building Access After-Hours

Students may be granted building access during non-operational hours provided that a responsible University employee completes an online request form and submits it to the relevant 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 relevant Department Head and employee must approve the form. Facilities Management will reprogram the electronic lock within three days of the receipt of the request or issue a key as applicable.

Emergency Services

Emergency services are provided by the campus Security Department, which operates 24 hours daily. These services can be requested by calling 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. Rapid response is generally initiated when Security Services is contacted by staff, students or visitors by:

- Calling to the emergency line 02 312 3999
- Approaching one of the Patrolling Security on the campus
- Any lift phone
- Alarm notification, e.g. fire alarm

Environment, Health, and Safety

The University conducts periodic Environment, Health and Safety (EHS) online training / briefings, which are mandatory for students. Students are responsible for understanding the environment, health and safety training materials and instructions presented at these briefings and for acting in accordance with them. Further information is available in the Environment, Health and Safety manuals.

In an engineering university, students are expected to use instruments, equipment, and materials that are potentially hazardous. For this reason, students are required to attend mandatory environment, health, and safety laboratory inductions and orientations, and to read the Environment, Health and Safety manuals associated with all lab and workshop activities. Students will not be allowed to participate in lab or workshop activities unless they have demonstrated clear understanding of the safety procedures involved and have approved risk assessment for the activities /experiment to be performed inside the lab.

Students may not work alone in a hazardous lab or workshop and report to EHS department in case of any incident 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. Students have a responsibility to report any infringements that they witness.

Food Outlets and Retailers

The primary dining area and main restaurant are located in the Student Hub, E-Building, and offers students a comfortable place to relax between classes, do classwork, or have a lunch or coffee with friends. There are a wide variety of restaurant and food options on the Main Campus, including:

- **Main Restaurant (So Daily)** - Located in (food court) building E, Ground floor. Breakfast is served from 7:30 AM to 11:00 AM and lunch from 11:00 AM to 4:00 PM.
- **Taboon** - Located in (food court) building E, Ground floor. Arabic food restaurant.
- **House Of Tea** - Located in (food court) building E, Ground floor. Cafeteria.
- **Basil** - Located in (food court) building E, Ground floor. Italian food restaurant.
- **Starbucks -** Located in building E, Ground floor. Café.
- **Blue Mart -** Located in building E, Ground floor. Mini mart.

- **Magrudy Enterprises -** Located in building E, Ground floor. Bookstore.
- **Acai Xpress** - Located in building E, Ground floor. Acai shop.
- **Chubby Cheeks** - Located in building D, Ground floor. Nursery.
- **Green for Life** - Located in the spine between C-D, Ground floor. Healthy snacks.
- **Haagen Dazs** - Located in the spine between B-C, Ground floor. Ice cream shop.
- **Shot café** - Located in building B, Ground floor (outdoor). Café.
- **Bike Shop** - Located in building B, Ground floor (outdoor). Khalifa University Bike Shop.
- **Delimarche (Lavazza)** - Located in building A, Ground floor. Café.
- **Oriental Spa** - Located in building D, First floor gym. Female Salon.
- **Costa** - Located besides of building R. Café.
- **Bloom Room** - Located besides of building R. Flower shop & Café.
- **Low Calories** - Located in building L, Ground floor. Healthy food restaurant.
- **Sky Line** - Located in building M, Ground floor. Electronics shop for student projects.
- **Geo Car wash -** Car wash service available in Main and SAN Campus parking.

Health Services

The Main Campus Clinic is located on the ground floor of D Building. Male and female nurses provide first aid services, emergency care and can also give advice on healthy lifestyle and other related health issues. Students are required to complete a Medical Record Form giving details of their medical history and specific instructions for emergency situations. Students should inform the nurse of any medical ailments or ongoing treatment. A female nurse is on full time duty to care for female students who require emergency treatment while on campus. Minor ailments will be treated at the First Aid Clinic in private treatment rooms. Clinics are also located in the female dorm at Umm Al Lulu and female dorm Resident Hall.

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.

Nursery

The Nursery is planned to open on the Main Campus. The aim of the Nursery is to provide a warm, caring and safe environment for the small children of our students, to develop their abilities by using play and planned activities for all age ranges. We look forward to working with you and your child to ensure that their time spent at the nursery is productive and happy.

Prayer Rooms

Purpose built rooms are located across all campuses for prayers, including separate areas for wudhu ablution. Prayer rooms for male and female students are located in the R-Building, L-Building, G-Building and E-Building.

Safety and Security

The University maintains public areas that are open, well-lit and staffed by receptionists and uniformed security personnel. Although movement on the campus is free, female students are encouraged not to linger in public areas in the interest of safety. Female students may request a personal safety escort to and from any campus location, should they be on campus after dark.

Sport Facilities

All sports and fitness facilities are gender specific and provided for the use of University students with a valid student card. The facilities are strictly for the University's students, staff and faculty and all users are required to produce their ID cards if so requested by staff manning the Reception area or security. The Sports Complex in the Main Campus is located in Building D, next to the Student Hub. The state-of-the-art sports facility includes:

- Climbing wall (planned to open inside female gym)
- Squash court (located inside male gym)
- Weightlifting area (male/female sections)
- Cardio area (male/female sections)
- Stretching area
- Group exercise studios (three studios for each gender)

- Multi-use indoor fields for basketball, football, handball, volleyball, badminton, etc.
- Table tennis room
- Outdoor tennis court
- Outdoor basketball court (5 on 5)
- Outdoor running track / tracking field
- Outdoor miniature basketball court (3 on 3)

Student Lounges

Separate lounge areas are provided for male and female students. Please refer to the campus map to locate the student lounges.

Main Campus Map

Sas Al Nakhl Campus

Banking Services

A number of ATMs are provided on the SAN Campus for the convenience of students, faculty, and staff. The ATMs are located in Bu Hasa and Arzanah building.

Dining Services

ADNH (So Daily) cafeterias, open for breakfast, lunch, and snacks, are located in Habshan, and Satah Buildings. Costa café is also available in Bu Hasa and Arzanah Buildings offering coffee, breakfast, light lunch and snacks. Green for Life healthy restaurant available in building Zarkuh, Shot Café available in Ruwais building and ADNOC Oasis convenience store is located in the center of the Campus.

House Of Tea - Located in (Student Center) Satah building, Ground floor. Cafeteria.

Green for Life - Located in (Zarkuh) Building 1. Healthy snacks.

Costa - Located in (Bu Hasa) Building 2 & (Arzanah) Building 8. Café.

Shot café - Located in (Ruwais) Building 3. Café

CAF - Located in (Arzanah) Building 8. Café

Geo Car wash - Car wash service available in Main and SAN Campus parking.

Health Services

First Aid Clinics provide primary health care to the students, faculty, and staff members on the Sas Al Nakhl Campus. The Sas Al Nakhl Clinic (open to male) is open 24-hour 7 days, accident and emergency care. Depending on the nature of the illness, patients may be referred to other hospitals or clinics for further treatment and for female student's service available from 8am to 4pm Monday to Friday.

Housing

The Um Al Lulu Housing Complex at SAN Campus houses female graduate students. Each student is provided with a single bedroom, as well as a shared living room and kitchen facilities. Daily shuttle bus to Main Campus.

Prayer Rooms and Masjid

Purpose built rooms are located across all campuses for prayers, including separate areas for wudhu ablution. Prayer rooms are available in Bu Hasa, Ruwais and Arzanah as well as main Masjid behind Habshan building.

Sports and Fitness Facilities

The men's section of the campus has a grass soccer field and outdoor basketball court. The second floor of the Satah, Student Center houses a variety of fitness and weightlifting equipment and is open for use from 7:00am - 11:00pm daily. A variety of indoor and outdoor facilities is available:

- Indoor pool / billiards (Satah 2nd floor)
- Indoor table tennis (Satah 2nd floor)
- Outdoor football (2 Grass fields)
- Falcon outdoor court (basketball, volleyball and badminton)

The women's section of the campus features a gym, an outdoor volleyball and badminton court and a jogging and

circuit fitness track. Regular intramural sports tournaments are organized, including indoor soccer, basketball, volleyball and table tennis. The women's dorm has a multi-function fitness room in Tower 2, the main administrative building. Furthermore, one of the residential villas contains a variety of fitness equipment, bicycle 'spinning' room and floor exercise facilities.

Student Centers

The Student Centers are located in the Bu Hasa Building in the co-ed section and the Arzanah Building in the women's section. A number of student lounges are also available. These student-centered facilities provide a dedicated setting for social, organizational, and extracurricular activities. The Student Centers are equipped with computers, gaming tables, large flat screen televisions, etc.

Sas Al Nakhl Campus Map

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.

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 Admission Requirements

Undergraduate admission to Khalifa University is highly competitive. In order to qualify for admission, applicants 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:

1. Applicants should have graduated from High School no later than two years prior to the current year.

2. Applicants must hold a UAE High School Certificate with the following minimum averages:

- Elite **75%**,
- Advanced **80%**,
- General **90%**,
- All other curricula **75%** or its equivalent

- Applied Track applicants are not eligible for admission.

3. Aplicants must achieve the following minimum EmSAT scores, or, the below indicated Emsat Alternatives/Replacements :

- English **1400** OR IELTS (Academic) **6.0** OR TOEFL iBT **79**,
- Math **1250**, Physics **1000**,
- 1 EmSAT Elective from Chemistry or Biology **1000**,
- Computer Science **1000** (Java, C++, and Python),
- Arabic **700**.

For non-Arabic speakers, the EmSAT Arabic exam can be waived.

EmSAT Alternatives/Replacements:

	• IELTS (Academic): 6.0.
EmSAT English 1400	• TOEFL iBT: 79.
EmSAT Math 1250	• AP Math Min. score of 3 (any of the following): • Math: Calculus AB. • Math Calculus BC with AB sub-score. • Math Calculus BC. • A-Level Mathematics Minimum score of C. • IB SL or HL Mathematics Minimum score of 4.
EmSAT Physics 1000	• AP Physics Min score of 3 (any of the following): • Physics C Mechanics. • Physics C Electricity, Magnetism. • A-Level Physics Minimum score of C. • IB SL or HL Physics with Magnetism Minimum score of 4.
EmSAT Chemistry 1000	• AP Chemistry Minimum score of 3. • A-Level Chemistry Minimum score of C. • IB SL or HL Chemistry Minimum score of 4.
EmSAT Biology 1000	• AP Biology Minimum score of 3. • A-Level Biology Minimum score of C. • IB SL or HL Biology Minimum score of 4.
EmSAT Computer Science (Java, C++, or, Python) 1000	• AP Computer Science A Minimum score of 3. • A-Level Computer Science Minimum score of C. • IB SL or HL Computer Science Minimum score of 4.
EmSAT Arabic 700 (For Non-Arabic speakers: EmSAT Arabic can be waived)	-

Applicants coming from High School *Outside* the UAE:

1. Applicants 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, Biology or Chemistry, and, Computer Science.
  - SAT Math score **>= 700** (preferable)
- **British Curriculum**
  - Minimum grade of **C** in Eight IGCSE: **5 O** Subjects including Math, Physics, Biology or Chemistry, and, Computer Science; in addition to **4 AS/A** Subjects including Math, Physics, Biology or Chemistry, and, Computer Science.
- **IB Curriculum**
  - Minimum score of **4 out of 7** in all courses including Math, Physics, Biology or Chemistry, and, Computer Science.

2. In addition, applicants must provide a proof of any one of the following English language Proficiency Certificates:

IELTS (Academic) 6.0 OR TOEFL iBT 79.

Undergraduate Admissions – Types

There is one type of admission to Khalifa University for

students applying from both inside and outside the UAE: Full admission to the First Year.

KU no longer offers a Foundation year; qualifying students will be directly admitted to the First Year.

International Applicants (coming from high schools outside the UAE)

Applicants coming from High School *Outside* the UAE:

1. Applicants must provide one of the following certificates to be considered for admission:

-

American Curriculum

- Minimum score of 3 **in all 4 AP** courses including Math, Physics, Biology or Chemistry, and, Computer Science.
- SAT Math score **>= 700** (preferable)

-

British Curriculum

- Minimum grade of **C** in Eight IGCSE: **5 O** Subjects including Math, Physics, Biology or Chemistry, and, Computer Science; in addition to **4 AS/A** Subjects including Math, Physics, Biology or Chemistry, and, Computer Science.

-

IB Curriculum

- Minimum score of **4 out of 7** in all courses including Math, Physics, Biology or Chemistry, and, Computer Science.

2. Applicants must provide a proof of any one of the following **English language Proficiency Certificates**:

IELTS (Academic) **6.0, or**

TOEFL iBT **79**.

Satisfactory Entrance Interview

All 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

Undergraduate Admissions – Documents

The following documents are required as part of the undergraduate admission process:

* A filled and complete Khalifa University online application form with all necessary documents

- * An attested copy of High School Certificate/Transcript
  - - Government and Private high school students should submit a copy of their Grade 12 First Term certificate (if the final certificate is not yet issued).
  - - British System high school 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.
  - - IB System High school should submit a copy of their Grade 12 First Term certificate, or, a letter from the school stating predicted grades.
  - **IMPORTANT NOTES:** Please provide the school's grading scale (system) equivalency. All foreign and private school certificates must be

authenticated/attested and equated by the Ministry of Education in the UAE.

- * Official EmSAT Scores Certificate
- * Official TOEFL or IELTS certificates (original, plus an extra copy).* Passport
- - For UAE Nationals: front page and unified number page
- - For UAE Residents: Copy of passport name page and visa permit page
- - For International students outside the UAE: Copy of passport name page

- * Passport size photograph
- * For UAE Nationals and UAE Residents: Emirates ID (Front and Back)
- * For UAE Nationals Only: A complete copy of Khulasat Al Qaid (UAE National Family Book)

N.B: Applications with missing documents will not be accepted.

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)

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 ransfer for various exams appear below:

Math: Calculus AB	4/5	MATH 111
Math Calculus BC with AB sub-score	4/5	MATH 111
Math: Calculus BC	4/5	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 111

International Baccalaureate

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 transfer for various exams appear below:

Mathematics	5/6/7	MATH 112 via credit by examination
Physics with Magnetism	5/6/7	PHYS 122 via credit by examination
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 111and BIOL 112 via credit by examination

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

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 transfer for various exams appear below:

Mathematics	B/A	MATH 112 via credit by examination
Physics	B/A	PHYS 122 via credit by examination
Chemistry	B/A	CHEM 115
Psychology	B/A	HUMA 140
Sociology	B/A	HUMA 141
Computer Science	B/A	ENGR 112
Biology	B/A	BIOL 101 or BIOL 111and BIOL 112 via credit by examination

***Examination Policies and Procedures**

Undergraduate Admissions – Procedure

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

1. Online Application
2. Application Screening
3. Admission documents, video interview, and 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. Only complete online applications that include the grades of at least the first term of Grade 12, and the required EmSAT scores, will be considered.

2. **Application Screening**

All complete applications are screened thoroughly against Khalifa University admission requirements. All rejected applicants are notified.

3. **Admission documents and assessments**

All eligible applicants must provide supporting admission documents and submit the interview video.

4. **Application Evaluation**

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

5. **Final Decision**

The Undergraduate Admissions Committee will announce the admission decisions in an adequate time prior to the start of the semester. Each accepted applicant will be sent an official admission offer and undertaking (contract) to sign within a period 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.
- No stipend will be offered to Emirati and International students who is joining Khalifa University starting from Fall 2023.
- 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.

Scholarships for UAE National and Children of Emirati Mothers Students

Khalifa University of Science and Technology offers the following scholarships to support qualified UAE national and Children of Emirati Mothers students enrolled in undergraduate programs on a full-time basis. The University reserves the right to make changes to the published scholarship benefits and conditions without prior notice.

- Full/Partial coverage of tuition fees.
- Free University accommodation for eligible students.
- Free weekly transportation for eligible students.
- Textbooks provided by the University.

Scholarships for International Students

Khalifa University of Science and Technology offers the following scholarships to support qualified international students enrolled in undergraduate programs on a full-time basis. The University reserves the right to make changes to the published scholarship benefits and conditions without prior notice.

- The scholarship may consist of full or partial tuition assistance.
- Scholarships for international 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, international students on Tier I 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.

Tier I

- Full coverage of tuition fees.
- Textbooks provided by the University.
- Medical insurance coverage for students sponsored by Khalifa University.
- Coverage of UAE visa application fees.

To retain the Tier I scholarship (100%), student must maintain a CGPA of 3.3 on scale of 4.0. Students who do not maintain this CGPA in a semester will consequently be charged at the full rate per credit tuition fee, as below:

Status	Scholarship College of Engineering	Scholarship College of Science
International with CGPA >= 3.3	100% waiver of the tuition fees	100% waiver of the tuition fees
International with CGPA 3.0 – 3.29	75% waiver of the tuition fees	75% waiver of the tuition fees
International with CGPA 2.50 – 2.99	50% waiver of the tuition fees	50% waiver of the tuition fees
International with CGPA 2.49 – 2.0	25% waiver of the tuition fees	25% waiver of the tuition fees
International with CGPA < 2.0	0% waiver of the tuition fees	0% waiver of the tuition fees

Tier II

- Partial waiver of tuition fees.
- 75% for College of Science.
- 50% for College of Engineering.
- Textbooks provided by the University.
- Medical insurance coverage for students sponsored by Khalifa University.
- Coverage of UAE visa application fees

To retain the Tier II scholarship (50% for the College of Engineering or 75% for the College of Science), student must maintain a CGPA of 3.0 on scale of 4.0. Students who do not maintain this CGPA in a semester will consequently be charged at the full rate per credit tuition fee, as below:

Status	Scholarship College of Engineering	Scholarship College of Science
International with CGPA >= 3.0	50% of tuition fees	75% of tuition fees
International with CGPA 2.50 – 2.99	35% of tuition fees	50% of tuition fees
International with CGPA 2.0 – 2.49	20% of tuition fees	25% of tuition fees
International with CGPA < 2.0	0% of the tuition fees	0% of the tuition fees

Tier III

- Textbooks provided by the University.
- Medical insurance coverage for students sponsored by Khalifa University.
- Coverage of UAE visa application fees.

Tier III students may receive a tuition waiver if CGPA of 3.8 or above is obtained. the Percentage is provided in the below table:

Status	Scholarship College of Engineering	Scholarship College of Science
CGPA >= 3.8	20% of the tuition fees	30% of the tuition fees
CGPA < 3.8	0% of the tuition fees	0% of the 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 3.0. Students whose CGPA fall below 3.0 will be required to pay their tuition fees as per the below table:

Status	Scholarship College of	Scholarship College of
CGPA 3.0 and above	100% waiver of tuition fees	100% waiver of tuition fees
CGPA Between 2.5 and 2.99	75% waiver of tuition fees	75% waiver of tuition fees
CGPA Between 2.0 and 2.49	50% waiver of tuition fees	50% waiver of tuition fees
CGPA below 2.00	0% waiver of the tuition fees	0% waiver of the tuition fees

External Scholarships

Khalifa University, along with its partners, offers a number of selective undergraduate scholarships for its students. The goal behind allowing such scholarships is to link students to industry, support Emiratization, provide guaranteed internship opportunities, and build links with the University's research and development activities. Students are encouraged to search for their desired scholarships, taking into account that University Scholarship Office must be informed prior to signing any scholarship.

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 2023 are as follows:

Student Level	Scholarship
Undergraduate	AED 2,500 per credit

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 Science 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 Physics

The length of the undergraduate science programs ranges between 123-125 credits. These credits are divided into 45 credits of University General Education Requirements (GERs), 4 credits of College of Science Requirements (CERs), and 74-76 credits of specific Major requirements.

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 Engineering Systems and Management
- Bachelor of Science (BSc) in Mechanical Engineering
- Bachelor of Science (BSc) in Petroleum Engineering

The length of the undergraduate engineering programs ranges between 129-130 credits. These credits are divided into 45 credits of University General Education Requirements (GERs), between 19-23 credits of College of Engineering Requirements (CERs), and 61-66 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. Khalifa University will confer the bachelor's degree when the following requirements have been met:

- Successful completion of the University General Education Requirements described in this Catalog.
- Satisfactory completion of the requirements of the chosen college and degree program as described in the appropriate sections of this Catalog.
- A minimum 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 45 credits

- **English & Communication (6 credits)**

Course Code	Course Name	Credits
ENGL 101	Academic English I	3 cr.
ENGL 102	Academic English II	3 cr.

- **Grand Challenges and Student Development (7 credits)**

Course Code	Course Name	Credits
GENS101	**Grand Challenges**	4 cr.
GENS100	**Academic Development and Success**	1 cr.
GENS300	**Career Preparation**	1 cr.
GENS400	**Enhancing Employability and Job Readiness**	1 cr.

- **Mathematics & Science (16 credits)**

Course Code	Course Name	Credits
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.

- **Arabic, Islamic and U.A.E Studies (6 credits)**

Course Code	Course Name	Credits
HUMA XXX	Arabic Language and Islamic Studies Elective	3 cr.
HUMA XXX	U.A.E. Studies	3 cr.

- **Innovation, Entrepreneurship & Sustainability (3 credits)**

Course Code	Course Name	Credits
BUSS 322	Fundamentals of Innovation & Entrepreneurship	3 cr.

- **Programing (4 credits)**

Course Code	Course Name	Credits
COSC114	Intro. To Computing Using Python	4 cr.

- **Humanities or Business Studies Elective (3 credits)**

Course Code	Course Name	Credits
BUSS XXX or HUMA XXX	Business Studies or Humanities Elective	3 cr.

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 Preparation (GENS 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 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.

interested students must request to declare a minor after completing a minimum of 30 credits from the degree requirements. The student must have a minimum CGPA of 3.0 when submitting a request to declare a minor.

All courses taken to fulfill minor requirements must be

passed with a minimum grade of C.

Degree Concentration

Concentrations refer to a grouping of courses which represent a sub-specialization taken within the major field of study. A concentration at Khalifa University o 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

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

- Consulting an advisor should be 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 Science 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.

Student Registration

Orientation Program

Newly admitted students participate in an orientation program that introduces them to various aspects of the Khalifa University 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 (p. 3) 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 Khalifa University 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 (p. 29) 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

Khalifa University 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 Khalifa University consists of two regular semesters and a summer term. The two regular semesters which are referred to as the fall semester and the spring semester, consist of 15 weeks of teaching and final examinations period. The summer term lasts for five to six weeks of teaching. In the summer, a three-credit course meets 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 Khalifa University is the credit hour. It ordinarily represents one lecture hour per week for one semester. A lecture hour has a nominal duration of fifty minutes. A sequence of three laboratory hours per week or two hours of problem-solving sessions per week are considered to be the equivalent of one credit hour. Credit hours are also referred to as credits or semester credit hours.

Language of Instruction and Examination

English is the official language at Khalifa University. 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 Laboratory hours per week 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.

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.

Attendance

Khalifa University 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

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 Khalifa University 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

Khalifa University 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

Khalifa University 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.

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 ensure that administrative decisions are made, or actions taken, with fair regard for the known and legitimate interests of students.
- KU is obliged to maintain safe and suitable conditions of learning and study.
- KU is obliged 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.
- 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 Rights

Every Khalifa University 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.
- 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 regarding student records, counseling records, and personal information (see ACA 3850 Confidentiality and Privacy of Student Records).
- 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.

- Appeal an academic or financial decision or ruling, or a sanction resulting from a code of conduct violation.
- File a grievance regarding a perceived injustice without fear of negative repercussions.

Student Responsibilities

Khalifa University espouses a simple statement of student conduct which is expected of all students in the university community. This statement is as follows: “Whether engaging in university activities or engaging in their lives outside the university, students at Khalifa University are expected to show respect for order, morality, personal honor and the rights of others as is demanded of good citizens. This includes conforming to applicable laws and respecting at all times 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 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. Khalifa University expects high standards of scholarship and integrity from all members of its community. To accomplish its mission of providing an optimal educational environment and developing leaders of society, the University promotes the assumption of personal responsibility and integrity and prohibits all forms of academic dishonesty.

The purpose of education is to develop a student's ability to think logically and to express himself/ herself accurately.

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

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

Plagiarism

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, 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:

1. 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

2. 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

3. 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)

iiii. Failing the student in the relevant course

iiiii. Failing the student in all courses for the semester during which the academic misconduct has occurred

iiiiii. 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.

iiiiiii. 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.

iiiiiiii. 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.

Non-Academic Student Conduct

The Student Services Office 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 students are required to adhere to the University dress code when on campus or representing the University off-campus (see KU Policy *STL 5430 Dress Code*).

Student Code of Conduct

Every member of the Khalifa University 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

Khalifa University 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.

Campus Facilities and Services

Laboratories and Workshops

Khalifa University conducts periodic Environment, Health and Safety (EHS) briefings, and online training through Black Board system, 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 handle instruments, equipment, and materials that might be potentially hazardous. For this reason, students are required to attend the Online EHS inductions and Lab Specific 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 are not allowed to work alone in a lab or workshop 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 students, instructor and only if authorized to do so. Students have a responsibility to report any unsafe act or condition which they witness. Further information is available in the EHS manuals.

Building Access After Hours

Students may be granted building access during normal working Hours from 07:30 until 20:00

STL 5710 Campus Access for Students states:
Section 4.3.

Non-Operational Hours.

Working in a laboratory after official hours or weekends must be
recorded with the entrance security or relevant department.
Undergraduate students must be under the supervision of a member of
academic staff when working in a laboratory.

STL 5710 Campus Access for Students states:

Section 5.5.5.3.

Using the Buidling Non-Operational Hours.

All people using the building or facilities outside of normal working
hours should provide the security their exact location and contact information.

STL 5710 Campus Access for Students states:

Section 5.5.5.4.

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 for male nurses and Monday to Friday for Female nurse from 8:00 A.M to 4:00 P.M .Main campus Monday to Friday 8:00 A.M to 6:00 P.M., Residence life (Umm lulu and ADNOC School) 8:00 P.M to 4:00 A.M . 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.

COMMUNICATION OF EMERGENCY PROCEDURES TO STUDENTS

Overview of Information to be Presented

- Stress to students the importance of knowing what to do in an emergency situation that requires the building to be evacuated. Explain how they will know that emergency is in progress (alarms etc) The priority is to leave the building immediately via the nearest exit.
- A safe exit from the building requires an orderly and prompt response.
- Indicate to the students the nearest emergency exits for the area in which the class is being presented.
- Check that the students know where they are on campus.
- Indicate to the students the appropriate assembly areas for the buildings in which the subject is scheduled.
- Staff and students are not to re-enter the building until advised by building wardens (will be wearing orange vests) or security that it is safe to do so.
- Verify that any mobility impaired student is aware of the procedures to ensure their safety in the event of an evacuation. Mobility impaired persons who are in immediate danger, should be moved to a safe place in the presence of a Building Warden. The Chief Warden should be made aware of the circumstances and then communicate this to Emergency Services.

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 (p. 58).

Student Lounges

Separate lounge areas are provided for male and female students.

Sport Facilities

All sports and fitness facilities are gender specific and provided for the use of University students with a valid student card. The facilities are strictly for the University's students, staff and faculty and all users are required to produce their ID cards if so requested by staff manning the Reception area or security. The Sports Complex in the Main Campus is located in Building D, next to the Student Hub, & 2nd floor Main Campus for the Female Gym, Male gym (SAN Campus) and Um lulu Dorm, Masdar Dorm, ADNOC School Dorm. The state-of-the-art sports facility includes:

MALE GYM (MAIN CAMPUS)

- Squash court (located inside male gym)
- Weightlifting area (male)
- Cardio area (male)
- Stretching area
- Group exercise studios (three studios for each gender)
- Multi-use indoor fields for: Basketball, Volleyball, Table tennis, Badminton.
- Outdoor field such as: Tracking field, Basketball, Tennis, Cardio area

FEMALE (MAIN CAMPUS)

- Weightlifting area
- Cardio area
- Wall climbing
- Spinning room
- Aerobics room

MALE GYM (SAN CAMPUS)

- Weightlifting area
- Cardio area
- Table tennis
- Billiards
- Outdoor field : Football, Basketball, Tennis.

UM LULU DORM

- Weightlifting area
- Cardio area

MASDAR DORM

- Weightlifting area
- Cardio area

ADNOC SCHOOL DORM

- Weightlifting area
- Cardio area

Online Training Program

Goals

- To provide students with access to high quality training without having to leave their homes.

Objectives

- INCREASE Student's knowledge of fitness and exercise techniques.
- PROMOTE a healthy lifestyle among students.
- PROVIDE a platform for students to connect with professional trainers.

Deliverables

- Video Tutorials
- Live Training Sessions
- Virtual Fitness Challenges

GYM Timing

Main campus timing:

6:00am - 9:00pm (Monday to Friday)

SAN campus timing:

6:00am - 11:00pm (Monday to Sunday)

Trainer Availability:

12:00pm - 9:00 pm (Monday to Thursday)

10:00 am - 6:00 pm (Friday)

Dress code:

Sports Wears, Sports shoe

(Casual formal dress and formal shoes are not allowed)

Food and Retail Outlets

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

Main Campus:

Main Restaurant (So Daily) - Located in (food court) building E, Ground floor. Breakfast is served from 7:30 AM to 11:00 AM and lunch from 11:00 AM to 4:00 PM.

Taboon - Located in (food court) building E, Ground floor. Arabic food restaurant.

House Of Tea - Located in (food court) building E, Ground floor. Cafeteria.

Basil - Located in (food court) building E, Ground floor. Italian food restaurant.

Starbucks - Located in building E, Ground floor. Café.

Blue Mart - Located in building E, Ground floor. Mini mart.

Magrudy Enterprises - Located in building E, Ground floor. Bookstore.

Acai Xpress - Located in building E, Ground floor. Acai shop.

Chubby Cheeks - Located in building D, Ground floor. Nursery.

Green for Life - Located in the spine between C-D, Ground floor. Healthy snacks.

Haagen Dazs - Located in the spine between B-C, Ground floor. Ice cream shop.

Shot café - Located in building B, Ground floor (outdoor). Café.

Bike Shop - Located in building B, Ground floor (outdoor). Khalifa University Bike Shop.

Delimarche (Lavazza) - Located in building A, Ground floor. Café.

Oriental Spa - Located in building D, First floor gym. Female Salon.

Costa - Located beside the building R. Café.

Bloom Room - Located besides the building R. Flower shop & Café.

Low Calories - Located in building L, Ground floor. Healthy food restaurants.

Sky Line - Located in building M, Ground floor. Electronics shop for student projects.

The restaurant and food options in Khalifa University SAN Campus:

At the Sas Al Nakhl Campus the Student Center is located in Satah building, it consists of a main restaurant (So Daily) serves three meals a day and similar outlets are open in Habshan building & Arzanah building serving Breakfast & lunch.

House Of Tea - Located in (Student Center) Satah building, Ground floor. Cafeteria.

Green for Life - Located in (Zarkuh) Building 1. Healthy snacks.

Costa - Located in (Bu Hasa) Building 2 & (Arzanah) Building 8. Café.

Shot café - Located in (Ruwais) Building 3. Café

CAF - Located in (Arzanah) Building 8. Café

Sas Al Nakhl Complex :

Best Cup - Mini mart & café.

Class Café - Food Truck. Coffee and snacks.

The retail options in Um Lulu Hostel:

Blue Mart - Located in tower 2, Ground floor. Mini mart.

Velo Fitness - Located in tower 2, Ground floor. Female spa & fitness.

The Vending machines options in Khalifa University:

Massafi - served a Vending machines are located in the both campuses SAN & Main campus.

Yalla Food - provide vending machines in the both campuses SAN & Main campus and in the Umm Lulu Building and ADNOC School hostel.

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.

Video link of all retail stores in Khalifa University: https://kudrive.ku.ac.ae/oc-shib/index.php/s/Cu11XWFZ54l5Nxb .

Telecommunication Customer Services (Etisalat)

Khalifa University has opened an Etisalat kiosk in the Student Hub hall, operating from 8am to 5pm Monday through Friday, 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 students enrolled at Khalifa University should have their own visas. However, students whose studies may be interrupted due to visa problems should inform the Student Services Office of their situation. In some cases, the University may be able to assist.

Campus Map

Main Campus Map

SAN Campus Map

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 Life is committed to enriching the University's campus life by offering students an opportunity to take the initiative and assume leadership roles through student groups such as Student Council, clubs, and associations. Students are closely involved in organizing extracurricular activities, major and minor events. The aim is to promote a campus climate that enhances students' educational, physical, social, and emotional well-being and create a collaborative, caring, and participatory work environment.

Transportation Services

The University provides a range of transportation services for students:

- Daily shuttle bus service between the University campuses and Residences.
- Weekend transportation for students living in the university accommodation, subject to online registration. Transportation fees are set according to the University payment guidelines.
- Transportation to external events such as field, recreational, and ad hoc trips upon official requests by the concerned department.

Student Residences

University Residences offer an environment where students from different parts of the country and international destinations have the chance to meet and learn from one another.

Student housing (subject to availability) is available to international students and students residing outside the city of Abu Dhabi. The University offers separate residential quarters for male and female students. All housing facilities are managed by on-site staff and a security team.

Students are expected to be respectful and considerate of all different cultures, customs, and traditions.

Students are encouraged to refer to the Undergraduate Residence Guidebooks for further information.

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 at leading 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's mission and 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 seven-week Training Certificate on Leadership (Leading with Passion and knowledge)
- A series of workshops about the following topics:
    - Reflective Practice
    - Public Speaking
    - Problem Solving and Critical Thinking
    - Event Planning
    - Leadership Training for Seniors
- Grit and Growth Mindset Workshops
- Entrepreneurship & Innovation Bootcamps
- Training on the use of Blackboard (LMS) and other tools (e-Portfolio)
- A semester-long Intensive Training on Leadership

To keep students and KU community abreast of trends in digital transformation, CTL offers various activities including Hackathon, E-gaming Competition, and Musabaqat Math Competition. CTL also sponsors an annual Experiential Learning (ExL) Symposium, which offers students an opportunity to reflect on, and share about experiences inside and outside the classroom space. The ExL also offers students opportunities to assess challenges and successes, which serves to inspire their peers and other members of the academic community. To learn more about this initiative, 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

Khalifa University 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

Student Success Office

The Student Success Department provides services and resources designed to support and develop the personal, social and academic success of students. Through personalized advising and counseling, workshops, and volunteering, Student Success fosters a learner-centered experience for undergraduate students by empowering individuals to take an active role in their own learning and development.

Community Services

The Community Service Unit endeavors to raise the students' levels of consciousness in different fields of the community, and foster the spirit of cooperation and collaboration in the area of service learning. To accomplish this, all undergraduate students are required to carry out a minimum of 20 hours of Community Service per academic year, for a total of 80 hours. Students must follow this developmental graduation requirement to complete all required sections of the Community Service Plan that includes training, experiences, and volunteering engagements.

Counseling Services

Counseling services at Khalifa University are designed to help students make the most of their university experience both personally and academically. The counselors provide a trustworthy, confidential, and private atmosphere where students can share their concerns in a non-judgmental and welcoming environment. The counselors are available to support the students with academic Issues, personal difficulties, and social issues. The services are offered through individual counseling, consultation, group counseling, and workshops covering various topics catered to the needs of students. Counseling services also assist students with special needs by offering special accommodations, to ensure they have access to educational opportunities equal to their fellow students. All students are encouraged to schedule an appointment with their assigned counselor through Navigate.

Student Activities and Events

Campus life

Purposeful and planned student activities at Khalifa University 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 Khalifa University

- 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 Khalifa University. Any student who is enrolled as a student in aerospace engineering or in any graduate-level degree program is eligible for membership of the chapter.

ASCE Student 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 at Khalifa University 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:

- 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.

Student Governance

Khalifa University 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.

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 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.

General Education Unit

Khalifa University's General Education Unit (GEU) is an undergraduate curricular unit for students from all colleges, and its classes are taught by diverse faculty from across the university. The GEU provides a number of required courses that are integral to unifying students' learning experiences, instituting essential learning and career development strategies, raising their awareness of key problems in the world today, and building their skills as effective academic researchers and writers. The GEU also helps support the English language needs of undergraduate students through the Center of Teaching and Learning's Writing Center.

The GEU has four main components:

(1.) the English writing and research classes, English 101 and English 102;

(2.) the GENS courses, which include GENS 101 - Grand Challenges and the single-credit courses of GENS 100, 300, and 400, which focus on academic development, career preparation, and enhancing employability and job readiness;

(3.) introductory-level foreign language courses in languages including Chinese, Japanese, Korean, and Spanish; and

(4.) SDAS and LTCM Courses and the Preparatory Program, all of which are being phased out.

Students are typically enrolled in English 101, English 102, GENS 100 and GENS 101 in their Freshman Year and GENS 300 and GENS 400 in their junior and senior year respectively.

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 I	1 cr.

List of Faculty

A

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Omdurman Islamic University, 2007; Senior Lecturer of Social Sciences

Abbas, Manzar, PhD,

University of Chinese Academy of Science, 2017; Assistant Professor of Chemistry

Abdelhady, Ahmed, PhD,

The University of Manchester, 2011; Assistant Professor of Chemistry

Abdeljabbar, Alrazi, PhD,

University of South Florida, 2012; Associate Professor of Mathematics

Abdellah, Marwa, PhD,

University of Waterloo, 2015; Assistant Professor of Chemistry

Abderrahmane, Hamid, PhD,

Concordia University, 2009; Associate Professor of Mechanical and Nuclear Engineering

Abdul Samad, Yarjan, PhD,

Khalifa University, 2016; Assistant Professor of Aerospace Engineering

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Framingham State University, 2014; Lecturer of General Education Unit

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New Jersey Institute of Technology, 1998; Associate Professor of Physics

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University of Claude Bernard Lyon 1, 2011; Associate Professor of Chemistry

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Missouri University of Science and Technology, 2009; Associate Professor of Electrical Engineering and Computer Science

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Louisiana State University, 2004; Professor of Mechanical and Nuclear Engineering

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Technological University, 2010; Associate Professor of Management Science and Engineering

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Uppsala University, 1987; Professor of Pharmacology

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The Ohio State University, 2011; Associate Professor of Electrical Engineering and Computer Science

Al Jaafari, Khaled, PhD,

Texas A and M University, 2016; Assistant Professor of Electrical Engineering and Computer Science

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Colorado School of Mines, 2015; Assistant Professor of Mechanical and Nuclear Engineering

Al Khaleel, Mohammad, PhD,

McGill University, 2007; Associate Professor of Mathematics

Al Khazraji, Saeed, PhD,

Case Western Reserve University, 2011; Professor of Chemical and Petroleum Engineering

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Colorado School of Mines, 2010; Associate Professor of Chemical and Petroleum Engineering

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RWTH Aachen University, 2021; Senior Lecturer of Chemical and Petroleum Engineering

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Masdar Institute of Science and Technology, 2015; Associate Professor of Chemical and Petroleum Engineering

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University of Western Australia, 2011; Professor of Biomedical Engineering

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The Senate of Memorial University of New foundland, 2007; Senior Lecturer of Chemistry

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Alameri, Saeed, PhD,

Colorado School of Mines, 2015; Assistant Professor of Mechanical and Nuclear Engineering

Alameri, Waleed, PhD,

Colorado School of Mines, 2015; Associate Professor of Chemical and Petroleum Engineering

AlAwadi, Khaled, PhD,

University of Texas at Austin, 2012; Associate Professor of Civil Infrastructure and Environmental Engineering

Alazzam, Anas, PhD,

Concordia University, 2010; Associate Professor of Mechanical and Nuclear Engineering

AlBlooshi, Hanifa, PhD,

AE University, 2014; Assistant Professor of Chemical and Petroleum Engineering

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Ali, Amin, PhD,

Khartoum University, 2020; Senior Lecturer of Biology

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Ali, Mohammed, PhD,

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Ali, Nazar, PhD,

University of Bradford, 1991; Associate Professor of Electrical Engineering and Computer Science

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University of Notre Dame, 2010; Senior Lecturer of Aerospace Engineering

Allouch, Nouha, PhD,

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University College London, 2018; Senior Lecturer of Pharmacology

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Al-Sarairah, Eman, PhD,

University of Manchester, 2007; Senior Lecturer of Mathematics

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Masdar Institute of Science and Technology, 2017; Assistant Professor of Biomedical Engineering

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New Mexico State University, 2010; Associate Professor of Aerospace Engineering

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Dublin City University, 2003; Professor of Mechanical and Nuclear Engineering

Everett, Dean, PhD,

University of London, 2007; Professor of Pathology and Infectious Disease

F

Fantino, Elena, PhD,

Universita degli Studi di Padova, 2001; Associate Professor of Aerospace Engineering

Fatt, Yap, PhD,

Nanyang Technological University, 2007; Associate Professor of Mechanical and Nuclear Engineering

Fernandes, Ryan, PhD,

University of Kentucky, 1991; Associate Professor of Mathematics

Fernandez, Maria, PhD,

Universidad de Sevilla, 1995; Professor of Chemical and Petroleum Engineering

Foulon, Francois, PhD,

Universite Paris, 1990; Professor of Mechanical and Nuclear Engineering

Francis, Diana, PhD,

Sorbonne Universities Paris, 2009; Assistant Professor of

Earth Science

G

Gabor, Adriana, PhD,

University of Twente, 2002; Associate Professor of Mathematics

Gacesa, Marko, PhD,

University of Connecticut, 2010; Assistant Professor of Physics

Galadari, Abdulla, PhD,

University of Aberdeen, 2013; Associate Professor of Social Sciences

Gardi, Alessandro, PhD,

RMIT University, 2017; Assistant Professor of Aerospace Engineering

Garvey, Kevin, Masters,

University of Surrey, 1998; Lecturer of General Education Unit

Gebrehiwot, Berihu, PhD,

University of Milan, 2010; Assistant Professor of Mathematics

Ghosh, Bisweswar, PhD,

Nagpur University, 1995; Associate Professor of Chemical and Petroleum Engineering

Giaralis, Agathoklis, PhD,

Rice University, 2008; Associate Professor of Civil Infrastructure and Environmental Engineering

Gkousis, Dimitrios, PhD,

University of California, 1986; Professor of Mechanical and Nuclear Engineering

Goharzadeh, Afshin, PhD,

University of Le Havre, 2001; Associate Professor of Mechanical and Nuclear Engineering

Goonetilleke, Ravindra, PhD,

State University of New York, 1990; Professor of Management Science and Engineering

Griffiths, Steven, PhD,

Massachusetts Institute of Technology, 2002; Professor of Practice of Chemical and Petroleum Engineering

Guha, Partha, PhD,

Oxford University, 1996; Professor of Mathematics

Gupta, Vinay, PhD,

Maharshi Dayanand Saraswati University Ajmer, 1997; Assistant Professor of Physics

H

Habbal, Kheirat, PhD,

The American University of Beirut, 2012; Assistant Professor of Family Medicine

Hamdan, Hamdan, PhD,

University of Arkansas for Medical Sciences, 2012; Assistant Professor of Physiology and Immunology

Harid, Noureddine, PhD,

University of Wales, 1991; Associate Professor of Electrical Engineering and Computer Science

Haroun, Mohamed, PhD,

University of Southern California, 2009; Associate Professor of Chemical and Petroleum Engineering

Hasan, Shadi, PhD,

Concordia University, 2011; Associate Professor of Chemical and Petroleum Engineering

Hasheem, Nabee, Masters,

Bangalore University, 1983; Senior Lecturer of Physics

Hassan, Jamal, PhD,

University of Waterloo, 2006; Associate Professor of Physics

Hassan, Shabir, PhD,

Zurich University, 2015; Assistant Professor of Biology

Hassen, Halah, Masters,

Mount Sinai School of Medicine, 1995; Associate Professor of Practice of Medicine

Hatzikirou, Haralampos, PhD,

Tu Dresden, 2009; Associate Professor of Mathematics

Henschel, Andreas, PhD,

Massachusetts Institute of Technology, 2010; Associate Professor of Electrical Engineering and Computer Science

Hjouj, Fawaz, PhD,

SIUC, 2013; Senior Lecturer of Mathematics

Hughes, Michael, PhD,

University of Wales, 1995; Professor of Biomedical Engineering

Hussain, Irfan, PhD,

University of Siena, 2016; Assistant Professor of Mechanical and Nuclear Engineering

I

Ibrahim, Saleh, PhD,

University of Helsinki, 1993; Professor of Physiology and Immunology

Islam, MD Didarul, PhD,

University of the Ryukyus, 2007; Associate Professor of Mechanical and Nuclear Engineering

J

James, Joann, PhD,

University of Bath, 2021; Senior Lecturer of General Education Unit

Janajreh, Isam, PhD,

Virginia Tech University, 1998; Professor of Mechanical and Nuclear Engineering

Javed, Sajid, PhD,

Kyungpook National University, 2017; Assistant Professor of Electrical Engineering and Computer Science

Jayaraman, Raja, PhD,

Texas Tech University, 2008; Associate Professor of Management Science and Engineering

Jelinek, Herbert, PhD,

University of Sydney, 2019; Associate Professor of Biomedical Engineering

Jimaa, Shihab, PhD,

Loughborough University, 1989; Associate Professor of Electrical Engineering and Computer Science

Jouini, Mohamed, PhD,

University of Bordeaux, 2009; Associate Professor of Mathematics

Junior, Mauro, PhD,

University of Arizona, 1992; Professor of Physics

K

Kappos, Andreas, PhD,

Aristotle University of Thessaloniki, 1986; Professor of Civil Infrastructure and Environmental Engineering

Karki, Hamad, PhD,

Tokyo University of Technology, 2008; Associate Professor of Mechanical and Nuclear Engineering

Kashir, Junaid, PhD,

Oxford University, 2012; Associate Professor of Biology

Khadkikar, Vinod, PhD,

École de technologie supérieure, 2008; Professor of Electrical Engineering and Computer Science

Khalaf, Kinda, PhD,

Ohio State University, 1998; Associate Professor of Biomedical Engineering

Khaleel, Maryam, PhD,

University of Minnesota, 2015; Assistant Professor of Chemical and Petroleum Engineering

Khalfan, Malik, PhD,

Loughborough University, 2001; Associate Professor of Management Science and Engineering

Khamsi, Mohamed, PhD,

University of Paris 6, 1987; Professor of Mathematics

Khan, Kamran, PhD,

Texas A and M University, 2011; Associate Professor of Aerospace Engineering

Khandoker, Ahsan, PhD,

Muroran Institute of Technology, 2004; Professor of Biomedical Engineering

Khonji, Majid, PhD,

University of Leeds, 2015; Assistant Professor of Electrical Engineering and Computer Science

Khraibi, Ali, PhD,

University of Mississippi, 1984; Professor of Physiology and Immunology

Kim, Jang, PhD,

University of Sydney, 1991; Professor of Mechanical and Nuclear Engineering

Kim, Nam Woon, PhD,

Texas University, 1993; Professor of Management Science and Engineering

Kim, Tae, PhD,

Duke University, 2007; Associate Professor of Civil Infrastructure and Environmental Engineering

Kirane, Mokhtar, PhD,

Pierre and Marie Curie University, 1983; Professor of Mathematics

Kishida, Tadahiro, PhD,

University of California, 2008; Associate Professor of Civil Infrastructure and Environmental Engineering

Kitapbayev, Yerkin, PhD,

The University of Manchester, 2014; Assistant Professor of Mathematics

Kohli, Nupur, PhD,

Aston University, 2015; Assistant Professor of Biomedical Engineering

Kourakis, Ioannis, PhD,

Universite Libre de Bruxelles Belgium, 2002; Professor of Mathematics

Koyi, Hemin, PhD,

Upsala University, 1989; Professor of Earth Science

Kui, Cheng, PhD,

The University of New South Wales, 2011; Associate Professor of Chemical and Petroleum Engineering

Kusmartsev, Fedor, PhD,

Landau Institute for Theoretical Physics, 1983; Professor of Physics

Kyritsis, Dimitrios, PhD,

Princeton University, 1998; Professor of Mechanical and Nuclear Engineering

L

Laadhari, Aymen, PhD,

University of Grenoble, 2011; Assistant Professor of Mathematics

Lee, Sung, PhD,

Texas A and M University, 2005; Associate Professor of Biomedical Engineering

Lehtonen, Erkko, Masters,

Tampere University of Technology, 1998; Assistant Professor of Mathematics

Liao, Kin, PhD,

Uni. of Illinois at Urbana, 1998; Professor of Aerospace Engineering

Liatsis, Panagiotis, PhD,

University of Manchester, 2002; Professor of Electrical Engineering and Computer Science

Loke, Show Pau, PhD,

UNIVERSITY PUTRA MALAYSIA, 2012; Professor of Chemical and Petroleum Engineering

Luckachan, Gisha, PhD,

Cochin University of Science and Technology (CUSAT), 2006; Lecturer of Chemistry

M

Maalej, Nabil, PhD,

University of Wisconsin - Madison, 1994; Associate Professor of Physics

Maalouf, Maher, PhD,

University of Oklahoma, 2009; Associate Professor of Management Science and Engineering

Mao, Samuel, PhD,

University of California, 2000; Professor of Practice of Mechanical and Nuclear Engineering

Martin, Neville, Masters,

Newcastle Upon Tyne Polytechnic, 1984; Lecturer of Mathematics

Mayyas, Ahmad, PhD,

Clemson University, 2012; Assistant Professor of Management Science and Engineering

Meribout, Mahmoud, PhD,

University of Technology of Compiegne, 1994; Professor of Electrical Engineering and Computer Science

Mettu, Srinivas, PhD,

Lehigh University, 2012; Assistant Professor of Chemical and Petroleum Engineering

Mezher, Toufic, PhD,

George Washington University, 1992; Professor of Management Science and Engineering

Mizouni, Rabeb, PhD,

Concordia University, 2007; Associate Professor of Electrical Engineering and Computer Science

Mohamad, Akbar, PhD,

IIT Madras, 2011; Assistant Professor of Chemistry

Mohamed, Sharmarke, PhD,

University College London, 2011; Associate Professor of Chemistry

Mohammad, Baker, PhD,

University of Texas at Austin, 2008; Professor of Electrical Engineering and Computer Science

Mohideen, Mohamed, PhD,

University of St.Andrews, 2011; Assistant Professor of Chemistry

Moran, Valentine, Masters,

Heriot-Watt University, 2001; Senior Lecturer of Management Science and Engineering

Moreeno, Mariam, Masters,

Marquette University, 1984; Lecturer of Mathematics

Mughrabi, Asma, Masters,

University of JO, 2005; Senior Lecturer of Mathematics

Muhaidat, Sami, PhD,

University of Waterloo, 2006; Professor of Electrical Engineering and Computer Science

Muschert, Glenn, PhD,

University of Colorado, 2002; Professor of Social Sciences

Mylonakis, George, PhD,

State University of New York at Buffalo, 1995; Professor of Civil Infrastructure and Environmental Engineering

N

Nader, Moni, PhD,

University of Sherbrooke, 2005; Associate Professor of Physiology and Immunology

Nashef, Enas, PhD,

University of South Carolina, 2004; Professor of Chemical and Petroleum Engineering

Nayfeh, Ammar, PhD,

Stanford University, 2006; Associate Professor of Electrical Engineering and Computer Science

Nogueira, Ricardo, PhD,

Pierre et Marie Curie University, 2004; Professor of Chemical and Petroleum Engineering

Nwayhed, Nadia, Masters,

The American Unviersity of Beirut, 2008; Lecturer of Mathematics

O

Okorie, Idika, PhD,

University of Manchester, 2020; Senior Lecturer of Mathematics

Omar, Mohammad, PhD,

University of Kentucky, 2004; Professor of Management Science and Engineering

Osman, Wael, PhD,

Tokyo University, 2014; Assistant Professor of Biology

Ossa, Frantz, PhD,

University of Poitiers, 2010; Assistant Professor of Earth Science

O'Sullivan, Siobhan, PhD,

University College Cork, 2000; Assistant Professor of Molecular Biology and Genetics

Otrok, Hadi, PhD,

Concordia University, 2008; Professor of Electrical Engineering and Computer Science

Oueis, Emilia, PhD,

University of Rouven, 2013; Assistant Professor of Chemistry

Oulhaj, Abderrahim, PhD,

Universite Catholique De Louvain, 2003; Associate Professor of Epidemiology & Public Health

P

Palmisano, Giovanni, PhD,

University of Palermo, 2008; Professor of Chemical and Petroleum Engineering

Pappa, Anna-Maria, PhD,

Ecole des Mines de St. Etienne, 2017; Assistant Professor of Biomedical Engineering

Parezanovic, Vladimir, PhD,

Ecole Polytechnique – ParisTech, 2011; Assistant Professor of Aerospace Engineering

Passamani Zubelli, Jorge, PhD,

University of California, 1989; Professor of Mathematics

Patole, Shashikant, PhD,

Sungkyunkwan University, 2010; Associate Professor of Physics

Pitsalidis, Charalampos, PhD,

Aristotle University of Thessaloniki, 2014; Assistant Professor of Physics

Polychronopoulou, Kyriaki, PhD,

University of Cyprus, 2005; Professor of Mechanical and Nuclear Engineering

Porcu, Emilio, PhD,

Trinity College, 2004; Professor of Mathematics

Puthal, Deepak, PhD,

University of Technology Sydney, 2017; Assistant Professor of Electrical Engineering and Computer Science

Q

Qattan, Issam, PhD,

Northwestern University, 2005; Associate Professor of Physics

Qurashi, Ahsan, PhD,

Chonbuk National University Jeonju, 2008; Associate Professor of Chemistry

R

Rahman, MD, PhD,

The University of New South Wales, 2002; Associate Professor of Chemical and Petroleum Engineering

Rahmani, Mohamed, PhD,

Universite Paris 7 Denis Diderot, 1999; Professor of Molecular Biology and Genetics

Rai, Muhammad, PhD,

Free University of Berlin, 2008; Assistant Professor of Anatomy and Cellular Biology

Raja, Aamir, PhD,

University of Canterbury, 2013; Assistant Professor of Physics

Rajasekaran, Senthil, PhD,

Sri Ramachandra Medical College, 2004; Professor of Medicine

Randelovic, Dragana, PhD,

University of NIS, 2008; Lecturer of Civil Infrastructure and Environmental Engineering

Rao, Sanjeev, PhD,

University of Auckland, 2009; Assistant Professor of Aerospace Engineering

Renda, Federico, PhD,

Scuola Superiore Sant'Anna, 2014; Associate Professor of Mechanical and Nuclear Engineering

Rezeq, Moh'D, PhD,

University of Ottawa, 2002; Associate Professor of Physics

Riahi, Mohamed, PhD,

Pierre et Marie Curie University, 2012; Assistant Professor of Mathematics

Richards, Selena, PhD,

University of Hull, 2008; Assistant Professor of Chemistry

Rios Torres, Ramon, PhD,

University of Barcelona, 2000; Professor of Chemistry

Rodriguez, Jorge, PhD,

University of Santiago de Compostela, 2006; Associate Professor of Chemical and Petroleum Engineering

Rossiter, Ashley, PhD,

University of Exeter, 2014; Associate Professor of Social Sciences

S

Sabatini, Roberto, PhD,

University of Nottingham, 2017; Professor of Aerospace Engineering

Sajini, Abdulrahim, PhD,

University of Cambridge, 2016; Assistant Professor of Biomedical Engineering

Sakhnini, Mohammad, PhD,

University of Exerter, 2014; Senior Lecturer of General Education Unit

Salah, Khaled, PhD,

Illinois Institute of Technology, 2000; Professor of Electrical Engineering and Computer Science

Saleh, Hani, PhD,

University of Texas at Austin, 2009; Associate Professor of Electrical Engineering and Computer Science

Sanduleanu, Mihai, PhD,

University of Twente, 1999; Associate Professor of Electrical Engineering and Computer Science

Schiffer, Andreas, PhD,

University of Oxford, 2014; Associate Professor of Mechanical and Nuclear Engineering

Seghier, Mohamed, PhD,

Joseph fourier University of Grenoble, 2000; Professor of Biomedical Engineering

Semiz, Sabina, PhD,

The University of British Columbia, 2001; Professor of Molecular Biology and Genetics

Seneviratne, Seneviratne, PhD,

Virginia Tech, 1994; Professor of Mechanical and Nuclear Engineering

Sengodan, Sivaprakash, PhD,

Ulsan National Institute of Science and Technology, 2015; Assistant Professor of Mechanical and Nuclear Engineering

Shakfa, Mohammad, PhD,

Technische University Braunschweig, 2015; Assistant Professor of Physics

Shanti, Aya, Masters,

Khalifa University, 2019; Lecturer of Biology

Sharif, Bayan, PhD,

University of Ulster, 1988; Professor of Electrical Engineering and Computer Science

Shariff, Mohd, PhD,

University of Newcastle Upon Tyne, 1985; Professor of Mathematics

Shaya, Janah, PhD,

University De Nice, 2016; Assistant Professor of Chemistry

Sheehan, David, PhD,

Trinity College Dublin, 1985; Professor of Chemistry

Shetty, Dinesh, PhD,

Seoul National University, 2011; Assistant Professor of Chemistry

Shoufan, Abdulhadi, PhD,

Technische Universitaet Darmstadt, 2007; Associate Professor of Electrical Engineering and Computer Science

Sim, Li-Chen, PhD,

University of Oxford, 2005; Assistant Professor of Social Sciences

Simsekler, Mecit, PhD,

University of Cambridge, 2014; Associate Professor of Management Science and Engineering

Singh, Nirpendra, PhD,

INn Institute of Technology Roorkee, 2007; Assistant Professor of Physics

Singh, Shakti, PhD,

Purdue University, 2010; Senior Lecturer of Electrical Engineering and Computer Science

Siraki, Arby Ted, PhD,

University of Ottawa, 2013; Assistant Professor of General Education Unit

Sleptchenko, Andrei, PhD,

University of Twente, 2002; Associate Professor of Management Science and Engineering

Sofotasios, Paschalis, PhD,

University of Leeds, 2011; Associate Professor of Electrical Engineering and Computer Science

Steuber, Thomas, PhD,

University of Cologne, 1989; Professor of Earth Science

Stitou, Samira, Masters,

University of Toronto, 1998; Lecturer of Mathematics

Stouraitis, Athanasios, PhD,

University of Florida, 1986; Professor of Electrical Engineering and Computer Science

Subhi, Enaam, Masters,

INna University, 2002; Senior Lecturer of General Education Unit

Subhiyyah, Hazim, Masters,

Northeastern University, 1999; Senior Lecturer of Physics

Susanto, Hadi, PhD,

University of Twente, 2006; Professor of Mathematics

Svetinovic, Davor, PhD,

Delft University of Technology, 2009; Associate Professor of Electrical Engineering and Computer Science

Swei, Sean, PhD,

Purdue University, 1993; Professor of Practice of Aerospace Engineering

T

Taha, Kamal, PhD,

University of Texas at Arlington, 2010; Associate Professor of Electrical Engineering and Computer Science

Tajdin, Mustapha, PhD,

University of al-Qarawiyyin, 2000; Assistant Professor of Social Sciences

Tardy, Blaise, PhD,

The University of Melbourne, 2015; Assistant Professor of Chemical and Petroleum Engineering

Temouri, Yama, PhD,

Aston University, 2008; Associate Professor of Management Science and Engineering

Thoudam, Satyendra, PhD,

Radboud University, 2012; Assistant Professor of Physics

U

Umar, Abdullahi, PhD,

University of St.Andrews, 1992; Professor of Mathematics

Umer, Rehan, PhD,

University of Auckland, 2009; Professor of Aerospace Engineering

V

Vahdati, Nader, PhD,

University of California Davis, 1989; Associate Professor of Mechanical and Nuclear Engineering

Van Vliet, Arjen, PhD,

Universitat Hamburg, 2014; Assistant Professor of Physics

Viegas, Jaime, PhD,

University of Porto, 2010; Associate Professor of Electrical Engineering and Computer Science

Werghi, Naoufel, PhD,

University of Strasbourg, 1996; Professor of Electrical Engineering and Computer Science

Wijeweera, Albert, PhD,

University of Tennessee, 2004; Associate Professor of Management Science and Engineering

Wollenberg, Alexander, PhD,

National University of Singapore, 2011; Assistant Professor of Management Science and Engineering

Y

Yates, Athol, PhD,

The Australian National University, 2011; Associate Professor of Social Sciences

Yeun, Chan, PhD,

University of London, 2000; Associate Professor of Electrical Engineering and Computer Science

Yildiz, Ibrahim, PhD,

University of Miami, 2008; Associate Professor of Chemistry

Yong, Kong, PhD,

National University of Singapore, 2002; Associate Professor of Electrical Engineering and Computer Science

Young, David, Masters,

University of Limerick, 2001; Senior Lecturer of General Education Unit

Yousef, Ahmed, PhD,

University of Western Ontario, 2009; Associate Professor of Biology

Z

Zahawi, Bashar, PhD,

Newcastle University, 1988; Professor of Electrical Engineering and Computer Science

Zaki, Wael, PhD,

Ecole Polytechnique, 2006; Professor of Mechanical and Nuclear Engineering

Zalloua, Pierre A., PhD,

University of California, 1996; Professor of Molecular Biology and Genetics

Zein El din, Hatem, PhD,

University of Waterloo, 2006; Professor of Electrical Engineering and Computer Science

Zemerly, Mohamed, PhD,

University of Birmingham, 1989; Associate Professor of Electrical Engineering and Computer Science

Zhang, Tiejun, PhD,

City University of Hong Kong, 2008; Professor of Mechanical and Nuclear Engineering

Zhao, Ruikun, PhD,

University of East Anglia, 2013; Senior Lecturer of Chemistry

Zheng, Lianxi, PhD,

University of Hong Kong, 2001; Professor of Mechanical and Nuclear Engineering

Zhou, Bing, PhD,

University of Adelaide, 1998; Associate Professor of Earth Science

Zikkos, Elias, PhD,

University of Cyprus, 2005; Senior Lecturer of Mathematics

Zou, Linda, PhD,

Monash University, 1998; Professor of Civil Infrastructure and Environmental Engineering

Zweiri, Yahya, PhD,

University of London, 2003; Professor of Aerospace Engineering

Programs-of-Study

College of Science

The College of Science 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 center of educational excellence for the region and the world.

College Undergraduate Degree Programs

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

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

The length of these undergraduate programs ranges between 123 and 125 credits. These credits are divided into 45 credits of University General Education Requirements (GERs), 4 credits of College Requirements and between 74 to 76 credits for specific Major Requirements.

College Undergraduate Minors

Currently, there is one minor offered by the College of Science. Additional minor degrees are planned and will be offered by the College in the near future. The currently available minor degree is:

- Minor in Mathematics

College Requirements

All the college of Science programs have to complete the following courses. The total required hours for most degrees are 4 credits with the exception of the Earth and Planetary Sciences program where the internship is 4 credits.

SCIE 202 Data Science and AI for Scientists (3 credits)

XXXX 399 Internship / EPSS 397 (1 or 4 credits)

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

Bachelor of Science in Chemistry Requirements

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 a 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. Five specialized 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 allow students to develop advanced skills in organic chemistry that are relevant to applications in the pharmaceutical and biomedical industries.
- The **Pre-Med** 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 destinations within the UAE and the Gulf region encompass quality control, analytical and technical roles, education, consultancy, as well as research and development (R&D) roles. 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:

1. Have specialized knowledge of the major sub-disciplines within chemistry, and the capacity to apply that knowledge in a professional context.
2. Have a broad understanding of the sciences, mathematics and other disciplines relevant to chemistry and be able to integrate that knowledge to solve problems.

3. Be able to efficiently search for, retrieve and critically evaluate technical literature and data.
4. Be able to design and implement laboratory or computational experiments, analyse the resulting data, and apply appropriate safety measures.
5. Be able to use the scientific method, apply critical thinking and reason analytically to solve chemical problems and conduct research.
6. Be able to communicate effectively in oral or written form, to a range of scientific and non-scientific audiences.
7. Be able to work productively in multidisciplinary teams to solve problems, debate different points of view, and exercise self-reflection following professional norms.
8. 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 125 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, 45 credits), College Requirements (4 credits), Chemistry Core Requirements (59 credits), Science Electives (11 credits), and Free Electives (6 credits) .

Chemistry Core Requirements (59 Credits)

CHEM 116	General Chemistry II	4
CHEM 201	Quantitative Methods in Physical Sciences	3
CHEM 206	Chemical Safety and Research Skills	3
CHEM 221	Organic Chemistry I	4
CHEM 322	Organic Chemistry II	4
CHEM 231	Physical Chemistry I	4
CHEM 332	Physical Chemistry II	4
CHEM 251	Inorganic Chemistry	4
CHEM 352	Inorganic Chemistry II	4
CHEM 331	Introduction to Computational Chemistry	3
CHEM 311	Biochemistry	4
CHEM 241	Introduction to Analytical Chemistry	4
CHEM 342	Modern Techniques for Chemical Analysis	4
CHEM 343	Advanced Instrumental Analysis Techniques in Chemistry	4
CHEM 497	Senior Research Project I	3
CHEM 498	Senior Research Project II	3

Chemistry Technical Elective Requirements (11 credits)

The BSc Chemistry program has five tracks: (i) Environmental Chemistry, (ii) Forensic Chemistry, (iii) Materials Chemistry, (iv) Medicinal Chemistry and (v) Pre-Med. Each of these tracks requires a certain set of courses (termed "Science Electives") that students are expected to complete, totalling 11 credits.

A complete list of the Science Elective courses is given below.

BIOL 312	Biochemistry II	3
CHEM 423	Introduction to Medicinal Chemistry	4
CHEM 424	Synthesis of Medicinal Compounds	4
CHEM 461	Environmental Chemistry	4
CHEM 462	Pollution Science and Control - Management, Technology and Regulations	4
CHEM 463	Methods for Environmental Trace Analysis	4
CHEM 471	Fundamentals of Forensic Science	3
CHEM 472	Forensic Chemistry and Evidence Analysis	4
CHEM 473	Fundamentals of Forensic Toxicology	
CHEM 481	Materials Chemistry	4
CHEM 482	Nanochemistry	4
CHEM 483	Polymer Chemistry	4
BIOL 111	General Biology I	3
BIOL 112	General Biology II	4
PHYS 122	University Physics II	4
CHEM 377	Undergraduate Research	3
	Or	
CHEM 477	Undergraduate Research	3

Chemistry BSc Tracks

Chemistry students select one of five available tracks as described above. These tracks are provided as a means for

chemistry students to specialize in a particular area of Chemistry (e.g. Forensic Chemistry) beyond the knowledge gained in the core curriculum. In the case of the Pre-med track, the Science Electives have been chosen to fulfill KU requirements for enrolling on the MD program. The following courses are approved by the Chemistry Department for each track. Note that at most 4 credits of Science Electives may be satisfied from a different track following departmental approval. In special circumstances, a student may also be allowed to satisfy at most 4 credits of Science Electives via alternative advanced chemistry free elective topics (where they exist) subject to departmental approval.

Environmental Chemistry Track (11 credits)

CHEM 461	Environmental Chemistry	4
CHEM 462	Pollution Science and Control - Management, Technology and Regulations	4
CHEM 463	Methods for Environmental Trace Analysis	4

Forensic Chemistry Track (11 credits)

CHEM 471	Fundamentals of Forensic Science	3
CHEM 472	Forensic Chemistry and Evidence Analysis	4
CHEM 473	Fundamentals of Forensic Toxicology	

Medicinal Chemistry Track (11 credits)

BIOL 312	Biochemistry II	3
CHEM 423	Introduction to Medicinal Chemistry	4
CHEM 424	Synthesis of Medicinal Compounds	4

Pre-Med-Track (11-credits)

BIOL 111	General Biology I	3
BIOL 112	General Biology II	4
PHYS 122	University Physics II	4

Typical Course Sequence for a BSc degree in Chemistry

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1
GENS 101	Grand Challenges	4

Spring Semester

ENGL 102	Academic English II	3
PHYS 121	University Physics I	4
MATH 112	Calculus II	4
CHEM 116	General Chemistry II	4

Summer Semester

	Free Elective	3

Year 2

Fall Semester

CHEM 201	Quantitative Methods in Physical Sciences	3
CHEM 206	Chemical Safety and Research Skills	3
CHEM 251	Inorganic Chemistry	4
COSC 114	Introduction to Computing Using Python	4

Spring Semester

SCIE 202	Data Science & AI for Scientists	3
CHEM 221	Organic Chemistry I	4
CHEM 231	Physical Chemistry I	4
CHEM 241	Introduction to Analytical Chemistry	4

Year 3

Fall Semester

CHEM 331	Introduction to Computational Chemistry	3
CHEM 322	Organic Chemistry II	4
CHEM 332	Physical Chemistry II	4
CHEM 342	Modern Techniques for Chemical Analysis	4

Spring Semester

CHEM 311	Biochemistry	4
CHEM 343	Advanced Instrumental Analysis Techniques in Chemistry	4
CHEM 352	Inorganic Chemistry II	4
	Free Elective	3
GENS 300	Career Preparation	1

Summer Semester

CHEM 399	Internship	1

Year 4

Fall Semester		
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
HUMA XXX	UAE Studies Elective	3
HUMA 108	Arabic and Islamic Heritage	3
CHEM 497	Senior Research Project I	3
	Science Elective	3
Spring Semester		
BUSS XXX	Business Studies Elective	3
CHEM 498	Senior Research Project II	3
	Science Elective	4
	Science Elective	4
GENS 400	Enhancing Employability and Job Readiness	1

Subtotal: 125

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 hosts the BSc in Cell and Molecular Biology (CAMB) degree program and graduate programs (combined MSc/PhD and PhD) in Molecular Life Sciences. The BSc program will graduate highly qualified future scientists and leaders in the life sciences field that can either start their careers directly or continue their education as graduate students in the Department's PhD program. Importantly, the BSc CAMB program is designed such that all graduates complete all the courses required to apply to Khalifa University's MD program, in the College of Medicine and Health Sciences.

Furthermore, the Department of Biology aims to be a strategic partner and interdisciplinary bridge between the College of Engineering, the College of Medicine and Health Sciences and the College of Science to enable excellence in life science research and lead key research activities at KU. The department will also offer collaborative opportunities (faculty and resources) to carry out innovative research and work closely with Khalifa University's Research Centers.

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

Bachelor of Science in Cell and Molecular Biology Requirements

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 who can use their scientific knowledge to solve problems in life sciences and to effectively communicate with various stakeholders.

Program Educational Objectives

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

- Exhibit substantial knowledge of various aspects of

Cell and Molecular Biology including Chemistry, Mathematics, and Physics.

- Demonstrate strong abilities for problem-solving, teamwork, and effective communication.
- Be competent in various professional and transferable skills to have a successful career in industry, graduate school, or medical school.
- 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 125 credit hours in 8 semesters (and 1 summer term).

The 125 credit hours are divided into:

- 45 credit hours of University General Education requirements (GER)
- 4 credit hours of the College of Science requirements (3 credit hours for SCIE 202 Data Science and Artificial Intelligence for Scientists + 1 credit hour for the Internship)
- 76 credit hours of specific major requirements, as follows: (23 credit hours of Chemistry/Mathematics /Physics Requirements, 47 credit hours of Biology Core Requirements, and 6 credit hours of Humanities Electives).

Chemistry/Mathematics/Physics Requirements (23 credit hours)

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
CHEM 211	Fundamentals of Organic Chemistry	4
CHEM 241	Introduction to Analytical Chemistry	4
CHEM 311	Biochemistry	4
MATH 252	Introduction to Applied Statistics	3
PHYS 122	University Physics II	4

Biology Core Requirements (47 credit hours)

BIOL 111	General Biology I	3
BIOL 112	General Biology II	4
BIOL 211	General Genetics	4
BIOL 221	Applied Microbiology	4
BIOL 301	Cell Biology	3
BIOL 312	Biochemistry II	3
BIOL 331	Physiology	3
BIOL 335	Developmental Biology	3
BIOL 411	Immunology	3
BIOL 431	Bioinformatics	3
BMED 341	Molecular Cell Biology	4
BMED 342	Molecular Genetics, Technologies and Tools	4
BIOL 497	Senior Research Project I	3
BIOL 498	Senior Research Project II	3

Elective Requirements (6 credits)

Every student must select 6 credits of electives from the list below:

HUMA 277	Introduction to Logical Reasoning	3
HUMA 140	Introduction to Psychology	3
HUMA 141	Introduction to Sociology	3
HUMA 156	Human Behavior and Well-Being	3

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

Requirements

Year 1

Fall Semester

GENS 101	Grand Challenges	4
ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
BIOL 111	General Biology I	3
CHEM 116	General Chemistry II	4

Year 2

Fall Semester

BIOL 211	General Genetics	4
CHEM 211	Fundamentals of Organic Chemistry	4
BIOL 112	General Biology II	4
PHYS 121	University Physics I	4

Spring Semester

PHYS 122	University Physics II	4
CHEM 311	Biochemistry	4
CHEM 241	Introduction to Analytical Chemistry	4
HUMA 140	Introduction to Psychology	3
GENS 300	Career Preparation	1

CHEM 241: Only offered in the Spring Term.

Year 3

Fall Semester

BIOL 312	Biochemistry II	3
COSC 114	Introduction to Computing Using Python	4
HUMA 277	Introduction to Logical Reasoning	3
BIOL 301	Cell Biology	3
BMED 341	Molecular Cell Biology	4

BMED 341: Only offered in the Fall Term.

Spring Semester

BIOL 221	Applied Microbiology	4
BIOL 331	Physiology	3
MATH 252	Introduction to Applied Statistics	3
BMED 342	Molecular Genetics, Technologies and Tools	4
GENS 400	Enhancing Employability and Job Readiness	1

MATH 252 and BMED 342: Only offered in the Spring Term.

Summer Semester

BIOL 399	Internship	1

Year 4

Fall Semester

BUSS XXX	Business Studies	3
BIOL 497	Senior Research Project I	3
BIOL 335	Developmental Biology	3
HUMA XXX	UAE Studies Elective	3
SCIE 202	Data Science & AI for Scientists	3

Spring Semester

BIOL 498	Senior Research Project II	3
BIOL 411	Immunology	3
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
BIOL 431	Bioinformatics	3
HUMA 108	Arabic and Islamic Heritage	3

Subtotal: -125

Subtotal: 125

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 the 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, and 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.

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 demonstrate 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

Bachelor of Science in Earth and Planetary Sciences Requirements

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 economic 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 including 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 Department of Earth Sciences 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

American Association of Petroleum Geologists (AAPG) student chapter in the Earth and Planetary Sciences 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 Earth Sciences Student Society aims to help and support students as they prepare to start their careers within the Earth Sciences. As well as supporting the next generation of geoscientists, the society also provides a range of social activities for geoscience 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 University General Education Requirements (45 credit hours), additional Basic Sciences (6 credit hours including General Biology and Calculus III), the College Requirements (7 credit hours, including SCIE 202 and EPSS 397), the Discipline Specific Core Courses (55 credit hours), and Free Electives requirements (12 credit hours). The normal length of the undergraduate BSc in Earth and Planetary Sciences is 125 credit hours.

Mathematics/Science Requirements (6 credits)

The BSc in Earth and Planetary Sciences program requires additional Mathematics and Science courses, beyond the General Education Requirements, including:

BIOL 111	General Biology I	3
MATH 231	Calculus III	3

Earth and Planetary Sciences Core Requirements (55 credits)

For the BSc in Earth and Planetary Sciences degree, students must complete the following Core Requirement courses:

EPSS 200	Earth Systems Science	3
EPSS 210	Earth Materials	3
EPSS 211	Physics of the Earth	4
EPSS 222	The Evolving Earth	4
EPSS 223	Introduction to Geochemistry	3
EPSS 230	Geological Maps	3
EPSS 300	MATLAB for Earth Scientists	3
EPSS 305	Sedimentology	4
EPSS 310	Remote Sensing and Geomatics	4
EPSS 321	Structural Geology	4
EPSS 323	Solid Earth Geophysics	4
EPSS 331	Igneous &Metamorphic Petrology	3
EPSS 400	Planetary Sciences	4
EPSS 415	Environmental Geology	3
EPSS 497	Senior Research Project I	3
EPSS 498	Senior Design Project II	3

Earth and Planetary Sciences Free Electives (12 credits)

All students must complete at least 12 credits of free electives, which are intended to provide students with the 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

Requirements

The table below shows the study plan for the BSc in Earth and Planetary Sciences.

Year 1

Fall Semester

ENGL 101	Academic English I	3
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
MATH 111	Calculus I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
PHYS 121	University Physics I	4
MATH 112	Calculus II	4
EPSS 200	Earth Systems Science	3

Year 2

Fall Semester

EPSS 223	Introduction to Geochemistry	3
BIOL 111	General Biology I	3
EPSS 211	Physics of the Earth	4
COSC 114	Introduction to Computing Using Python	4
HUMA XXX	UAE Studies Elective	3

Spring Semester

EPSS 210	Earth Materials	3
EPSS 222	The Evolving Earth	4
EPSS 230	Geological Maps	3
SCIE 202	Data Science & AI for Scientists	3
MATH 231	Calculus III	3

Year 3

Fall Semester

EPSS 331	Igneous &Metamorphic Petrology	3
EPSS 305	Sedimentology	4
EPSS 321	Structural Geology	4
EPSS 300	MATLAB for Earth Scientists	3
HUMA 10X	Arabic/Islamic Heritage	3

Spring Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
EPSS 310	Remote Sensing and Geomatics	4
EPSS 323	Solid Earth Geophysics	4
HUMA XXX	Humanities Elective Or	3
BUSS XXX	Business Elective	3
GENS 300	Career Preparation	1

Summer Semester

EPSS 397	Field Geology	4

Year 4

Fall Semester

EPSS 400	Planetary Sciences	4
EPSS 497	Senior Research Project I	3
EPSS XXX	Elective	3
EPSS XXX	Elective	3

Spring Semester

EPSS 415	Environmental Geology	3
EPSS 498	Senior Design Project II	3
EPSS XXX	Elective	3
EPSS XXX	Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Subtotal: 125

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.

Petroleum Geosciences Track

The 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

EPSS 312	Reflection Seismology	4
EPSS 401	Petrophysics and Logging	4
EPSS 413	Geology of Mars & Other Planet	4
EPSS 461	Reservoir Characterization	4
EPSS 410	Reservoir Geophysics	3
EPSS 381	Rock Mechanics and Reservoirs	3
EPSS 293	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 393	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 493	Special Topics in Earth and Planetary Sciences	1-3
EPSS 294	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 394	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 494	Special Topics in Earth and Planetary Sciences	1-3

Planetary Science Track

This track offers 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 offers 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.

Electives

PHYS 203	Introduction to Astronomy	4
PHYS 211	Computational Physics	4
EPSS 413	Geology of Mars & Other Planet	4
EPSS XXX	GIS for Planetary Sciences	3
EPSS XXX	Planetary Atmospheres	3
EPSS XXX	Remote Sensing of Solar System Bodies	3
EPSS XXX	Ice in the Solar System	2
EPSS XXX	Volcanism and Tectonics in the Solar System	2
EPSS XXX	Small Bodies in the Solar System	2
EPSS XXX	Astrobiology	2
EPSS 293	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 393	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 493	Special Topics in Earth and Planetary Sciences	1-3
EPSS 294	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 394	Special Topics in Earth and Planetary Sciences	1-3
	Or	
EPSS 494	Special Topics in Earth and Planetary Sciences	1-3

Environmental and Atmospheric Sciences Track

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.

Electives

EPSS 3XX	Climate and Environmental Change Science and Policy	3
EPSS 412	Hydrogeology	3
EPSS 322	Geomorphology and Geohazards	4
EPSS 411	Atmosphere and Climate Dynamics	3
EPSS 4XX	Engineering Solutions to Climate and Environmental Change	2

Additional Out of Program Technical Electives

CHEM 311	Biochemistry	4
CHEM 461	Environmental Chemistry	4
CHEM 342	Modern Techniques for Chemical Analysis	4
CHEM 463	Methods for Environmental Trace Analysis	4
CHEM 462	Pollution Science and Control - Management, Technology and Regulations	4

Department of Social Sciences

Introduction

The Department of Social Sciences is an academic unit within the College of Sciences. The Department provides courses which support all undergraduate degree programs across the University. Every student take a minimum of 6 credits and may add one elective of 3 credits from the Department to satisfy the University General Education Requirements (GERs). These include courses in Arabic and Islamic Heritage , U.A.E. Studies, and Humanities Electives. To satisfy the GER, students must take:

Social Sciences Requirements

1. One of the following UAE Studies Courses

HUMA 105	Emirates Society	3
HUMA 106	Emirates Studies	3

2. One of the following Islamic Studies Courses

HUMA 107	Introduction to Arabic and Islamic Heritage	3
HUMA 108	Arabic and Islamic Heritage	3

3. 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

The department offers a range of courses that may be selected by students to satisfy the GER or as another elective course.

HUMA 264	Arabic Language II	3
HUMA 106	Emirates Studies	3
HUMA 110	Middle East Studies	3
HUMA 140	Introduction to Psychology	3
HUMA 141	Introduction to Sociology	3
HUMA 156	Human Behavior and Well-Being	3
HUMA 214	Environment and Society	3
HUMA 215	World Religions	3
HUMA 265	Sufism in Islam	3
HUMA 268	Western Civilization from 1500	3
HUMA 277	Introduction to Logical Reasoning	3
HUMA 291	Leadership by Design	3
HUMA 295	Special Topics in Humanities and Social Sciences	3
HUMA 296	Directed Studies	3

Language Courses

CHNA 101	Elementary Chinese I	3
JAPN 101	Elementary Japanese I	3
JAPN 102	Elementary Japanese II	3
KORA 101	Elementary Korean I	3
KORA 102	Elementary Korean II	3
SPAN 101	Elementary Spanish I	3
SPAN 102	Elementary Spanish II	3

Department of Mathematics

Introduction

The Department of Mathematics is an academic unit within the College of Science. The department offers a BSc program in Applied Mathematics, Statistics, and Data Science. Students may choose to complete a broad program of study leading to the award of a BSc degree in Applied Mathematics, Statistics, and Data Science, 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 Mathematics of Financial Data and Decisions, and Mathematics of Life Sciences. Additionally, a Minor in Mathematics is also offered for students satisfying certain eligibility criteria.

Bachelor of Science in Applied Mathematics, Statistics and Data Science

Bachelor of Science in Applied Mathematics, Statistics and Data Science Requirements

The BSc in Applied Mathematics, Statistics, and Data Science program offers training in mathematicalproblem-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 B.Sc. in Applied Mathematics, Statistics, and Data Science will have achieved the following set of knowledge and performance-based skills, and affective competencies:

1. An ability to read, understand and construct mathematical proofs.
2. An ability to build and solve mathematical and statistical models that are suitable to real-world applications.
3. An ability to assess the applicability of data science methodologies to enable data analysis, interpretation and prediction.
4. An ability to use appropriate software packages and computer programming to solve mathematical, statistical and data science related problems.
5. An ability to communicate mathematical ideas orally and in writing, to both technical and non-tech-nical audiences.
6. An understanding of professional and ethical responsibility.
7. An ability to function in a team as a member or leader.
8. An ability to use sources of scientific information and an understanding of how mathematical 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 B.Sc. in Applied Mathematics, Statistics and Data Science, students must satisfactorily complete the courses in the specified categories as set out below. The normal length of the BSc in Applied Mathematics, Statistics and Data Science program is 123 credits, comprising 45 credits of University General Education Requirements, 4 credits of College Requirements, and 74 credits of specific Mathematics Major Requirements distributed in the following categories:

Science/Engineering Electives (3 credits)

Students may select one course from the following list to satisfy their Science/Engineering Elective requirements for

the BSc in Applied Mathematics, Statistics and Data Science. Additional courses may be approved by the department as Science/Engineering electives.

BIOL 111	General Biology I	3
BIOL 112	General Biology II	4
BMED 202	Biomedical Engineering Fundamentals	4
BMED 211	Human Anatomy	4
BMED 321	Mechanics for Biomedical Engineers	4
CHEM 116	General Chemistry II	4
CHEM 211	Fundamentals of Organic Chemistry	4
ECCE 230	Object-Oriented Programming	4
ISYE 200	Engineering Economic Analysis	3
ISYE 341	Simulation Modeling and Analysis	4
ISYE 351	Production and Operations Management	3
ISYE 430	Supply Chain and Logistics	4
ISYE 431	Time Series Forecasting	3
ISYE 441	Advanced Simulation	3
ISYE 451	Operations Research 2	3
ISYE 480	Financial Engineering	3
MEEN 200	Statics	3
MEEN 201	Engineering Dynamics	3
MEEN 240	Thermodynamics	3
MEEN 335	Fluid Mechanics	4
PHYS 122	University Physics II	4

Applied Mathematics and Statistics and Data Science Core Requirements (56 credits)

MATH 101	Fundamentals of Mathematical Reasoning	3
MATH 231	Calculus III	3
MATH 204	Linear Algebra	3
MATH 206	Differential Equations	3
MATH 251	Operations Research I	4
MATH 214	Mathematical and Statistical Software	3
MATH 244	Probability	3
MATH 245	Mathematical Statistics	3
MATH 352	Complex Functions	3
MATH 324	Real Analysis I	4
MATH 315	Advanced Linear Algebra with Applications to Data Science	3
MATH 316	Partial Differential Equations	3
MATH 318	Multivariate Statistics	3
MATH 319	Numerical Analysis I	3
MATH 412	Optimization	3
MATH 419	Numerical Analysis II	3
MATH 497	Senior Research Project I	3
MATH 498	Senior Research Project II	3

Applied Mathematics, Statistics, and Data Science Technical Electives (15 credits)

To satisfy the B.Sc. in Applied Mathematics, Statistics, and Data Science Technical Elective requirement, students must take five courses from the following list. Students may be allowed to choose technical electives from the Mathematics of Financial Data and Decisions concentration or the Mathematics of Life Sciences concentration with department approval. Moreover, the department may approve additional courses.

MATH 317	Nonparametric Statistics	3
MATH 320	Mathematical Foundations of General Relativity	3
MATH 331	Stochastic Processes	3
MATH 410	Introduction to Topology	3
MATH 411	Modern Algebra	3
MATH 413	Game Thoery	3
MATH 414	Discrete Mathematics	3
MATH 415	Design of Experiments	3
MATH 416	Sample Survey Design and Analysis	3
MATH 417	Measure and Probability Theory	3
MATH 431	Discrete Mathematical Models in Biology	3
MATH 432	Continuous Mathematical Models in Biology	3
MATH 475	Model Calibration and Uncertainty Quantification	3
MATH 485	Nonlinear Dynamics	3

Applied Mathematics, Statistics and Data Science - Mathematics of Financial Data and Decisions (Concentration)

Students may select a Mathematics of Financial Data and Decisions 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 Mathematics of Financial Data and Decisions concentration suggests the student to select BUSS 201 Fundamentals of Accounting and Finance as a Business Elective, and requires the student to select ISYE 480 Financial Engineering from the list of Science/Engineering Electives and replace all technical electives with five courses from the following list. Moreover, the department may approve additional courses.

MATH 317	Nonparametric Statistics	3
MATH 331	Stochastic Processes	3
MATH 421	Econometrics	3
MATH 422	Stochastic Differential Equations	3
MATH 423	Financial Risk Analysis	3
MATH 424	Optimal Control Thoery	3
MATH 425	Financial Portfolio Management	3
MATH 426	Finance in Discrete Time	3
MATH 475	Model Calibration and Uncertainty Quantification	3
MATH 485	Nonlinear Dynamics	3

Applied Mathematics, Statistics and Data Science – Mathematics of Life Sciences (Concentration)

Students may select a Mathematics of Life Sciences 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 Mathematics of Life Sciences Concentration suggests the student to select BIOL 111 General Biology I from the list of Science/Engineering Electives, and requires the student to replace all technical electives with five courses from the following list. Moreover, the department may approve additional courses.

MATH 317	Nonparametric Statistics	3
MATH 331	Stochastic Processes	3
MATH 431	Discrete Mathematical Models in Biology	3
MATH 432	Continuous Mathematical Models in Biology	3
MATH 433	Biostatistisc	3
MATH 434	Bioinformatics	3
MATH 435	Mathematical Imaging	3
MATH 475	Model Calibration and Uncertainty Quantification	3
MATH 485	Nonlinear Dynamics	3

Typical Course Sequence for the BSc in Applied Mathematics, Statistics and Data Science

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1
GENS 101	Grand Challenges	4

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
MATH 101	Fundamentals of Mathematical Reasoning	3
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA 105	Emirates Society	3

Year 2

Fall Semester

MATH 231	Calculus III	3
MATH 204	Linear Algebra	3
SCIE 202	Data Science & AI for Scientists	3
PHYS 121	University Physics I	4
HUMA 108	Arabic and Islamic Heritage	3

Spring Semester

MATH 324	Real Analysis I	4
MATH 206	Differential Equations	3
MATH 244	Probability	3
MATH 251	Operations Research I	4

Year 3

Fall Semester

MATH 352	Complex Functions	3
MATH 315	Advanced Linear Algebra with Applications to Data Science	3
MATH 245	Mathematical Statistics	3
MATH 214	Mathematical and Statistical Software	3
GENS 300	Career Preparation	1

Spring Semester

MATH 316	Partial Differential Equations	3
MATH 318	Multivariate Statistics	3
MATH 319	Numerical Analysis I	3
BUSS XXX	Business Elective	3
	Technical Elective	3

Summer Semester

MATH 399	Internship	1

Year 4

Fall Semester

MATH 419	Numerical Analysis II	3
MATH 412	Optimization	3
	Technical Elective	3
	Technical Elective	3
MATH 497	Senior Research Project I	3
GENS 400	Enhancing Employability and Job Readiness	1

Spring Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
	Science/Engineering Elective	3
	Technical Elective	3
	Technical Elective	3
MATH 498	Senior Research Project II	3

Typical Course Sequence for the BSc in Applied Mathematics, Statistics and Data Science

Concentration in Mathematics of Financial Data and Decisions

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1
GENS 101	Grand Challenges	4

Spring Semester

ENGL 102	Academic English II	3
MATH 101	Fundamentals of Mathematical Reasoning	3
MATH 112	Calculus II	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA 105	Emirates Society	3

Year 2

Fall Semester

MATH 231	Calculus III	3
MATH 204	Linear Algebra	3
SCIE 202	Data Science & AI for Scientists	3
PHYS 121	University Physics I	4
HUMA 108	Arabic and Islamic Heritage	3

Spring Semester

MATH 324	Real Analysis I	4
MATH 206	Differential Equations	3
MATH 244	Probability	3
MATH 251	Operations Research I	4

Year 3

Fall Semester

MATH 352	Complex Functions	3
MATH 315	Advanced Linear Algebra with Applications to Data Science	3
MATH 245	Mathematical Statistics	3
MATH 214	Mathematical and Statistical Software	3
GENS 300	Career Preparation	1

Spring Semester

MATH 316	Partial Differential Equations	3
MATH 318	Multivariate Statistics	3
MATH 319	Numerical Analysis I	3
BUSS XXX	Business Elective	3
	Technical Elective	3

Summer Semester

MATH 399	Internship	1

Year 4

Fall Semester

MATH 412	Optimization	3
MATH 419	Numerical Analysis II	3
	Technical Elective	3
	Technical Elective	3
MATH 497	Senior Research Project I	3
GENS 400	Enhancing Employability and Job Readiness	1

Spring Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
ISYE 480	Financial Engineering	3
	Technical Elective	3
	Technical Elective	3
MATH 498	Senior Research Project II	3

Typical Course Sequence for the BSc in Applied Mathematics, Statistics and Data Science

Concentration in Mathematics of Life Sciences

Year 1

Fall Semester		
ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1
GENS 101	Grand Challenges	4
Spring Semester		
ENGL 102	Academic English II	3
MATH 112	Calculus II	4
MATH 101	Fundamentals of Mathematical Reasoning	3
COSC 114	Introduction to Computing Using Python	4
Summer Semester		
HUMA 105	Emirates Society	3

Year 2

Fall Semester		
MATH 231	Calculus III	3
MATH 204	Linear Algebra	3
SCIE 202	Data Science & AI for Scientists	3
PHYS 121	University Physics I	4
HUMA 108	Arabic and Islamic Heritage	3
Spring Semester		
MATH 324	Real Analysis I	4
MATH 206	Differential Equations	3
MATH 244	Probability	3
MATH 251	Operations Research I	4

Year 3

Fall Semester		
MATH 352	Complex Functions	3
MATH 315	Advanced Linear Algebra with Applications to Data Science	3
MATH 245	Mathematical Statistics	3
MATH 214	Mathematical and Statistical Software	3
GENS 300	Career Preparation	1
Spring Semester		
MATH 316	Partial Differential Equations	3
MATH 318	Multivariate Statistics	3
MATH 319	Numerical Analysis I	3
BUSS XXX	Business Elective	3
	Technical Elective	3
Summer Semester		
MATH 399	Internship	1

Year 4

Fall Semester		
MATH 412	Optimization	3
MATH 419	Numerical Analysis II	3
	Technical Elective	3
	Technical Elective	3
MATH 497	Senior Research Project I	3
GENS 400	Enhancing Employability and Job Readiness	1
Spring Semester		
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
	Science/Engineering Elective	3
	Technical Elective	3
	Technical Elective	3
MATH 498	Senior Research Project II	3

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:

1. apply knowledge of mathematics, statistics, and computing.
2. implement algorithms and analyze and interpret

results.

3. understand and construct mathematical and statistical proofs.
4. formulate and solve mathematical models of real-world problems.

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 are encouraged taking a minor available within other programs. A wide range of elective physics courses is available for students. These include Advanced Instrumentation, Astronomy and Astrophysics, Atomic and Molecular Physics, Biological Physics, Nanotechnology, Nuclear and Particle Physics, and Quantum Mechanics.

Bachelor of Science in Physics

Bachelor of Science in Physics Requirements

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 124 credits from courses in specified categories, as set out below. In addition to University General Education Requirements (GERs, 45 credits), Mathematics/Science/Engineering Electives (4 credits), students must satisfy 75 credits of Major Requirements comprised of Additional Mathematics and Science Requirements (13 credits), Physics Core Requirements (43 credits), and Physics Technical Electives Requirements (15 credits).

Additional Science and Mathematics Requirements (13 credits)

Students must take the following four courses:

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

Physics Core Requirements (43 credits)

Students must take the following core courses:

PHYS 122	University Physics II	4
PHYS 201	Physics Instrumentation I	3
PHYS 211	Computational Physics	4
PHYS 213	University Physics III	4
PHYS 250	Mathematical Physics	4
PHYS 311	Intermediate Mechanics	3
PHYS 321	Electricity and Magnetism I	4
PHYS 331	Quantum Physics I	4
PHYS 340	Thermal & Statistical Physics	4
PHYS 351	Advanced laboratory I	3
PHYS 497	Senior Project I	3
PHYS 498	Senior Project II	3

Physics Technical Electives (15 credits)

To satisfy the BSc in Physics Technical Elective requirement, students must have a minimum of 15 credits from any of the courses in the following list:

PHYS 203	Introduction to Astronomy	4
PHYS 231	Optics	4
PHYS 295	Introduction to Quantum Mechanics for Scientists and Engineers	3
PHYS 350	Introduction to Nanophysics	3
PHYS 361	Engineering Physics I	3
PHYS 362	Engineering Physics II	3
PHYS 363	Physics Instrumentation II	3
PHYS 371		3
PHYS 372		3
PHYS 381	Introduction to Biological Physics	3
PHYS 482	Introduction to Medical Physics	4
PHYS 403	Observational Stellar and Galactic Astrophysics	3
PHYS 412	Advanced Mechanics	3
PHYS 420	Atomic and Molecular Physics	3
PHYS 422	Electricity and Magnetism II	3
PHYS 431	Solid State Physics	3
PHYS 432	Quantum Physics II	4
PHYS 441	Space Physics	3
PHYS 450	Nuclear and Particle Physics	3
PHYS 452	Advanced Laboratory II	3
PHYS 471	Physics Education Practicum I	3
PHYS 472	Physics Education Practicum II	3
PHYS 377	Undergraduate Research	3
	Or	
PHYS 477	Undergraduate Research	3

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.

	Math, Science, or Engineering Elective(s) (3XX or 4XX)	4

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	4
PHYS 231	Optics	4
PHYS 361	Engineering Physics I	3
PHYS 362	Engineering Physics II	3
PHYS 363	Physics Instrumentation II	3

Space Science Track (17 credits)

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

Physics Education Track (16 credits)

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

Typical Course Sequence for the BSc in Physics

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
COSC 114	Introduction to Computing Using Python	4
PHYS 121	University Physics I	4

Year 2

Fall Semester

MATH 231	Calculus III	3
MATH 204	Linear Algebra	3
MATH 206	Differential Equations	3
PHYS 122	University Physics II	4
BUSS XXX	Business Elective	3
	Or	
HUMA XXX	Humanities Elective	3

Spring Semester

PHYS 201	Physics Instrumentation I	3
PHYS 213	University Physics III	4
PHYS 250	Mathematical Physics	4
CHEM 116	General Chemistry II	4

Year 3

Fall Semester

PHYS 211	Computational Physics	4
PHYS 311	Intermediate Mechanics	3
PHYS 321	Electricity and Magnetism I	4
PHYS 331	Quantum Physics I	4
HUMA 108	Arabic and Islamic Heritage	3

Spring Semester

SCIE 202	Data Science & AI for Scientists	3
PHYS XXX	Technical Elective	3
PHYS 351	Advanced laboratory I	3
PHYS 340	Thermal & Statistical Physics	4
GENS 300	Career Preparation	1

Summer Semester

PHYS 399	Physics Internship	1

Year 4

Fall Semester

	Math, Science, or Engineering Elective(s) (3XX or 4XX)	4
PHYS XXX	Technical Elective	3
PHYS XXX	Technical Elective	3
PHYS 497	Senior Project I	3
HUMA XXX	UAE Studies Elective	3

Spring Semester

PHYS 498	Senior Project II	3
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
PHYS XXX	Technical Elective	3
PHYS XXX	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Subtotal: 124

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 center 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 Engineering Systems and Management
- Bachelor of Science (BSc) in Mechanical Engineering
- Bachelor of Science (BSc) in Petroleum Engineering

The length of the undergraduate engineering programs ranges between 129-130 credits. These credits are divided into 45 credits of University General Education Requirements (GERs), between 19-23 credits of College of Engineering Requirements (CERs), and 61-66 credits of specific Major requirements.

College Undergraduate Minors

The minors offered by the College of Engineering are:

- Minor in Artificial Intelligence
- 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. 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

Bachelor of Science in Aerospace Engineering Requirements

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:

- Aircraft Design Lab
- Computer-Aided Design Laboratory
- Solid Mechanics Laboratory
- Material Testing Laboratory
- Aerodynamics Laboratory
- Thermodynamics Laboratory
- Composites Manufacturing Laboratory
- Dynamic Systems/ Vibrations Laboratory
- Space Dynamics Laboratory
- Advanced Space Robotics Laboratory
- Guidance, Navigation & Control (GNC) and Avionics

- Advanced Space Materials & Structures Laboratory
- 3D Printing Workshop

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, 45 credits), College of Engineering Requirements (CER, 20 credits), as well as the Aerospace Engineering Core and Technical Electives requirements (65 credits).. The length of the program is 130 credits.

Additional Aerospace Engineering Math/Sciences Requirement (15 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, MATH111, and MATH112.

MATH 211	Differential Equations and Linear Algebra	4
MATH 231	Calculus III	3
PHYS 122	University Physics II	4
PHYS 203	Introduction to Astronomy	4

Aerospace Engineering Major Requirements (59 credits)

AERO 200	Statics	3
AERO 201	Engineering Dynamics	3
AERO 215	Introduction to Aerospace Engineering	3
AERO 225	Mechanics of Solids	4
AERO 240	Thermofluids for Aerospace Engineering	4
AERO 320	Aerospace Materials	3
AERO 321	Aerospace Structures	3
AERO 335	Aerodynamics I	4
AERO 336	Aerodynamics II	3
AERO 350	Dynamic Systems and Control	4
AERO 415	Aerospace Materials Manufacturing	3
AERO 440	Aerospace Propulsion	3
AERO 450	Flight Dynamics and Stability	3
AERO 465	Space Dynamics and Control	3
AERO 470	Aircraft Design Laboratory	4
AERO 485	Spacecraft Design	3
AERO 497	Senior Design Project I	3
AERO 498	Senior Design Project 2	3

Aerospace Engineering Technical 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.

AERO 401	UAV Modeling and Control	3
AERO 402	UAV Sensing	3
AERO 403	UAV Navigation	3
AERO 404	UAV Systems	3
AERO 426	Composite Materials Design	3
AERO 430	Intermediate Aerodynamics	3
AERO 431	Viscous Flows	3
AERO 433	Introduction to Computational Fluid Dynamics	3
AERO 435	Rotorcraft Aerodynamics and Performance	3
AERO 441	Introduction to Combustion	3
AERO 461	Aviation Management and Certification	3
AERO 495	Special Topics in Aerospace Engineering	3
CIVE 370	Introduction to Environmental	4

	Engineering	
ENGR 455	Finite Element Analysis	3
MEEN 360	Computational Methods for Mechanical Engineers	3
MEEN 343	Heat Transfer	4
AERO 391	Independent Study I	3
	Or	
AERO 491	Independent Study II	3

Typical Course Sequence for a BSc in Aerospace Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

MATH 211	Differential Equations and Linear Algebra	4
PHYS 122	University Physics II	4
AERO 200	Statics	3
PHYS 203	Introduction to Astronomy	4

Spring Semester

MATH 231	Calculus III	3
AERO 201	Engineering Dynamics	3
AERO 215	Introduction to Aerospace Engineering	3
AERO 225	Mechanics of Solids	4
AERO 240	Thermofluids for Aerospace Engineering	4

Summer Semester

HUMA XXX	UAE Studies Elective	3

Year 3

Fall Semester

AERO 320	Aerospace Materials	3
AERO 335	Aerodynamics I	4
AERO 350	Dynamic Systems and Control	4
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
ENGR 202	Data Science & AI	3

Spring Semester

AERO 321	Aerospace Structures	3
AERO 336	Aerodynamics II	3
AERO 450	Flight Dynamics and Stability	3
AERO 465	Space Dynamics and Control	3
GENS 300	Career Preparation	1

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

AERO 440	Aerospace Propulsion	3
AERO 470	Aircraft Design Laboratory	4
AERO 497	Senior Design Project I	3
BUSS XXX	Business Studies Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Spring Semester

AERO 415	Aerospace Materials Manufacturing	3
AERO 485	Spacecraft Design	3
AERO 498	Senior Design Project 2	3
	Technical Elective	3
	Technical Elective	3

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 130

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 endeavors. 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

Bachelor of Science in Biomedical Engineering Requirements

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, 45 credits), College of Engineering Requirements (CER, 19 credits), as well as the Biomedical Engineering Core and Technical/Free Electives requirements of 65 credits. The program includes a total of 129 credits of required coursework.

Additional Math/Science Requirements (14 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: CHEM 115, PHYS 121, MATH 111, and MATH 112.

MATH 211	Differential Equations and Linear Algebra	4
MATH 242	Introduction to Probability and Statistics	3
PHYS 122	University Physics II	4
BIOL 111	General Biology I	3

Biomedical Engineering Core Requirements (45 credits)

BMED 202	Biomedical Engineering Fundamentals	4
BMED 221	Human Anatomy and Physiological Modeling for Engineers	4
BMED 321	Mechanics for Biomedical Engineers	4
BMED 322	Functional Biomechanics	4
BMED 331	Biotransport Phenomena	3
BMED 341	Molecular Cell Biology	4
BMED 342	Molecular Genetics, Technologies and Tools	4
BMED 351	Biomedical Circuits and Signals	4
BMED 352	Fundamentals of Biomedical Signal Processing	4
BMED 497	Senior Design Project I	3
BMED 498	Senior Design Project II	3
CHEM 211	Fundamentals of Organic Chemistry	4

Biomedical Engineering Technical Electives (18 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.

BMED 411	Biomaterials	4
BMED 412	Regenerative Medicine	4
BMED 413	Application of Bio-molecular Tools	3
BMED 421	Physiological Control Systems	4
BMED 422	Rehabilitation Engineering	4
BMED 423	Biorobotics and Medical Device Design	4
BMED 430	Bioinformatics	4
BMED 431	Data Mining and Machine Learning for Bioinformatics	3
BMED 495	Special Topics in Biomedical Engineering	4
BMED 496	Data Measurement, Modeling and Analysis in Biomedical Engineering	1
CHEM 311	Biochemistry	4
BMED 377	Undergraduate Research	3
	Or	
BMED 477	Undergraduate Research	3

Free Electives (2 credits)

All students must complete 2 credits of free electives which are intended to provide students with flexibility to support their career paths and individual interests.

Free Elective	2

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:

CHEM 116	General Chemistry II	4
CHEM 311	Biochemistry	4
PHYS 122	University Physics II	4
HUMA 156	Human Behavior and Well-Being	3

In order to fulfill this, the Chemistry and Physics courses requirement (CHEM 116, CHEM 311 and PHYS 122) will replace 3 credits of "Free Elective" and 9 credits of "Technical Elective" from the core requirements of the Biomedical Engineering program. HUMA 156 will replace 3 credits of "Free Elective" in the program.

Typical Course Sequence for BSc in Biomedical Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Year 2

Fall Semester

MATH 242	Introduction to Probability and Statistics	3
ENGR 202	Data Science & AI	3
PHYS 122	University Physics II	4
BIOL 111	General Biology I	3
HUMA 108	Arabic and Islamic Heritage	3

Spring Semester

MATH 211	Differential Equations and Linear Algebra	4
BMED 202	Biomedical Engineering Fundamentals	4
BMED 221	Human Anatomy and Physiological Modeling for Engineers	4
CHEM 211	Fundamentals of Organic Chemistry	4
GENS 300	Career Preparation	1

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
BMED 321	Mechanics for Biomedical Engineers	4
BMED 341	Molecular Cell Biology	4
BMED 351	Biomedical Circuits and Signals	4
	Free Elective	2

Spring Semester

BMED 322	Functional Biomechanics	4
BMED 331	Biotransport Phenomena	3
BMED 342	Molecular Genetics, Technologies and Tools	4
BMED 352	Fundamentals of Biomedical Signal Processing	4

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

BMED 497	Senior Design Project I	3
	Technical Elective	3
	Technical Elective	3
	Technical Elective	3
BUSS XXX	Business Elective	3

Spring Semester

BMED 498	Senior Design Project II	3
	Technical Elective	3
	Technical Elective	3
	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1
HUMA XXX	UAE Studies Elective	3

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 129

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

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Year 2

Fall Semester

MATH 242	Introduction to Probability and Statistics	3
ENGR 202	Data Science & AI	3
PHYS 122	University Physics II	4
BIOL 111	General Biology I	3
CHEM 116	General Chemistry II	4

Spring Semester

MATH 211	Differential Equations and Linear Algebra	4
BMED 202	Biomedical Engineering Fundamentals	4
BMED 221	Human Anatomy and Physiological Modeling for Engineers	4
CHEM 211	Fundamentals of Organic Chemistry	4
GENS 300	Career Preparation	1

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
BMED 321	Mechanics for Biomedical Engineers	4
BMED 341	Molecular Cell Biology	4
BMED 351	Biomedical Circuits and Signals	4

Spring Semester

BMED 322	Functional Biomechanics	4
BMED 331	Biotransport Phenomena	3
BMED 342	Molecular Genetics, Technologies and Tools	4
BMED 352	Fundamentals of Biomedical Signal Processing	4

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

BMED 497	Senior Design Project I	3
	Technical Elective	3
CHEM 311	Biochemistry	4
HUMA 156	Human Behavior and Well-Being	3
BUSS XXX	Business Elective	3

Spring Semester

BMED 498	Senior Design Project II	3
	Technical Elective	3
	Technical Elective	3
HUMA 108	Arabic and Islamic Heritage	3
HUMA XXX	UAE Studies Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 129

Department of Chemical and Petroleum Engineering

The Chemical and Petroleum 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 and petroleum 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, and BSc degree in Petroleum Engineering.

Bachelor of Science in Chemical Engineering

Bachelor of Science in Chemical Engineering Requirements

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, 45 credits), College of Engineering Requirements (CER, 20 credits), as well as Chemical Engineering Core and Technical Electives requirements of 65 credits. The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (15 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, , MATH111, and MATH112.

CHEM 116	General Chemistry II	4
CHEM 211	Fundamentals of Organic Chemistry	4
MATH 211	Differential Equations and Linear Algebra	4
MATH 231	Calculus III	3

Chemical Engineering Core Requirements (53 credits)

CHEG 205	Principles of Chemical Engineering	3
CHEG 210	Introduction to Biochemical Engineering	3
CHEG 213	Experimental Design	3
CHEG 230	Chemical Engineering Thermodynamics I	3
CHEG 232	Fluid Mechanics	4
CHEG 312	Numerical Methods for Chemical Engineers	3
CHEG 324	Mass Transfer	3
CHEG 332	Chemical Engineering Thermodynamics II	3
CHEG 335	Heat Transfer	4
CHEG 350	Materials Science & Engineering	3
CHEG 412	Process Dynamics & Control	4
CHEG 443	Reaction Engineering	4
CHEG 485	Separation Processes	4
CHEG 497	Senior Design Project I	3
CHEG 498	Senior Design Project II	3
ESMA 200	Engineering Economic Analysis	3

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.

CHEG 325	Fundamentals of Nanotechnology	3
CHEG 340	Chemical Extraction of Metals	3
CHEG 341	Electrochemical Engineering	3
CHEG 352	Materials in Nuclear Power Plants	3
CHEG 360	Introduction to Hydrogen Technologies and Applications	3
CHEG 361	Hydrogen Safety	3
CHEG 380	Introduction To Polymer Science and Engineering	3
CHEG 381	Polymer Chemistry and Reaction Engineering	3
CHEG 377	Undergraduate Research	3
	Or	
CHEG 477	Undergraduate Research	3
CHEG 395	Special Topics in Chemical Engineering	3
	Or	
CHEG 495	Special Topics in Chemical Engineering	3
CHEG 410	Pollution Prevention and Waste Management	3
CHEG 411	Green Chemical Engineering	3
CHEG 415	Combustion and Air Pollution Control	3
CHEG 416	Corrosion Engineering	3
CHEG 423	Gas Processing Engineering	3
CHEG 424	Petroleum Refining and Processing	3
CHEG 430	Bioseparation Engineering	3
CHEG 432	Food Engineering and	3

	Technology	
CHEG 460	Introduction to Clean Energy Production	3
CHEG 470	Industrial Catalysis	3
CHEG 471	Water Chemistry for Environmental Engineering	3
CHEG 472	Water Treatment and Membrane Processes	3
CHEG 488	Polymer Properties	3

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.

CHEG 360	Introduction to Hydrogen Technologies and Applications	3
CHEG 460	Introduction to Clean Energy Production	3
CHEG 361	Hydrogen Safety	3
CHEG 325	Fundamentals of Nanotechnology	3

CHEG 360, CHEG 460, CHEG 361, and CHEG 325: 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 CHEG 472 as well as 3 of the remaining 5 offered courses.

CHEG 472	Water Treatment and Membrane Processes	3
CHEG 415	Combustion and Air Pollution Control	3
CHEG 410	Pollution Prevention and Waste Management	3
CHEG 411	Green Chemical Engineering	3
CHEG 471	Water Chemistry for Environmental Engineering	3

CHEG 472, CHEG 415, CHEG 410, CHEG 411, and CHEG 471: 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.

CHEG 325	Fundamentals of Nanotechnology	3
CHEG 340	Chemical Extraction of Metals	3
CHEG 380	Introduction To Polymer Science and Engineering	3
CHEG 416	Corrosion Engineering	3
CHEG 470	Industrial Catalysis	3
CHEG 488	Polymer Properties	3

CHEG 325, CHEG 340, CHEG 380, CHEG 416, CHEG 470, and CHEG 488: CHEG Technical Elective.

Typical Course Sequence for a BSc in Chemical Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
CHEM 116	General Chemistry II	4

Year 2

Fall Semester

MATH 231	Calculus III	3
CHEM 211	Fundamentals of Organic Chemistry	4
CHEG 205	Principles of Chemical Engineering	3
COSC 114	Introduction to Computing	4

	Using Python	
HUMA 108	Arabic and Islamic Heritage	3

Spring Semester

MATH 211	Differential Equations and Linear Algebra	4
CHEG 210	Introduction to Biochemical Engineering	3
CHEG 213	Experimental Design	3
CHEG 230	Chemical Engineering Thermodynamics I	3
CHEG 232	Fluid Mechanics	4

Summer Semester

BUSS XXX	Business Elective	3

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
CHEG 312	Numerical Methods for Chemical Engineers	3
CHEG 332	Chemical Engineering Thermodynamics II	3
CHEG 335	Heat Transfer	4
GENS 300	Career Preparation	1

Spring Semester

CHEG 324	Mass Transfer	3
CHEG 350	Materials Science & Engineering	3
ENGR 202	Data Science & AI	3
CHEG	CHEG XXX Technical Elective	3
ESMA 200	Engineering Economic Analysis	3

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

CHEG 497	Senior Design Project I	3
CHEG 485	Separation Processes	4
CHEG 443	Reaction Engineering	4
CHEG	CHEG XXX Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Spring Semester

CHEG 498	Senior Design Project II	3
CHEG 412	Process Dynamics & Control	4
HUMA XXX	UAE Studies Elective	3
CHEG	CHEG XXX Technical Elective	3
CHEG	CHEG XXX Technical Elective	3

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 130

Bachelor of Science in Petroleum Engineering

Bachelor of Science in Petroleum Engineering Requirements

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, 45 credits), College of Engineering Requirements (22 credits), as well as Petroleum Engineering Core and Technical Electives requirements for a total of 63 credits. The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (17 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, MATH111, and MATH112. The BSc. In Petroleum Engineering requires different math/sciences courses for a total of 17 credits.

CHEM 116	General Chemistry II	4
MATH 206	Differential Equations	3
MATH 231	Calculus III	3
PHYS 122	University Physics II	4
EPSS 200	Earth Systems Science	3

Petroleum Engineering Core Requirements (57 credits)

MEEN 240	Thermodynamics	3
PEEG 218	Reservoir Rock Properties	3
PEEG 219	Reservoir Fluid Properties	3
PEEG 252	Statics and Mechanics of Materials for PE	3
PEEG 302	Fluid Mechanics and Heat Transfer	3
PEEG 314	Well Logging	3
PEEG 315	Reservoir Characterization	3
PEEG 322	Drilling Engineering I	3
PEEG 326	Drilling Engineering II	3
PEEG 331	Reservoir Engineering I	3
PEEG 336	Well Testing	3
PEEG 341	Completion and Workover	3
PEEG 360	Petroleum Economics & Risk Analysis	4
PEEG 434	Reservoir Engineering II	4

PEEG 447	Production Engineering	3
PEEG 497	Senior Design Project I	3
PEEG 498	Senior Design Project II	3
EPSS 305	Sedimentology	4

Petroleum Engineering Technical Electives (6 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 6 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. Additional courses may be approved by the department as technical electives.

PEEG 420	Well Treatment	3
PEEG 423	Horizontal and Multilateral Well Technology	3
PEEG 424	Underbalanced Drilling Technology	3
PEEG 425	Pressure Control	3
PEEG 437	Natural Gas Engineering	3
PEEG 442	Surface Production Facilities	3
PEEG 445	Production Enhancement	3
PEEG 456	Petroleum Related Rock Mechanics	3
PEEG 377	Undergraduate Research	3
	Or	
PEEG 477	Undergraduate Research	3
PEEG 394	Research Topics in Petroleum Engineering	3
	Or	
PEEG 494	Research Topics in Petroleum Engineering	3
PEEG 395	Special Topics in Petroleum Engineering	3
	Or	
PEEG 495	Special Topics in Petroleum Engineering	3

Typical Course Sequence for BSc in Petroleum Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
CHEM 116	General Chemistry II	4

Year 2

Fall Semester

COSC 114	Introduction to Computing Using Python	4
PHYS 122	University Physics II	4
MATH 231	Calculus III	3
PEEG 218	Reservoir Rock Properties	3
MEEN 240	Thermodynamics	3

Spring Semester

MATH 206	Differential Equations	3
PEEG 219	Reservoir Fluid Properties	3
EPSS 200	Earth Systems Science	3
PEEG 252	Statics and Mechanics of Materials for PE	3
PEEG 302	Fluid Mechanics and Heat Transfer	3
ENGR 202	Data Science & AI	3

Summer Semester

BUSS 150	Introduction to Economics	3

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
EPSS 305	Sedimentology	4
PEEG 314	Well Logging	3
PEEG 322	Drilling Engineering I	3
PEEG 331	Reservoir Engineering I	3

Spring Semester

PEEG 315	Reservoir Characterization	3
PEEG 326	Drilling Engineering II	3
PEEG 336	Well Testing	3
PEEG 341	Completion and Workover	3
PEEG 360	Petroleum Economics & Risk Analysis	4
GENS 300	Career Preparation	1

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester		
GENS 400	Enhancing Employability and Job Readiness	1
PEEG 434	Reservoir Engineering II	4
	Technical Elective	3
PEEG 447	Production Engineering	3
PEEG 497	Senior Design Project I	3
Spring Semester		
	Technical Elective	3
PEEG 498	Senior Design Project II	3
HUMA XXX	Islamic/Arabic Studies Elective	3
HUMA XXX	UAE Studies Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 130

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 endeavors. 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

Bachelor of Science in Civil Engineering Requirements

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 Laboratories
- Geotechnical Materials Laboratory
- Computing Laboratory (Structure and Transportation & GIS)
- Structural Materials 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, 45 credits), College of Engineering Requirements (CER, 19 credits), as well as the Civil Engineering Core and Technical Electives requirements of 66 credits. The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (14 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.

MATH 211	Differential Equations and Linear Algebra	4
MATH 242	Introduction to Probability and Statistics	3
MATH 251	Operations Research I	4
	Science Elective	3

XXX xxx (Science Elective): The Science Elective should be approved by the Department.

Civil Engineering Core Requirements (54 credits)

CIVE 180	Engineering Graphics and Visualization	3
CIVE 200	Statics	3
CIVE 225	Mechanics of Solids	4
CIVE 310	Geomatics	3
CIVE 332	Fundamentals of Construction Engineering & Management	3
CIVE 335	Fluid Mechanics	4
CIVE 336	Civil Engineering Materials	4

CIVE 338	Geotechnical Engineering	4
CIVE 340	Behavior and Analysis of Structures	3
CIVE 341	Design of Steel Structures	3
CIVE 370	Introduction to Environmental Engineering	4
CIVE 380	Transportation Engineering	3
CIVE 442	Design of Concrete Structures	3
CIVE 470	Foundation Engineering	4
CIVE 497	Senior Design Project I	3
CIVE 498	Senior Design Project II	3

Civil Engineering Technical Electives (12 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.

CIVE 450	Coastal Engineering	3
CIVE 455	Blast Effects and Modern Protective Infrastructures	3
CIVE 463	Water and Wastewater Treatment Technologies	3
CIVE 465	Water Resources Management	3
CIVE 469	Air Pollution Control	3
CIVE 472	Pavements Design and Maintenance	3
CIVE 473	Structural Design of Buildings	3
CIVE 475	Earth Structures: Embankments, Slopes and Buried Structures	3
CIVE 480	Project Management and Contract Administration	3
CIVE 482	Project Control and Life Cycle Execution of Constructed Facilities	3
CIVE 484	Project Planning, Scheduling and Control	3
CIVE 485	Construction Project Management	3
CIVE 488	Advanced Construction Management	3
CIVE 492	Urban Transit Planning and Operations	3
CIVE 493	Airport Planning and Traffic Management	3
CIVE 495	Special Topics in Civil Engineering	3
CIVE 377	Undergraduate Research	3
	Or	
CIVE 477	Undergraduate Research	3

Typical Course Sequence for BSc in Civil Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Arabic Language Elective	3

Year 2

Fall Semester

MATH 211	Differential Equations and Linear Algebra	4
ENGR 202	Data Science & AI	3
CIVE 200	Statics	3
CIVE 180	Engineering Graphics and Visualization	3

Spring Semester

MATH 251	Operations Research I	4
MATH 242	Introduction to Probability and Statistics	3
	Science Elective	3
CIVE 225	Mechanics of Solids	4
CIVE 310	Geomatics	3

Summer Semester

HUMA XXX	UAE Studies Elective	3
CIVE 335	Fluid Mechanics	4

Year 3

Fall Semester		
CIVE 332	Fundamentals of Construction Engineering & Management	3
CIVE 336	Civil Engineering Materials	4
CIVE 340	Behavior and Analysis of Structures	3
GENS 300	Career Preparation	1
CIVE 370	Introduction to Environmental Engineering	4
Spring Semester		
CIVE 338	Geotechnical Engineering	4
CIVE 380	Transportation Engineering	3
CIVE 341	Design of Steel Structures	3
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
HUMA XXX	Humanities Elective	3
	Or	
BUSS XXX	Business Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1

Year 4

Fall Semester		
CIVE 497	Senior Design Project I	3
CIVE 442	Design of Concrete Structures	3
	Technical Elective	3
	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1
Spring Semester		
CIVE 470	Foundation Engineering	4
CIVE 498	Senior Design Project II	3
	Technical Elective	3
	Technical Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1

Subtotal: 130

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

Bachelor of Science in Computer Engineering Requirements

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, 45 credits), the College of Engineering Requirements (CER, 22 credits), as well as Computer Engineering Core (48 credits) and Technical Electives requirements (15 credits). Students may also opt for the degree concentration in Software Systems. The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (17 credits)

In addition to the CER 22 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, MATH111, and MATH112.

MATH 211	Differential Equations and Linear Algebra	4
PHYS 122	University Physics II	4
MATH 232	Engineering Mathematics	3
MATH 234	Discrete Mathematics	3
MATH 243	Probability and Statistical Inference	3

Computer Engineering Core Requirements (48 credits)

ECCE 210	Digital Logic Design	4
ECCE 221	Electric Circuits I	4
ECCE 230	Object-Oriented Programming	4
ECCE 302	Signals and Systems	3
ECCE 312	Electronic Circuits & Devices	4
ECCE 316	Microprocessor Systems	4
ECCE 336	Introduction to Software Engineering	3
ECCE 342	Data Structures and Algorithms	3

ECCE 350	Computer Architecture and Organization	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4
ECCE 450	Embedded Systems	3
ECCE 497	Senior Design Project I	3
ECCE 498	Senior Design Project II	3

Computer 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 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 their technical 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.

ECCE 326	Introduction to Semiconductor Devices	4
ECCE 330	System Analysis & Software Design	3
ECCE 341	Java and Network Programming	3
ECCE 391	Independent Study I	3
ECCE 406	Instrumentation and Measurements	3
ECCE 408	Digital Systems Design	3
ECCE 410	VLSI Systems Design	3
ECCE 420	Industrial Automation	3
ECCE 432	Introduction Human-Computer Interfaces	3
ECCE 436	Software Testing and Quality Assurance	3
ECCE 438	Software Architecture	3
ECCE 440	Distributed Systems	3
ECCE 444	Computer Security	3
ECCE 446	Network Security	3
ECCE 448	Cloud Infrastructure and Services	3
ECCE 449	iOS App Development	3
ECCE 454	Artificial Intelligence	3
ECCE 456	Image Processing and Analysis	3
ECCE 463	Information and Coding Theory	3
ECCE 481	Wireless Sensor Networks and Internet of Things	3
ECCE 495	Special Topics in Electrical and Computer Engineering	3

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 (15 credits) with the following five courses (15 credits).

ECCE 330	System Analysis & Software Design	3
ECCE 432	Introduction Human-Computer Interfaces	3
ECCE 436	Software Testing and Quality Assurance	3
ECCE 438	Software Architecture	3
ECCE 444	Computer Security	3

Typical Course Sequence for a BSc in Computer Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Year 2

Fall Semester

ECCE 210	Digital Logic Design	4
MATH 232	Engineering Mathematics	3
PHYS 122	University Physics II	4
ENGR 202	Data Science & AI	3
HUMA XXX	Islamic/Arabic Studies Elective	3

Spring Semester		
MATH 211	Differential Equations and Linear Algebra	4
ECCE 230	Object-Oriented Programming	4
MATH 243	Probability and Statistical Inference	3
ECCE 221	Electric Circuits I	4
Year 3		
Fall Semester		
ECCE 336	Introduction to Software Engineering	3
ECCE 302	Signals and Systems	3
ECCE 350	Computer Architecture and Organization	3
MATH 234	Discrete Mathematics	3
ECCE 316	Microprocessor Systems	4
GENS 300	Career Preparation	1
Spring Semester		
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4
ECCE 312	Electronic Circuits & Devices	4
ECCE 342	Data Structures and Algorithms	3
BUSS XXX	Business Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1
Year 4		
Fall Semester		
ECCE 450	Embedded Systems	3
	Technical Elective	3
	Technical Elective	3
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
GENS 400	Enhancing Employability and Job Readiness	1
ECCE 497	Senior Design Project I	3
Spring Semester		
HUMA XXX	UAE Studies Elective	3
	Technical Elective	3
	Technical Elective	3
	Technical Elective	3
ECCE 498	Senior Design Project II	3
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 130

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

Requirements

Year 1		
Fall Semester		
ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1
Spring Semester		
ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4
Year 2		
Fall Semester		
ECCE 210	Digital Logic Design	4
MATH 232	Engineering Mathematics	3
PHYS 122	University Physics II	4
ENGR 202	Data Science & AI	3
HUMA XXX	Islamic/Arabic Studies Elective	3
Spring Semester		
MATH 211	Differential Equations and Linear Algebra	4
ECCE 230	Object-Oriented Programming	4
MATH 243	Probability and Statistical Inference	3
ECCE 221	Electric Circuits I	4
Year 3		
Fall Semester		
ECCE 336	Introduction to Software Engineering	3
ECCE 302	Signals and Systems	3
ECCE 350	Computer Architecture and Organization	3
MATH 234	Discrete Mathematics	3
ECCE 316	Microprocessor Systems	4
GENS 300	Career Preparation	1

Spring Semester		
ECCE 312	Electronic Circuits & Devices	4
ECCE 342	Data Structures and Algorithms	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4
BUSS XXX	Business Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1
Year 4		
Fall Semester		
ECCE 450	Embedded Systems	3
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
ECCE 330	System Analysis & Software Design	3
ECCE 444	Computer Security	3
ECCE 497	Senior Design Project I	3
GENS 400	Enhancing Employability and Job Readiness	1
Spring Semester		
HUMA XXX	UAE Studies Elective	3
ECCE 436	Software Testing and Quality Assurance	3
ECCE 438	Software Architecture	3
ECCE 432	Introduction Human-Computer Interfaces	3
ECCE 498	Senior Design Project II	3
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 130

Bachelor of Science in Computer Science

Bachelor of Science in Computer Science Requirements

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, 45 credits), the College of Engineering Requirements (CER, 20 credits), as well as Computer Science Core (47 credits), and Technical Electives requirements (18 credits). The normal length of the program is 130 credits. Students may also opt for a concentration in Artificial Intelligence or Cybersecurity.

Additional Math/Sciences Requirements (15 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: CHEM 115, PHYS 121, MATH 111, and MATH 112.

MATH 204	Linear Algebra	3
MATH 214	Mathematical and Statistical Software	3
MATH 232	Engineering Mathematics	3
MATH 234	Discrete Mathematics	3
MATH 242	Introduction to Probability and Statistics	3

Computer Science Core Requirements (47 credits)

COSC 101	Foundations of Computer Science	3
COSC 201	Computer Systems Organization	3
ECCE 230	Object-Oriented Programming	4
ECCE 336	Introduction to Software Engineering	3
COSC 301	Automata, Computability, and Complexity	3
COSC 310	Data Structures	3
COSC 312	Design and Analysis of Algorithms	3
COSC 320	Principles of Programming Languages	3
COSC 330	Introduction to Artificial Intelligence	3
COSC 340	Introduction to Computer Security	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4
ECCE 434	Database Systems	3
COSC 497	Senior Design Project I	3
COSC 498	Senior Design Project II	3

Computer Science Technical Electives (18 credits)

Students are required to take a total of 18 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 401	Computational Social Science	3
COSC 410	Parallel and Distributed Computing	3
COSC 412	Numerical Computing	3
COSC 430	Data Analytics	3
COSC 432	Algorithmic Robotics	3
COSC 434	Introduction to Machine Learning	3
COSC 435	Introduction to AI/ML for Cybersecurity	3
COSC 440	Digital Forensics	3
COSC 442	Applied Cryptography	3
COSC 452	Human-Computer Interaction	3
COSC 454	Computer Graphics	3
COSC 460	Bioinformatics and Genomic Data Science	3
COSC 462	Mobile and Web Applications Development	3
COSC 464	Natural Language Processing	3
COSC 496	Artificial Intelligence Project	3

ECCE 341	Java and Network Programming	3
ECCE 436	Software Testing and Quality Assurance	3
ECCE 438	Software Architecture	3
ECCE 440	Distributed Systems	3
ECCE 446	Network Security	3
ECCE 448	Cloud Infrastructure and Services	3
ECCE 449	iOS App Development	3
ECCE 456	Image Processing and Analysis	3
ECCE 463	Information and Coding Theory	3
ECCE 481	Wireless Sensor Networks and Internet of Things	3
COSC 377	Undergraduate Research	3
	Or	
COSC 477	Undergraduate Research	3

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). The concentration consists of 15 credits in the specialized area.

Artificial Intelligence Concentration

COSC 330	Introduction to Artificial Intelligence	3
COSC 340	Introduction to Computer Security	3
COSC 430	Data Analytics	3
COSC 434	Introduction to Machine Learning	3
COSC 432	Algorithmic Robotics	3
COSC XXX	Artificial Intelligence Elective	3

COSC XXX (Artificial Intelligence Elective): From an approved list of courses.

Cyber Security Concentration

COSC 340	Introduction to Computer Security	3
COSC 435	Introduction to AI/ML for Cybersecurity	3
ECCE 446	Network Security	3
COSC 440	Digital Forensics	3
COSC 442	Applied Cryptography	3

Typical Course Sequence for a BSc in Computer Science

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
GENS 101	Grand Challenges	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

COSC 101	Foundations of Computer Science	3
MATH 204	Linear Algebra	3
MATH 242	Introduction to Probability and Statistics	3
ECCE 230	Object-Oriented Programming	4
ENGR 202	Data Science & AI	3

Spring Semester

COSC 201	Computer Systems Organization	3
MATH 214	Mathematical and Statistical Software	3
MATH 232	Engineering Mathematics	3
MATH 234	Discrete Mathematics	3
ECCE 342	Data Structures and Algorithms	3

Summer Semester

HUMA XXX	UAE Studies Elective	3

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3

COSC 301	Automata, Computability, and Complexity	3
ECCE 336	Introduction to Software Engineering	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4

Spring Semester

COSC 312	Design and Analysis of Algorithms	3
COSC 320	Principles of Programming Languages	3
COSC 330	Introduction to Artificial Intelligence	3
COSC 340	Introduction to Computer Security	3
GENS 300	Career Preparation	1

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

COSC 497	Senior Design Project I	3
ECCE 434	Database Systems	3
	Technical Elective	3
	Technical Elective	3
	Technical Elective	3

Spring Semester

COSC 498	Senior Design Project II	3
BUSS XXX	Business Elective	3
	Technical Elective	3
	Technical Elective	3
	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 130

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

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
GENS 101	Grand Challenges	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

COSC 101	Foundations of Computer Science	3
MATH 204	Linear Algebra	3
MATH 242	Introduction to Probability and Statistics	3
ECCE 230	Object-Oriented Programming	4
ENGR 202	Data Science & AI	3

Spring Semester

MATH 232	Engineering Mathematics	3
MATH 214	Mathematical and Statistical Software	3
MATH 234	Discrete Mathematics	3
COSC 201	Computer Systems Organization	3
ECCE 342	Data Structures and Algorithms	3

Summer Semester

HUMA XXX	UAE Studies Elective	3

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
COSC 301	Automata, Computability, and Complexity	3
ECCE 336	Introduction to Software Engineering	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4

Spring Semester

COSC 312	Design and Analysis of Algorithms	3

COSC 320	Principles of Programming Languages	3
COSC 330	Introduction to Artificial Intelligence	3
COSC 340	Introduction to Computer Security	3
GENS 300	Career Preparation	1

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

COSC 497	Senior Design Project I	3
COSC 430	Data Analytics	3
COSC 434	Introduction to Machine Learning	3
ECCE 434	Database Systems	3
	Technical Elective	3

Spring Semester

COSC 498	Senior Design Project II	3
COSC 432	Algorithmic Robotics	3
COSC XXX	Artificial Intelligence Elective	3
BUSS XXX	Business Elective	3
	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 130

Typical Course Sequence for BSc in Computer Science with Cybersecurity Concentration

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
GENS 101	Grand Challenges	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

COSC 101	Foundations of Computer Science	3
MATH 204	Linear Algebra	3
MATH 242	Introduction to Probability and Statistics	3
ENGR 202	Data Science & AI	3
ECCE 230	Object-Oriented Programming	4

Spring Semester

COSC 201	Computer Systems Organization	3
MATH 214	Mathematical and Statistical Software	3
MATH 232	Engineering Mathematics	3
MATH 234	Discrete Mathematics	3
ECCE 342	Data Structures and Algorithms	3

Summer Semester

HUMA XXX	UAE Studies Elective	3

Year 3

Fall Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
COSC 301	Automata, Computability, and Complexity	3
ECCE 336	Introduction to Software Engineering	3
ECCE 354	Operating Systems	3
ECCE 356	Computer Networks	4

Spring Semester

COSC 312	Design and Analysis of Algorithms	3
COSC 320	Principles of Programming Languages	3
COSC 330	Introduction to Artificial Intelligence	3
COSC 340	Introduction to Computer Security	3
GENS 300	Career Preparation	1

Summer Semester		
ENGR 399	Engineering Internship	1
Year 4		
Fall Semester		
COSC 497	Senior Design Project I	3
ECCE 434	Database Systems	3
COSC 435	Introduction to AI/ML for Cybersecurity	3
ECCE 446	Network Security	3
COSC 440	Digital Forensics	3
Spring Semester		
COSC 498	Senior Design Project II	3
COSC 442	Applied Cryptography	3
BUSS XXX	Business Elective	3
	Technical Elective	3
	Technical Elective	3
GENS 400	Enhancing Employability and Job Readiness	1
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 130

Bachelor of Science in Electrical Engineering

Bachelor of Science in Electrical Engineering Requirements

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.

(7) 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
- Power Systems Laboratory
- Projects Laboratory
- Renewable Energy Laboratory
- Communication Systems Laboratory

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.

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, 45 credits), the College of Engineering Requirements (CER, 21 credits), as well as Electrical Engineering Core (49 credits), and Technical Electives requirements (15 credits). The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (16 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: CHEM 115, PHYS 121, MATH 111, and MATH 112.

MATH 204	Linear Algebra	3
MATH 206	Differential Equations	3
MATH 232	Engineering Mathematics	3
MATH 243	Probability and Statistical Inference	3
PHYS 122	University Physics II	4

Electrical Engineering Core Requirements (49 credits)

ECCE 210	Digital Logic Design	4
ECCE 221	Electric Circuits I	4
ECCE 222	Electric Circuits II	3
ECCE 302	Signals and Systems	3
ECCE 312	Electronic Circuits & Devices	4
ECCE 316	Microprocessor Systems	4
ECCE 320	Applied Electromagnetics	3
ECCE 322	Electrical Machines	4
ECCE 323	Feedback Control Systems	4
ECCE 360	Communication Systems	4
ECCE 402	Digital Signal Processing	3
ECCE 421	Power System Analysis	3
ECCE 497	Senior Design Project I	3
ECCE 498	Senior Design Project II	3

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 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.

ECCE 422	High Voltage Engineering	3
ECCE 423	Power Electronics	3

ECCE 424	Electrical Power Distribution Systems	3
ECCE 425	Power System Stability and Control	3
ECCE 426	Electric Drives and Renewable Resources	3
ECCE 427	Power System Protection and Relays	3
ECCE 406	Instrumentation and Measurements	3
ECCE 420	Industrial Automation	3
ECCE 428	Modern Control Systems	3
ECCE 429	Digital Control Systems	3
ECCE 362	Digital Communications I	3
ECCE 460	Wireless Communications	3
ECCE 461	Advanced Digital Communications	3
ECCE 462	Communication Systems Design and Prototyping	3
ECCE 463	Information and Coding Theory	3
ECCE 470	Antennas and Propagation	3
ECCE 472	Optical Communications and Networks	3
ECCE 481	Wireless Sensor Networks and Internet of Things	3
ECCE 484	Satellite and Space Communications	3
ECCE 326	Introduction to Semiconductor Devices	4
ECCE 404	Microwave Circuits and Devices	3
ECCE 408	Digital Systems Design	3
ECCE 410	VLSI Systems Design	3
ECCE 411	Analog Integrated Circuits Design	3
ECCE 450	Embedded Systems	3
ECCE 377	Undergraduate Research	3
	Or	
ECCE 477	Undergraduate Research	3

Typical Course Sequence for BSc in Electrical Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
GENS 101	Grand Challenges	4
CHEM 115	General Chemistry I	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

MATH 232	Engineering Mathematics	3
PHYS 122	University Physics II	4
MATH 204	Linear Algebra	3
ECCE 221	Electric Circuits I	4
ENGR 202	Data Science & AI	3

Spring Semester

MATH 206	Differential Equations	3
MATH 243	Probability and Statistical Inference	3
ECCE 210	Digital Logic Design	4
ECCE 222	Electric Circuits II	3
ECCE 320	Applied Electromagnetics	3

Year 3

Fall Semester

ECCE 302	Signals and Systems	3
ECCE 312	Electronic Circuits & Devices	4
ECCE 322	Electrical Machines	4
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
GENS 300	Career Preparation	1

Spring Semester

ECCE 316	Microprocessor Systems	4
ECCE 323	Feedback Control Systems	4
ECCE 360	Communication Systems	4
ECCE 421	Power System Analysis	3

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

	Technical Elective	3

	Technical Elective	3
ECCE 402	Digital Signal Processing	3
ECCE 497	Senior Design Project I	3
HUMA XXX	UAE Studies Elective	3
GENS 400	Enhancing Employability and Job Readiness	1

Spring Semester

	Technical Elective	3
	Technical Elective	3
	Technical Elective	3
BUSS XXX	Business Elective	3
ECCE 498	Senior Design Project II	3

Summer Semester

ENGR 399	Engineering Internship	1

Subtotal: 130

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	4
ECCE 342	Data Structures and Algorithms	3

ECCE 230 and ECCE 342: Or equivalent.

Core Courses

COSC 330	Introduction to Artificial Intelligence	3
COSC 434	Introduction to Machine Learning	3

AI Elective Courses (Choose one)

COSC 430	Data Analytics	3
COSC 432	Algorithmic Robotics	3

AI Project

COSC 496	Artificial Intelligence Project	3

Department of Management Science and Engineering

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.

Engineering Systems and Management (ESMA) program requires strong analytical and creative thinking skills for effective decision-making. Engineering Systems and Management 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.

ESMA 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 Engineering Systems and Management

Bachelor of Science in Engineering Systems and Management Requirements

BSc in Engineering Systems and Management 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 engineering managers and systems engineers.
- Qualified graduates will pursue advanced study if they so desire.

Student Learning Outcomes

Students graduating with a BSc in Engineering Systems and Management 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 (SCORE)
- Industrial Visualization Laboratory
- Mini- Factory Laboratory

Professional Chapters

IISE Student Chapter

The objectives of the Institute of Industrial and Systems Engineers (IISE) student **c**hapter 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 Engineering Systems and Management, students must satisfactorily complete the courses in the specified categories as set out below. The categories cover the University General Education Requirements (GER, 45 credits), College of Engineering Requirements (CER, 19 credits), as well as the Engineering Systems and Management Core (56 credits), Free Electives (3 credits), and Technical Electives (6 credits) requirements. The normal length of the program is 129 credits.

Additional Math/Sciences Requirements (14 credits)

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

MATH 211	Differential Equations and Linear Algebra	4
MATH 242	Introduction to Probability and Statistics	3
MATH 251	Operations Research I	4
MATH 331	Stochastic Processes	3

Engineering Systems and Management Core Requirements (56 credits)

ESMA 200	Engineering Economic Analysis	3
ESMA 201	Introduction to Engineering Systems and Management	3
ESMA 271	Modern Methods of Manufacturing	4
ESMA 311	Quality & Reliability Engineering	4
ESMA 341	Simulation Modeling &Analysis	4
ESMA 351	Production and Operations Management	3
ESMA 360	Design for People	4
ESMA 362	Systems Project Management	3
ESMA 411	Operational Excellence	3
ESMA 430	Supply Chain and Logistics	4
ESMA 440	Fundamentals of Business Analytics	3
ESMA 451	Operations Research II	3
ESMA 462	Engineering Systems Design	3
ESMA 497	Senior Design Project I	3
ESMA 498	Senior Design Project II	3
BUSS 150	Introduction to Economics	3
BUSS 361	Business and Sustainability	3

Engineering Systems and Management Technical Course Electives (6 credits)

The following is a sample list of courses that will satisfy the technical electives for the BSc in Engineering Systems and Management. 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.

ESMA 361	Data and Information Engineering	3
ESMA 395	Special Topins in ISYE	3
ESMA 432	Advanced Stochastic Processes	3
ESMA 433	Advanced Statistics	3
ESMA 441	Advanced Simulation	3
ESMA 444	Healthcare Analytics and Management	3
ESMA 461	Engineering Psychology	3
ESMA 475	Facilities Planning and Warehousing	4
ESMA 480	Financial Engineering	3
ESMA 495	Special Topics in ISYE	3
ESMA 377	Undergraduate Research Or	3
ESMA 477	Undergraduate Research	3

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.

	Free Elective	3

Engineering Systems and Management Track (optional)

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

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

ESMA 440	Fundamentals of Business Analytics	3

Two of the following courses

ESMA 444	Healthcare Analytics and Management	3
ESMA 445	Six-Sigma Methodology & Applications	3
ESMA 441	Advanced Simulation	3

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

Typical Course Sequence for BSc in Engineering Systems and Management

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

BUSS 150	Introduction to Economics	3

Year 2

Fall Semester

MATH 242	Introduction to Probability and Statistics	3
BUSS 201	Fundamentals of Accounting and Finance	3
MATH 211	Differential Equations and Linear Algebra	4
ENGR 202	Data Science & AI	3
ESMA 201	Introduction to Engineering Systems and Management	3

Spring Semester

HUMA XXX	UAE Studies Elective	3
ESMA 200	Engineering Economic Analysis	3
MATH 251	Operations Research I	4
ESMA 271	Modern Methods of Manufacturing	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 3

Fall Semester

ESMA 311	Quality & Reliability Engineering	4
ESMA 341	Simulation Modeling &Analysis	4
ESMA 351	Production and Operations Management	3
GENS 300	Career Preparation	1
	Free Elective	3

Spring Semester

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
ESMA 362	Systems Project Management	3
MATH 331	Stochastic Processes	3
BUSS 361	Business and Sustainability	3
ESMA 360	Design for People	4

Summer Semester

ENGR 399	Engineering Internship	1

Year 4

Fall Semester

	Technical Elective	3
ESMA 430	Supply Chain and Logistics	4
ESMA 440	Fundamentals of Business Analytics	3

ESMA 451	Operations Research II	3
ESMA 497	Senior Design Project I	3
Spring Semester		
ESMA 462	Engineering Systems Design	3
ESMA 411	Operational Excellence	3
GENS 400	Enhancing Employability and Job Readiness	1
	Technical Elective	3
ESMA 498	Senior Design Project II	3
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 129

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, data analytics, 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 data analytic-based techniques to produce relevant information for stakeholders.
- Interpret costing methods to determine best product or process costing choices to maximize business profitability and management efficiency.
- 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, technology management, funding, employee relations, entrepreneurship to enable efficient management of 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 and forecasts to determine economy and industry performance, at macro and micro levels.
- 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
BUSS 201	Fundamentals of Accounting and Finance	3
BUSS 301	Corporate Leadership and Human Resource Management	3

BUSS 322	Fundamentals of Innovation and Entrepreneurship	3

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 Communication	3
BUSS 203	Environmental Economics	3
BUSS 204	Introduction to Organizational Management	3
BUSS 205	Business Forecasting	3
BUSS 344	Managerial Finance	3
BUSS 374	Managerial Accounting	3
BUSS 361	Business and Sustainability	3
BUSS 456	Investments & Portfolio Management	3
BUSS 339	Econometrics	3
BUSS 350	Economics	3
BUSS 381	Macroeconomics and the UAE Economy	3

Department of Mechanical and Nuclear 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.

Minor in Nuclear Engineering

The minor in nuclear engineering is designed to provide undergraduate students from other appropriate engineering programs with the fundamental concepts and practices of nuclear engineering, necessary to equip them with a sound understanding of nuclear engineering.

The minor in nuclear engineering is intended to allow students to develop an understanding of the fundamentals of nuclear physics and engineering. It is designed to provide students with the essentials necessary for employment in nuclear- related fields. Students considering nuclear graduate programs would also benefit from the minor in nuclear engineering. The courses designed for this minor will cover the following fundamental nuclear engineering areas, necessary to achieve the program goals and learning outcomes:

1. Radiation science and health physics
2. Nuclear reactor physics
3. Nuclear systems and operation
4. Nuclear thermal hydraulics
5. Materials in nuclear power plants

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) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) 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) Communicate effectively with a range of audiences.

(4) 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) Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

(6) Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

(7) Acquire and apply new knowledge as needed, using appropriate learning strategies.

Minor Requirements

Minor in Nuclear Engineering Requirements

The interested students in the nuclear engineering minor program are required to take 5 courses (15 credit hours), from the list of courses provided below, with minimum of 12 extra credit hours in addition to the ones required by their major. For the students from mechanical, chemical and petroleum, and aerospace, NUCE 303 could be waived (if the students took the equivalent course (s) from their major). Hence, they would only need to take four courses from the minor program.

NUCE 301	Radiation Science & Health Physics	3
NUCE 303	Mechanics & Thermal-hydraulics Principles for Nuclear Engineering	3
NUCE 304	Evaluative Methods for Nuclear Non-proliferation and Security	3
NUCE 401	Introduction to Nuclear Reactor Physics	3
NUCE 402	Introduction to Nuclear Systems and Operation	3
NUCE 352	Materials in Nuclear Power Plants	3

Bachelor of Science in Mechanical Engineering

Bachelor of Science in Mechanical Engineering Requirements

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, 45 credits), College of Engineering Requirements (CER, 19 credits), as well as the Mechanical Engineering Core and Technical Electives requirements of 66 credits. The normal length of the program is 130 credits.

Additional Math/Sciences Requirements (14 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: CHEM 115, PHYS 121, PHYS 122, MATH 111, and MATH 112.

MATH 231	Calculus III	3
MATH 243	Probability and Statistical Inference	3
PHYS 122	University Physics II	4
MATH 211	Differential Equations and Linear Algebra	4

Mechanical Engineering Core Requirements (60 credits)

MEEN 180	Computer Aided Design	3
MEEN 200	Statics	3
MEEN 201	Engineering Dynamics	3
MEEN 225	Engineering Materials	4
MEEN 240	Thermodynamics	3
MEEN 325	Mechanics of Solids	4
MEEN 335	Fluid Mechanics	4
MEEN 343	Heat Transfer	4
MEEN 350	Dynamic Systems and Vibration	3
MEEN 356	Computer-Controlled Systems	4

MEEN 360	Computational Methods for Mechanical Engineers	3
MEEN 370	Introduction to Manufacturing Processes	4
MEEN 387	Machine Element Design	3
MEEN 441	Applied Thermodynamics	3
MEEN 455	Finite Element Analysis	3
MEEN 484	Mechatronics	3
MEEN 497	Senior Design Project I	3
MEEN 498	Senior Design Project II	3

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.

MEEN 301	Introduction to Artificial Intelligence and its Applications in Mechanical Engineering	3
MEEN 380	Introduction to Polymer Science and Engineering	3
MEEN 377	Undergraduate Research	3
	Or	
MEEN 477	Undergraduate Research	3
MEEN 405	Vibration Analysis	3
MEEN 410	Viscous and Boundary Layer Flows	3
MEEN 420	Materials: Strength & Fracture	3
MEEN 421	Mechanics of Deformable Solids	3
MEEN 422	Fatigue and Fracture Analysis	3
MEEN 423	Physical Metallurgy	3
MEEN 435	Turbomachinery	3
MEEN 446	Internal Combustion Engines	3
MEEN 450	Vehicle Engineering	3
MEEN 454	Refrigeration, Air Conditioning and Cryogenics	3
MEEN 465	Bioengineering	3
MEEN 485	Introduction to Robotics	3
MEEN 486	Renewable & Sustainable Energy	3
MEEN 495	Special Topics in Mechanical Engineering	3

Typical Course Sequence for BSc in Mechanical Engineering

Requirements

Year 1

Fall Semester

ENGL 101	Academic English I	3
MATH 111	Calculus I	4
CHEM 115	General Chemistry I	4
GENS 101	Grand Challenges	4
GENS 100	Academic Development & Success	1

Spring Semester

ENGL 102	Academic English II	3
MATH 112	Calculus II	4
PHYS 121	University Physics I	4
COSC 114	Introduction to Computing Using Python	4

Summer Semester

HUMA XXX	Islamic/Arabic Studies Elective	3

Year 2

Fall Semester

MEEN 180	Computer Aided Design	3
PHYS 122	University Physics II	4
MATH 231	Calculus III	3
MEEN 200	Statics	3
MATH 211	Differential Equations and Linear Algebra	4

Spring Semester

MEEN 201	Engineering Dynamics	3
MEEN 225	Engineering Materials	4
MEEN 240	Thermodynamics	3
MATH 243	Probability and Statistical Inference	3
GENS 300	Career Preparation	1
HUMA XXX	UAE Studies Elective	3

Year 3

Fall Semester

MEEN 325	Mechanics of Solids	4
MEEN 335	Fluid Mechanics	4
MEEN 350	Dynamic Systems and Vibration	3
MEEN 360	Computational Methods for Mechanical Engineers	3
ENGR 202	Data Science & AI	3

Spring Semester		
BUSS 322	Fundamentals of Innovation and Entrepreneurship	3
MEEN 370	Introduction to Manufacturing Processes	4
MEEN 343	Heat Transfer	4
MEEN 356	Computer-Controlled Systems	4
MEEN 387	Machine Element Design	3
Summer Semester		
ENGR 399	Engineering Internship	1
Year 4		
Fall Semester		
BUSS XXX	Business Elective	3
MEEN 455	Finite Element Analysis	3
MEEN 484	Mechatronics	3
MEEN 441	Applied Thermodynamics	3
MEEN 497	Senior Design Project I	3
Spring Semester		
GENS 400	Enhancing Employability and Job Readiness	1
MEEN 498	Senior Design Project II	3
MEEN XXX	Major Elective	3
	Technical Elective	3
Summer Semester		
ENGR 399	Engineering Internship	1
		Subtotal: 130

Courses

AERO - Aerospace Engineering

AERO 200 - Statics (3)

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.

Prerequisite: PHYS 121. Offered: Fall Spring.

AERO 201 - Engineering Dynamics (3)

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.

Prerequisite: AERO 200. Corequisite: MATH211. Offered: Fall Spring Summer.

AERO 215 - Introduction to Aerospace Engineering (3)

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.

Prerequisite: GENS101, AERO 200. Offered: Fall Spring.

AERO 225 - Mechanics of Solids (4)

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.

Prerequisite: AERO 200. Offered: Fall Spring.

AERO 240 - Thermofluids for Aerospace Engineering (4)

This course introduces the students to the concepts of fluids, energy, and entropy. The fundamentals of thermodynamics, fluid mechanics, and heat transfer are introduced. The conservation axioms of mass, momentum, and energy are described and discussed in integral form. Emphasis is placed on employing these concepts to analyze steady-flow engineering applications.

Prerequisite: PHYS 121, CHEM 115. Offered: Fall Spring.

AERO 320 - Aerospace Materials (3)

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.

Prerequisite: PHYS 121. Offered: Fall Spring.

AERO 321 - Aerospace Structures (3)

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.

Prerequisite: AERO 225. Offered: Fall Spring.

AERO 335 - Aerodynamics I (4)

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.

Prerequisite: AERO 215, MATH 231. Offered: Fall Spring.

AERO 336 - Aerodynamics II (3)

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.

Prerequisite: AERO 240, AERO 335. Offered: Fall Spring.

AERO 350 - Dynamic Systems and Control (4)

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.

Prerequisite: AERO201, PHYS122, MATH211. Offered: Fall Spring.

AERO 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

AERO 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

AERO 395 - Special Topics in Aerospace Engineering (3)

This course mainly deals with new trends in Aerospace Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

AERO 401 - UAV Modeling and Control (3)

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.

Prerequisite: MEEN300, or (AERO201, or MEEN201), (AERO350, or MEEN356). Offered: Fall Spring.

AERO 402 - UAV Sensing (3)

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.

Prerequisite: (ECCE302, or ECCE300). Corequisite: ECCE356. Offered: Spring.

AERO 403 - UAV Navigation (3)

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.

Prerequisite: AERO401, AERO402.

AERO 404 - UAV Systems (3)

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.

Prerequisite: AERO401, AERO402. Corequisite: AERO403. Offered: Spring.

AERO 415 - Aerospace Materials Manufacturing (3)

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, additive manufacturing and metal manufacturing processes. Discussions will be presented on important material properties that influence different manufacturing processes.

Prerequisite: AERO225, AERO320. Offered: Fall Spring.

AERO 426 - Composite Materials Design (3)

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.

Prerequisite: AERO225, or CIVE225, or MEEN325. Offered: Fall Spring.

AERO 430 - Intermediate Aerodynamics (3)

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.

Prerequisite: AERO336.

AERO 431 - Viscous Flows (3)

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.

Prerequisite: AERO336.

AERO 433 - Introduction to Computational Fluid Dynamics (3)

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.

Prerequisite: AERO335, or MEEN335. Offered: Fall.

AERO 435 - Rotorcraft Aerodynamics and Performance (3)

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.

Prerequisite: AERO335. Offered: Fall Spring.

AERO 440 - Aerospace Propulsion (3)

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.

Prerequisite: AERO336. Offered: Fall Spring.

AERO 441 - Introduction to Combustion (3)

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.

Prerequisite: AERO240, or MEEN240. Offered: Fall Spring.

AERO 450 - Flight Dynamics and Stability (3)

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.

Prerequisite: AERO335, AERO350. Offered: Fall Spring.

AERO 461 - Aviation Management and Certification (3)

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.

Prerequisite: Senior standing. Offered: Fall.

AERO 465 - Space Dynamics and Control (3)

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.

Prerequisite: AERO350. Offered: Fall Spring.

AERO 470 - Aircraft Design Laboratory (4)

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.

Prerequisite: AERO225, AERO335, AERO350. Offered: Fall Spring.

AERO 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Spring.

AERO 480 - Aerospace Vehicle Performance (3)

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.

Corequisite: AERO 440. Offered: Fall Spring.

AERO 485 - Spacecraft Design (3)

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.

Prerequisite: AERO350. Offered: Spring.

AERO 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

AERO 495 - Special Topics in Aerospace Engineering (3)

This course mainly deals with new trends in Aerospace Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

AERO 497 - Senior Design Project I (3)

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.

Prerequisite: Senior Standing and approval of department. Offered: Fall Spring.

AERO 498 - Senior Design Project 2 (3)

Prerequisite: AERO 497. Offered: Fall Spring.

ARBH - Arabic Heritage and Culture

ARBH 002 - Introduction to Modern Standard Arabic (0)

Offered: Fall.

BIOL - Biology

BIOL 101 - Fundamentals of Biology (3)

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.

Offered: Fall Spring Summer.

BIOL 111 - General Biology I (3)

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.

Offered: Fall Spring Summer.

BIOL 112 - General Biology II (4)

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.

Prerequisite: BIOL111. Offered: Fall Spring.

BIOL 211 - General Genetics (4)

This course introduces fundamental concepts of Mendelian and molecular genetics such as functions of genetic material, mechanisms of inheritance, and genetic mutations. Additionally, the course discusses epigenetic modifications and their relationship to chromatin states. Finally, the course discusses population genetics and the factors behind genetic variation within populations. In addition to theoretical knowledge, case studies from the medical literature are introduced so students can link theory and practice.

Prerequisite: BIOL111. Offered: Fall Spring.

BIOL 221 - Applied Microbiology (4)

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.

Prerequisite: BIOL112. Offered: Spring.

BIOL 301 - Cell Biology (3)

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.

Prerequisite: BIOL112. Offered: Fall Spring.

BIOL 312 - Biochemistry II (3)

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.

Prerequisite: CHEM311. Offered: Fall Spring.

BIOL 331 - Physiology (3)

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

Prerequisite: BIOL301. Offered: Spring.

BIOL 335 - Developmental Biology (3)

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

Prerequisite: BIOL301. Offered: Fall.

BIOL 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing.

BIOL 399 - Internship (1)

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.

Prerequisite: SDAS 300. Offered: Summer.

BIOL 411 - Immunology (3)

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.

Prerequisite: BIOL301, BIOL221.

BIOL 430 - Bioinformatics (4)

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.

Prerequisite: BIOL 312, BMED 342.

BIOL 431 - Bioinformatics (3)

This course introduces future life scientists to bioinformatics, tools and analysis methods. Fundamental and current topics in bioinformatics, genomics, proteomics, transcriptomics, as well as epigenomics are highlighted. Students are 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

Prerequisite: BMED342, or BIOL312.

BIOL 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing.

BIOL 497 - Senior Research Project I (3)

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.

Prerequisite: Senior Standing or approval of department. Offered: Fall.

BIOL 498 - Senior Research Project II (3)

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.

Prerequisite: BIOL497.

BMED - Biomedical Engineering

BMED 202 - Biomedical Engineering Fundamentals (4)

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.

Prerequisite: GENS101. Corequisite: PHYS122, MATH211. Offered: Fall Spring.

BMED 211 - Human Anatomy (4)

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.

Prerequisite: MATH112. Corequisite: BMED202, BIOL111. Offered: Fall Spring.

BMED 212 - Physiological Systems & Modeling II (4)

The primary objective of this course is to apply the principles and concepts grasped in BMED 211 (Physiological Systems and Modeling I) to model the physiology of muscle, cardiovascular, respiratory, digestive, renal, and immune systems. The course introduces these physiological systems, coupled with modeling techniques of higher complexity. The student created models will relate to pathophysiology of the respective systems.

Prerequisite: BMED211. Offered: Fall Spring Summer.

BMED 221 - Human Anatomy and Physiological Modeling for Engineers (4)

The primary objective of this course is to provide the information of structure and basic function of the human body. Students will learn the anatomy and physiology of the following systems: skeletal, muscular, nervous, endocrine, circulatory, respiratory, digestive, and urinary.

Prerequisite: BIOL112.

BMED 321 - Mechanics for Biomedical Engineers (4)

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.

Prerequisite: BMED202, MATH211 . Offered: Fall Spring.

BMED 322 - Functional Biomechanics (4)

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.

Prerequisite: BMED321, BMED212. Offered: Fall Spring.

BMED 331 - Biotransport Phenomena (3)

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.

Corequisite: BMED212, MATH211. Offered: Fall Spring.

BMED 341 - Molecular Cell Biology (4)

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.

Prerequisite: (CHEM201, or CHEM211. Corequisite: BMED212. Offered: Fall Spring.

BMED 342 - Molecular Genetics, Technologies and Tools (4)

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, emerging novel technologies in genomics and analysis tools, the roles of genetics in the etiologyaetiology, pathophysiology, treatment of disease, as well as interpretation of and application of research data.

Prerequisite: BMED341. Offered: Fall Spring.

BMED 351 - Biomedical Circuits and Signals (4)

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.

Prerequisite: BMED212, PHYS122. Offered: Fall Spring.

BMED 352 - Fundamentals of Biomedical Signal Processing (4)

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.

Prerequisite: BMED351. Offered: Fall Spring.

BMED 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring.

BMED 391 - Independent Study II (4)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

BMED 395 - Special Topics in Biomedical Engineering (3)

This course mainly deals with new trends in Biomedical Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring Summer.

BMED 411 - Biomaterials (4)

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).

Prerequisite: BMED321. Corequisite: BMED341. Offered: Fall Spring.

BMED 412 - Regenerative Medicine (4)

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.

Prerequisite: BMED211. Corequisite: BMED341. Offered: Fall Spring.

BMED 413 - Application of Bio-molecular Tools (3)

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.

Prerequisite: CHEM211, or CHEM221. Offered: Spring.

BMED 421 - Physiological Control Systems (4)

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.

Prerequisite: BMED352, BMED322. Offered: Fall Spring.

BMED 422 - Rehabilitation Engineering (4)

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.

Prerequisite: BMED322, BMED352. Offered: Fall Spring.

BMED 423 - Biorobotics and Medical Device Design (4)

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.

Prerequisite: BMED322, BMED352. Offered: Fall.

BMED 430 - Bioinformatics (4)

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.

Prerequisite: MATH211, (ENGR114 or COSC114). Offered: Fall Spring.

BMED 431 - Data Mining and Machine Learning for Bioinformatics (3)

The course provides the students a comprehensive discussion of data-intensive computations and hands-on experience on applications of data mining and machine learning in the area of bioinformatics, scaffolding the concept of decision support systems and exploring advanced methodologies.. The course also covers information retrieval, feature selection, feature extraction, visualization, unsupervised learning, and supervised learning techniques for analyzing and extracting patterns from bioinformatics dataset, surfacing potential models and associations with the pathologies and their effects related to the examined datasets.

Prerequisite: BMED430. Offered: Spring.

BMED 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

BMED 491 - Independent Study III (4)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

BMED 495 - Special Topics in Biomedical Engineering (4)

This course mainly deals with new trends in Biomedical Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

BMED 496 - Data Measurement, Modeling and Analysis in Biomedical Engineering (1)

This course presents the fundamentals of data collection, modeling and analysis of diverse biomedical signals/systems, with particular emphasis on consideration of ethical principles and required biomedical standards applications in biomedical research and clinical medicine. Topics include data collection, analysis, filtering, coding, feature extraction, and modeling, in addition to biomedical standards and ethics, in a variety of cutting-edge biomedical engineering areas (e.g., biomechanics, neuro

engineering, biorobotics, cardiovascular engineering, wearables, bioinformatics).

Prerequisite: (ENGR111, or GENS101),(ENGR112, or ENGR113 or ENGR114, or COSC114). Offered: Fall Spring.

BMED 497 - Senior Design Project I (3)

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.

Prerequisite: Senior standing and approval of department. Offered: Fall Spring.

BMED 498 - Senior Design Project II (3)

Prerequisite: BMED497. Offered: Fall Spring.

BUSS - Business Studies

BUSS 150 - Introduction to Economics (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

BUSS 201 - Fundamentals of Accounting and Finance (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

BUSS 202 - Business Communication (3)

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.

Prerequisite: ENGL102. Offered: Spring.

BUSS 203 - Environmental Economics (3)

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.

Prerequisite: BUSS150. Offered: Spring.

BUSS 204 - Introduction to Organizational Management (3)

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.

Prerequisite: ENGL102.

BUSS 205 - Business Forecasting (3)

Prerequisite: MATH111. Offered: Fall Spring.

BUSS 296 - Directed Studies (3)

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.

Offered: Spring Summer.

BUSS 301 - Corporate Leadership and Human Resource Management (3)

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

Prerequisite: Junior standing. Offered: Fall Spring Summer.

BUSS 322 - Fundamentals of Innovation and Entrepreneurship (3)

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. Major topics include the design thinking process, lean startup methods, and principles of change and growth in entrepreneurial enterprises.

Prerequisite: Junior standing. Offered: Fall Spring Summer.

BUSS 339 - Econometrics (3)

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.

Prerequisite: BUSS150,(MATH242, or MATH243). Offered: Fall.

BUSS 344 - Managerial Finance (3)

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.

Prerequisite: BUSS201.

BUSS 350 - Economics (3)

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.

BUSS 361 - Business and Sustainability (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring.

BUSS 374 - Managerial Accounting (3)

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.

Prerequisite: BUSS201. Offered: Fall Spring.

BUSS 381 - Macroeconomics and the UAE Economy (3)

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.

Prerequisite: BUSS150. Offered: Spring.

BUSS 395 - Special Topics in Business Studies (3)

Offered: Fall Spring.

BUSS 3XX - Bussiness Elective

Offered: Fall Spring Summer.

BUSS 456 - Investments & Portfolio Management (3)

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.

Prerequisite: MATH231, (MATH204, or MATH211), (MATH242, or MATH243).

CHEG - Chemical Engineering

CHEG 205 - Principles of Chemical Engineering (3)

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.

Prerequisite: CHEM102. Corequisite: CHEM116, PHYS121. Offered: Fall Spring.

CHEG 210 - Introduction to Biochemical Engineering (3)

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.

Prerequisite: CHEG205. Offered: Fall Spring.

CHEG 213 - Experimental Design (3)

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.

Prerequisite: MATH231. Offered: Fall Spring.

CHEG 230 - Chemical Engineering Thermodynamics I (3)

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.

Prerequisite: CHEG205. Corequisite: PHYS122. Offered: Fall Spring Summer.

CHEG 232 - Fluid Mechanics (4)

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.

Prerequisite: CHEG205. Offered: Fall Spring.

CHEG 301 - Introduction to Artificial Intelligence and its Applications in Chemical Engineering (3)

This course provides an overview of the general artificial intelligence and machine learning approaches and techniques used to solve chemical engineering problems. The course covers the concepts of the three main techniques of machine learning: supervised learning, unsupervised learning and reinforcement learning, and their applications in chemical engineering.

Prerequisite: CHEG213, CHEG312. Offered: Fall.

CHEG 312 - Numerical Methods for Chemical Engineers (3)

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.

Prerequisite: MATH211, (ENGR114, or COSC114). Offered: Fall Spring.

CHEG 324 - Mass Transfer (3)

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.

Prerequisite: CHEG335. Offered: Fall Spring Summer.

CHEG 325 - Fundamentals of Nanotechnology (3)

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.

Prerequisite: PHYS122. Offered: Fall Spring.

CHEG 332 - Chemical Engineering Thermodynamics II (3)

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.

Prerequisite: CHEG230. Offered: Fall Spring.

CHEG 335 - Heat Transfer (4)

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.

Prerequisite: CHEG230, CHEG232. Offered: Fall Spring Summer.

CHEG 340 - Chemical Extraction of Metals (3)

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.

Prerequisite: CHEG230. Offered: Fall.

CHEG 341 - Electrochemical Engineering (3)

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).

Prerequisite: CHEG230. Offered: Spring.

CHEG 350 - Materials Science & Engineering (3)

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.

Prerequisite: (CHEM116, PHYS122). Offered: Fall Spring.

CHEG 352 - Materials in Nuclear Power Plants (3)

The course covers materials (metals, alloys, ceramics, polymers, and concrete) used in nuclear power plants. Topics covered include understanding of material behavior; the effects of structure, properties, and processing of materials used in nuclear systems on their behavior in radiation environments. Emphasis is on the effect of radiation on the microstructure, mechanical, electrical, thermal and corrosion properties of materials.

Prerequisite: CHEG350. Offered: Fall.

CHEG 360 - Introduction to Hydrogen Technologies and Applications (3)

This course provides the basic knowledge on hydrogen technologies and applications. The aim of the course is to enable the students to apply these learnings in their profession, as well as taking additional specialized courses in this field. The course includes fundamental information

about hydrogen properties, an overview of different technologies to produce hydrogen, to store and transport it, depending on the needs, finalizing with hydrogen utilization in different industrial sectors, and in the context of sustainable energy.

Prerequisite: CHEG230, CHEG232. Offered: Fall.

CHEG 361 - Hydrogen Safety (3)

This course deals with the principles and practical applications of hydrogen safety in hydrogen production, distribution, and utilization facilities. The aim of this course is to provide an overview of both the theoretical and practical aspects of hydrogen safety including hydrogen production, compression/liquefaction, transport, and storage. The course will incorporate well-developed health and safety as well as legal components and be focused on critical case studies.

Prerequisite: CHEG230, CHEG232. Offered: Fall.

CHEG 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

CHEG 380 - Introduction To Polymer Science and Engineering (3)

This course aims to develop a thorough understanding about polymeric materials including a description of basic organic chemistry reactions supporting polymerization. Routes to characterize polymers in terms of molecular weight and molecular weight distribution are presented. Also, rheological and visco-elasto-plastic properties related to microstructure and thermomechanical behavior are discussed to establish structure-property relationships. The prevalence of polymer processing techniques in various industries is included.

Prerequisite: CHEM211. Offered: Fall Spring.

CHEG 381 - Polymer Chemistry and Reaction Engineering (3)

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.

Prerequisite: CHEM211.

CHEG 382 - Polymer Chemistry Lab (1)
CHEG 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Spring.

CHEG 395 - Special Topics in Chemical Engineering (3)

This course mainly deals with new trends in Chemical Engineering and emerging technologies. Course is repeatable if title and content differ

Offered: Fall Spring.

CHEG 397 - CHEG: Summer Internship Program (3)

Offered: Summer.

CHEG 410 - Pollution Prevention and Waste Management (3)

This course aims to reorient the chemical engineering students' outlook to incorporate the society's interest in environmental quality and sustainability into their engineering decisions and to build stronger environmental ethics. It aims to give chemical engineers the tools to incorporate environmental consequences in decision making in the same way that economic and safety factors are considered.

Prerequisite: CHEG324.

CHEG 411 - Green Chemical Engineering (3)

This course deals with the cost-effective design, commercialization and use of chemical processes in ways that minimize pollution at the source and reduce impact on health and the environment. Developing safer environmentally friendly chemicals and processes results in: reduced waste, eliminating costly end-of-pipe treatments, safer products, and reduced use of energy and resources all improving the competitiveness of chemical manufacturers and their customers.

Corequisite: CHEG324. Offered: Spring.

CHEG 412 - Process Dynamics & Control (4)

Mathematical modeling and analysis of transient systems. Applications of control theory to response of dynamic chemical engineering systems and processes.

Prerequisite: (CHEG443, CHEG312). Offered: Fall Spring.

CHEG 415 - Combustion and Air Pollution Control (3)

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.

Prerequisite: CHEG324, CHEG335. Offered: Spring.

CHEG 416 - Corrosion Engineering (3)

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.

Offered: Fall Spring.

CHEG 423 - Gas Processing Engineering (3)

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.

Prerequisite: CHEG332, CHEG324. Offered: Fall Spring.

CHEG 424 - Petroleum Refining and Processing (3)

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.

Prerequisite: CHEG324. Offered: Fall Spring Summer.

CHEG 430 - Bioseparation Engineering (3)

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

Prerequisite: CHEG210. Offered: Fall.

CHEG 432 - Food Engineering and Technology (3)

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.

Prerequisite: CHEG210. Offered: Fall Spring.

CHEG 443 - Reaction Engineering (4)

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.

Prerequisite: (CHEG332, CHEM211). Offered: Fall Spring.

CHEG 455 - Chemical Engineering Laboratory II (2)

Prerequisite: CHEG 313, CHEG 324. Offered: Fall.

CHEG 460 - Introduction to Clean Energy Production (3)

This course aims to disseminate knowledge on the concept of clean energy, which will encompass thermodynamics aspects and working principles. A special focus will be given to recent advancement and evolution of latest

technology in this area. During the course delivery, the impacts from different clean energy technologies on the environment and social economy will be highlighted too. Latest challenges and progress in clean energy adoption will also be discussed.

Prerequisite: CHEG335. Offered: Spring.

CHEG 470 - Industrial Catalysis (3)

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.

Prerequisite: CHEG230. Offered: Fall Spring.

CHEG 471 - Water Chemistry for Environmental Engineering (3)

The course brings into focus chemistry fundamentals that are particularly valuable for solving environmental engineering problems. The fundamentals of quantitative analysis methods used in the water and wastewater industries are also covered providing a strong foundation in all phases of environmental engineering practice and research.

Prerequisite: CHEG230, CHEG232. Offered: Fall.

CHEG 472 - Water Treatment and Membrane Processes (3)

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.

Prerequisite: CHEG324. Offered: Fall Spring.

CHEG 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

CHEG 485 - Separation Processes (4)

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.

Prerequisite: CHEG324. Offered: Fall Spring.

CHEG 488 - Polymer Properties (3)

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.

Prerequisite: CHEG380. Offered: Spring.

CHEG 490 - Chemical Engineering Design Project I (3)

Prerequisite: CHEG 313, CHEG 314, CHEG 324, STPS 251. Offered: Fall Spring.

CHEG 491 - Chemical Engineering Design Project II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

CHEG 495 - Special Topics in Chemical Engineering (3)

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 (3)

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.

Prerequisite: CHEG213, CHEG324, Senior Standing. Offered: Fall Spring.

CHEG 498 - Senior Design Project II (3)

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.

Prerequisite: CHEG497. Offered: Fall Spring.

CHEM - Chemistry

CHEM 115 - General Chemistry I (4)

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.

Offered: Fall Spring Summer.

CHEM 116 - General Chemistry II (4)

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.

Prerequisite: CHEM115. Offered: Fall Spring Summer.

CHEM 200 - Quantitative Methods in Physical Sciences (4)

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.

Prerequisite: CHEM116, MATH111. Offered: Fall Spring.

CHEM 201 - Quantitative Methods in Physical Sciences (3)

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.

Prerequisite: CHEM116, MATH111. Offered: Fall Spring.

CHEM 206 - Chemical Safety and Research Skills (3)

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.

Prerequisite: CHEM116. Offered: Fall.

CHEM 211 - Fundamentals of Organic Chemistry (4)

This course introduces students to the foundations of organic chemistry by focusing on the structures, properties and chemical reactivity of the different functional groups such as alkenes, aromatic compounds, alcohols, ethers, amines, and carbonyl compounds. It covers different aspects of isomerism and stereochemistry observed in organic compounds. Major organic reactions are analyzed through reaction mechanisms.

Prerequisite: CHEM115. Offered: Fall Spring.

CHEM 221 - Organic Chemistry I (4)

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.

Prerequisite: CHEM116. Offered: Fall Spring.

CHEM 222 - Organic Chemistry II (4)

Prerequisite: CHEM 221. Offered: Spring.

CHEM 231 - Physical Chemistry I (4)

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.

Prerequisite: CHEM116. Offered: Spring.

CHEM 241 - Introduction to Analytical Chemistry (4)

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.

Prerequisite: CHEM116. Offered: Spring.

CHEM 251 - Inorganic Chemistry (4)

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.

Prerequisite: CHEM116. Offered: Fall.

CHEM 311 - Biochemistry (4)

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.

Prerequisite: CHEM211, or CHEM221. Offered: Fall Spring.

CHEM 322 - Organic Chemistry II (4)

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.

Prerequisite: CHEM221. Offered: Fall.

CHEM 330 - Introduction to Computational Chemistry (4)

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.

Prerequisite: CHEM231. Offered: Fall.

CHEM 331 - Introduction to Computational Chemistry (3)

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.

Prerequisite: CHEM231.

CHEM 332 - Physical Chemistry II (4)

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.

Prerequisite: CHEM231. Offered: Fall.

CHEM 342 - Modern Techniques for Chemical Analysis (4)

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.

Prerequisite: (CHEM221, or CHEM211), CHEM241. Offered: Fall.

CHEM 343 - Advanced Instrumental Analysis Techniques in Chemistry (4)

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.

Prerequisite: CHEM342, CHEM351, or CHEM251. Offered: Spring.

CHEM 351 - Main Group Compounds: Structure, Reactivity and Characterization (4)

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.

Prerequisite: CHEM116. Offered: Fall Spring.

CHEM 352 - Inorganic Chemistry II (4)

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.

Prerequisite: CHEM251, or CHEM351. Offered: Spring.

CHEM 360 - Microbiology and Biocorrosion for Engineers (3)

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.

Prerequisite: CHEM115.

CHEM 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Junior Standing and approval of the department.

CHEM 391 - Independent Study I (3)

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.

Prerequisite: Junior Standing and approval of the department. Offered: Fall Spring.

CHEM 399 - Internship (1)

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.

Prerequisite: SDAS 300. Offered: Summer.

CHEM 423 - Introduction to Medicinal Chemistry (4)

This course introduces students to the principles involved in the design, synthesis, testing and administration of drugs and medicines. Some of the major human physiological systems are described with an emphasis on the study of disease mechanisms and drug actions. Students discover what factors need to be considered in designing an effective drug molecule, the physico-chemical characteristics needed for successful drug action and the steps needed to bring a drug to market.

Prerequisite: CHEM311, CHEM322. Offered: Fall.

CHEM 424 - Synthesis of Medicinal Compounds (4)

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.

Prerequisite: CHEM423, CHEM322. Offered: Spring.

CHEM 461 - Environmental Chemistry (4)

This course lays the foundations for environmental chemistry sciences and provides a breadth of understanding of fundamental concepts and technical definitions associated with the field. It introduces the physical, chemical and biotic aspects of the natural environment, and particularly underpins the processes occurring within and among the lithosphere (soil), the hydrosphere (water), and the atmosphere (air). The course also surveys the main sources of air pollution that cause ozone depletion and consequential global warming due to photochemical smog process and greenhouse effect. Global climate change is further overviewed from the perspective of worldwide energy consumption from non-sustainable fossil fuels, trends in carbon dioxide emissions and alternative "green" approaches involving renewable technologies.

Prerequisite: CHEM251, CHEM241. Offered: Fall.

CHEM 462 - Pollution Science and Control - Management, Technology and Regulations (4)

This course is designed to provide the fundamental knowledge widely applied in environmental assessment, protection and management. It lays the foundations of environmental pollution science by underpinning the sources, movements, reactions and fates of contaminants found in air, water and soil. Facets critical to pollution analysis and management are presented and elaborated to give a holistic picture on risk assessment, regulations, monitoring and mitigation technologies for waste management and water treatment.

Prerequisite: CHEM461.

CHEM 463 - Methods for Environmental Trace Analysis (4)

This course is essential for chemistry majors wishing to pursue further studies or professional career in environmental monitoring, at quality control industries or regulator settings. The course introduces the students to a spectrum of analytical methodologies that can applied towards the identification or determination of natural and anthropogenic species occurring in traces within the atmosphere, waters, soils and wastes, and their control by regulations and standards. Two generic trace analysis workflows are presented and distinguished according to "organic" or "inorganic" nature of the target species. The course particularly builds on separation and spectroscopic knowledge acquired through analytical chemistry courses to develop an understanding of the methodologies to be applied for studying environmental samples. Emphasis is

placed on appropriating the sampling methods, sample handling and pre-treatment procedures to (i) matrix type (e.g., solid, liquid, and gas), (ii) sample abundance, (iii) stability of target species, (iv) interferences, and to making important considerations with regard to sample hazardousness and exposure risks. Selection of the most appropriate analytical characterization tool will be surveyed based on selectivity, sensitivity, detection limit, quantitation limit, and overall economic suitability.

Prerequisite: CHEM342, CHEM461.

CHEM 471 - Fundamentals of Forensic Science (3)

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.

Prerequisite: CHEM311. Offered: Fall.

CHEM 472 - Forensic Chemistry and Evidence Analysis (4)

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.

Prerequisite: CHEM471. Offered: Spring.

CHEM 473 - Fundamentals of Forensic Toxicology

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.

CHEM 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Senior Standing and approval of the department. Offered: Spring.

CHEM 481 - Materials Chemistry (4)

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.

Prerequisite: CHEM352. Offered: Fall.

CHEM 482 - Nanochemistry (4)

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.

Prerequisite: CHEM481. Offered: Spring.

CHEM 483 - Polymer Chemistry (4)

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.

Prerequisite: CHEM481. Offered: Spring.

CHEM 491 - Independent Study II (3)

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.

Prerequisite: Senior Standing and approval of the department. Offered: Spring.

CHEM 495 - Special Topics in Chemistry (3)

This course mainly deals with new trends in Chemistry and related sciences. The course is repeatable if title and content differ.

CHEM 497 - Senior Research Project I (3)

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. The project will require students to apply a broad range of theoretical and practical research techniques to the question and to exercise good laboratory practice, advanced critical thinking and evaluation as the project progresses, leading to new insights.

Prerequisite: CHEM343, Senior Standing and approval of the department. Offered: Fall Spring.

CHEM 498 - Senior Research Project II (3)

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. The project will require students to apply a broad range of theoretical and practical research techniques to the question and to exercise good laboratory practice, advanced critical thinking and evaluation as the project progresses, leading to new insights.

Prerequisite: CHEM497, Senior Standing and approval of the department. Offered: Fall Spring.

CHME - Chemical Engineering

CHME 361 - Separation Processes (4)

Prerequisite: CHME 240, CHME 335, CHME 343.

CHNA - Chinese Language

CHNA 101 - Elementary Chinese I (3)

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.

Offered: Fall.

CIVE - Civil Engineering

CIVE 180 - Engineering Graphics and Visualization (3)

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.

Prerequisite: ENGR114, or COSC114. Offered: Fall Spring Summer.

CIVE 200 - Statics (3)

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.

Prerequisite: PHYS121. Offered: Fall Spring.

CIVE 201 - Engineering Dynamics (3)

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.

Prerequisite: CIVE200. Corequisite: MATH211. Offered: Fall Spring Summer.

CIVE 225 - Mechanics of Solids (4)

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.

Prerequisite: CIVE200. Offered: Fall Spring.

CIVE 238 - Geology for Civil Engineering (3)

Prerequisite: PHYS 121. Offered: Fall.

CIVE 310 - Geomatics (3)

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.

Corequisite: CIVE180. Offered: Fall Spring.

CIVE 330 - Artificial Intelligence and Data Analytics in Civil Engineering (3)

This course introduces undergraduate students in CIVE with fundamental concepts of artificial intelligence (AI) and data analytics (DA) methods, and implications on different fields of civil and environmental engineering. Various AI techniques covered in this course include combinations of fuzzy logic, genetic algorithm, artificial neural networks (ANN), and deep learning. In parallel, massive amount of data is being collected via civil infrastructure-based sensors forming the big-data requiring DA methods to manage it. This course will introduce the students with data management topics including: relational databases, database by structured query language (SQL) and Exploratory DA by Python.

Prerequisite: (ENGR114, or COSC114), MATH242.

CIVE 332 - Fundamentals of Construction Engineering & Management (3)

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.

Prerequisite: GENS101. Offered: Fall Spring.

CIVE 335 - Fluid Mechanics (4)

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.

Prerequisite: PHYS121, MATH231. Offered: Spring.

CIVE 336 - Civil Engineering Materials (4)

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.

Prerequisite: CHEM115, CIVE225. Offered: Fall.

CIVE 338 - Geotechnical Engineering (4)

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.

Prerequisite: CIVE225. Offered: Spring.

CIVE 340 - Behavior and Analysis of Structures (3)

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 and ETABS software for analyzing structures.

Prerequisite: CIVE225. Offered: Fall.

CIVE 341 - Design of Steel Structures (3)

This course is to understand the fundamentals of structural steel design of structural members such as beams and columns and their connections based on the Load and Resistance Factor Design method. It covers design of structural members for tension, flexure, shear, compression, and combined loads, and design of bolted and welded connections.

Prerequisite: CIVE336, CIVE340. Offered: Spring.

CIVE 370 - Introduction to Environmental Engineering (4)

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.

Prerequisite: CHEM115, MATH112. Offered: Fall Spring.

CIVE 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

CIVE 380 - Transportation Engineering (3)

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; connected and autonomous vehicles (CAVs) are discussed. Emerging technologies and methodologies including artificial intelligence are discussed in the context of smart intersections and CAV operations.

Prerequisite: CIVE310. Offered: Fall Spring.

CIVE 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

CIVE 395 - Special Topics in Civil Engineering (3)

This course mainly deals with new trends in Civil Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

CIVE 442 - Design of Concrete Structures (3)

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.

Prerequisite: CIVE336. Offered: Fall Spring.

CIVE 450 - Coastal Engineering (3)

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.

Prerequisite: CIVE335, CIVE370.

CIVE 455 - Blast Effects and Modern Protective Infrastructures (3)

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

Prerequisite: CIVE341, CIVE442.

CIVE 463 - Water and Wastewater Treatment Technologies (3)

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.

Prerequisite: CIVE335, CIVE370. Offered: Fall Spring.

CIVE 465 - Water Resources Management (3)

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.

Prerequisite: CIVE335, CIVE370. Offered: Spring.

CIVE 469 - Air Pollution Control (3)

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.

Prerequisite: CHEM115, CIVE335. Offered: Fall Spring.

CIVE 470 - Foundation Engineering (4)

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.

Prerequisite: CIVE338. Offered: Fall Spring.

CIVE 472 - Pavements Design and Maintenance (3)

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.

Prerequisite: CIVE336. Offered: Spring.

CIVE 473 - Structural Design of Buildings (3)

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.

Prerequisite: CIVE341, CIVE442. Offered: Spring.

CIVE 475 - Earth Structures: Embankments, Slopes and Buried Structures (3)

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.

Prerequisite: CIVE338, CIVE470. Offered: Spring.

CIVE 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

CIVE 480 - Project Management and Contract Administration (3)

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.

Prerequisite: CIVE332.

CIVE 482 - Project Control and Life Cycle Execution of Constructed Facilities (3)

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.

Prerequisite: CIVE332.

CIVE 484 - Project Planning, Scheduling and Control (3)

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.

Prerequisite: CIVE332. Offered: Spring.

CIVE 485 - Construction Project Management (3)

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.

Prerequisite: CIVE480.

CIVE 488 - Advanced Construction Management (3)

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.

Prerequisite: CIVE485.

CIVE 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

CIVE 492 - Urban Transit Planning and Operations (3)

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.

Prerequisite: CIVE380. Offered: Fall.

CIVE 493 - Airport Planning and Traffic Management (3)

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.

Prerequisite: CIVE380. Offered: Fall Summer.

CIVE 495 - Special Topics in Civil Engineering (3)

This course mainly deals with new trends in Civil Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

CIVE 497 - Senior Design Project I (3)

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.

Prerequisite: CIVE332, or CIVE335, or CIVE338, or CIVE341, or CIVE370, or CIVE380. Offered: Fall Spring.

CIVE 498 - Senior Design Project II (3)

Prerequisite: CIVE497. Offered: Fall Spring.

COSC - Computer Science

COSC 101 - Foundations of Computer Science (3)

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.

Prerequisite: ENGR114, or COSC114. Offered: Fall Spring.

COSC 114 - Introduction to Computing Using Python (4)

Introduction to computer systems: computer hardware components, operating system, compiling, debugging, libraries, linking. Programming based problem solving that includes program development lifecycle. Imperative programming: data types, conditional expressions and statements, repetitive structures, arithmetic and logic operators, functions, arrays, strings, data structures (database, tuple), file I/O.

COSC 201 - Computer Systems Organization (3)

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.

Prerequisite: COSC101. Offered: Fall Spring.

COSC 301 - Automata, Computability, and Complexity (3)

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.

Prerequisite: COSC101, MATH234. Offered: Fall.

COSC 310 - Data Structures (3)

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.

Prerequisite: ECCE230. Offered: Fall Spring.

COSC 312 - Design and Analysis of Algorithms (3)

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.

Prerequisite: COSC301, COSC310. Offered: Spring.

COSC 320 - Principles of Programming Languages (3)

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.

Prerequisite: COSC301. Offered: Spring.

COSC 330 - Introduction to Artificial Intelligence (3)

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.

Prerequisite: ECCE230. Offered: Fall Spring.

COSC 340 - Introduction to Computer Security (3)

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.

Prerequisite: ECCE354. Offered: Fall Spring.

COSC 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

COSC 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

COSC 395 - Special Topics in Computer Science (3)

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 (3)

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.

Prerequisite: COSC312, COSC410.

COSC 410 - Parallel and Distributed Computing (3)

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.

Prerequisite: COSC312, ECCE354. Offered: Fall.

COSC 412 - Numerical Computing (3)

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.

Prerequisite: COSC312.

COSC 430 - Data Analytics (3)

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.

Prerequisite: COSC330, (MATH242, or MATH243). Corequisite: COSC434. Offered: Fall Spring.

COSC 432 - Algorithmic Robotics (3)

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.

Prerequisite: COSC330. Offered: Fall Spring.

COSC 433 - Neural Networks (3)

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.

Prerequisite: COSC330.

COSC 434 - Introduction to Machine Learning (3)

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.

Prerequisite: COSC330, MATH204, (MATH243, or MATH242). Offered: Fall Spring.

COSC 435 - Introduction to AI/ML for Cybersecurity (3)

This course covers the use of artificial intelligence and

machine learning techniques and algorithms for the design of cybersecurity systems and solutions. The particular emphasis is given to the use of machine learning system design principles to be able to implement production quality cybersecurity systems.

Prerequisite: ECCE336, COSC330.

COSC 440 - Digital Forensics (3)

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.

Prerequisite: COSC340.

COSC 442 - Applied Cryptography (3)

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.

Prerequisite: COSC340.

COSC 452 - Human-Computer Interaction (3)

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.

Prerequisite: ECCE336. Offered: Spring.

COSC 454 - Computer Graphics (3)

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.

Prerequisite: COSC312.

COSC 460 - Bioinformatics and Genomic Data Science (3)

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.

Prerequisite: COSC312, COSC410.

COSC 462 - Mobile and Web Applications Development (3)

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.

Prerequisite: COSC310.

COSC 464 - Natural Language Processing (3)

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.

Prerequisite: COSC330, COSC410.

COSC 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

COSC 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

COSC 495 - Special Topics in Computer Science (3)
COSC 496 - Artificial Intelligence Project (3)

Over the course of the semester, a small team of students will work closely with a faculty member of their department or Electrical and Computer Engineering department to address significant research or development questions on an artificial intelligence (AI)-related project. The team will combine and apply a broad range of AI concepts and techniques to the questions and will exercise advanced critical thinking and evaluation as the project progresses. The team will be guided through the whole research process of hypothesis generation, initial study and literature review, analysis, design, implementation, experimentation, and conclusion and will be encouraged to produce professional-standard presentations and publication.

Corequisite: COSC434. Offered: Fall Spring.

COSC 497 - Senior Design Project I (3)

Students participating in team projects work on problems with specific objectives and constraints to propose, design, develop and document solutions. Some of the projects offered by the department will have a multi-disciplinary nature, i.e involve other engineering departments. The students will exercise initiative, judgment, self-reliance, creativity and interact in a team environment similar to that in industry. The design projects require students to use engineering standards in their design process, develop suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

Prerequisite: COSC312, Senior Standing. Offered: Fall Spring.

COSC 498 - Senior Design Project II (3)

Students participating in team projects work on problems with specific objectives and constraints to propose, design, develop and document solutions. Some of the projects offered by the department will have a multi-disciplinary nature, i.e involve other engineering departments. The students will exercise initiative, judgment, self-reliance, creativity and interact in a team environment similar to that in industry. The design projects require students to use engineering standards in their design process, develop suitable criteria for selection based on their acquired engineering skills, experience, and other pertinent resources. Oral and written presentations are required.

Prerequisite: COSC497. Offered: Fall Spring.

ECCE-Electrical-Computer-Engr

ECCE 200 - Fundamentals of Electronic Systems (4)

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.

Prerequisite: PHYS122. Offered: Fall Spring.

ECCE 210 - Digital Logic Design (4)

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.

Prerequisite: (ENGR114, or COSC114). Offered: Fall Spring.

ECCE 221 - Electric Circuits I (4)

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.

Corequisite: MATH232, PHYS122. Offered: Fall Spring.

ECCE 222 - Electric Circuits II (3)

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.

Prerequisite: ECCE221. Corequisite: MATH206. Offered: Fall Spring.

ECCE 230 - Object-Oriented Programming (4)

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.

Prerequisite: (ENGR114, or COSC114). Offered: Fall Spring.

ECCE 300 - Signals, Circuits and Communications (3)

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.

Prerequisite: MATH211, or MATH206. Offered: Fall Spring.

ECCE 302 - Signals and Systems (3)

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.

Prerequisite: MATH232, MATH204. Corequisite: ECCE221. Offered: Fall Spring.

ECCE 312 - Electronic Circuits & Devices (4)

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.

Prerequisite: ECCE221. Offered: Fall Spring.

ECCE 316 - Microprocessor Systems (4)

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.

Prerequisite: ECCE210. Offered: Fall Spring.

ECCE 320 - Applied Electromagnetics (3)

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.

Prerequisite: PHYS122, MATH232. Corequisite: MATH206, or MATH211. Offered: Fall Spring.

ECCE 322 - Electrical Machines (4)

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.

Prerequisite: ECCE221, ECCE320. Offered: Fall Spring.

ECCE 323 - Feedback Control Systems (4)

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.

Prerequisite: ECCE302. Offered: Fall Spring.

ECCE 326 - Introduction to Semiconductor Devices (4)

This course is designed to provide an introduction to the mechanisms of device operation. It introduces and explains terminology, models, properties, and concepts associated with semiconductor devices and offer insight into the internal workings of the "building-block" device structures such as the pn-junction diode, BJT, and MOSFET. The course also introduces optoelectronics, discusses current technological issues, and feature modern devices.

Prerequisite: PHYS122. Offered: Fall Spring.

ECCE 330 - System Analysis & Software Design (3)

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.

Prerequisite: ECCE336. Offered: Fall.

ECCE 336 - Introduction to Software Engineering (3)

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.

Prerequisite: ECCE230. Offered: Fall Spring Summer.

ECCE 341 - Java and Network Programming (3)

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.

Prerequisite: ECCE230.

ECCE 342 - Data Structures and Algorithms (3)

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.

Prerequisite: ECCE230. Offered: Fall Spring.

ECCE 350 - Computer Architecture and Organization (3)

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.

Prerequisite: (ENGR114, or COSC114). Corequisite: ECCE210. Offered: Fall Spring.

ECCE 354 - Operating Systems (3)

This course covers the important problems in operating system design and implementation. The course will start with a brief historical perspective of the evolution of operating systems over the last fifty years and then covers the major components of the operating systems. The course

will cover the tradeoffs that can be made between the performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to four major operating system concepts including process management (processes, threads, CPU scheduling, inter-process communication, and deadlock management), memory management (paging, segmentation, and address translation), device and file managements.

Prerequisite: (ECCE350, or COSC201). Offered: Fall Spring.

ECCE 356 - Computer Networks (4)

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.

Prerequisite: (COSC201, or ECCE210). Offered: Fall Spring Summer.

ECCE 360 - Communication Systems (4)

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.

Prerequisite: MATH232, MATH243. Corequisite: ECCE302. Offered: Fall Spring.

ECCE 362 - Digital Communications I (3)

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.

Prerequisite: ECCE360. Offered: Fall.

- ECCE 370
ECCE 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall.

ECCE 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

ECCE 395 - Special Topics in Electrical and Computer (3)

This course mainly deals with new trends in Electrical/ Computer Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

ECCE 401 - Filter synthesis (3)

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.

Prerequisite: ECCE302. Offered: Fall Spring.

ECCE 402 - Digital Signal Processing (3)

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.

Prerequisite: ECCE302. Offered: Fall Spring.

ECCE 404 - Microwave Circuits and Devices (3)

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.

Prerequisite: ECCE312.

ECCE 406 - Instrumentation and Measurements (3)

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.

Prerequisite: ECCE302, ECCE312. Offered: Fall.

ECCE 408 - Digital Systems Design (3)

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.

Prerequisite: ECCE210. Offered: Fall Spring.

ECCE 410 - VLSI Systems Design (3)

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.

Prerequisite: ECCE312, ECCE210. Offered: Fall Spring.

ECCE 411 - Analog Integrated Circuits Design (3)

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.

Prerequisite: ECCE312. Offered: Fall Spring.

ECCE 420 - Industrial Automation (3)

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.

Prerequisite: ECCE323. Offered: Fall Spring.

ECCE 421 - Power System Analysis (3)

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.

Prerequisite: ECCE324, or ECCE322. Offered: Fall Spring.

ECCE 422 - High Voltage Engineering (3)

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.

Prerequisite: ECCE320. Offered: Fall.

ECCE 423 - Power Electronics (3)

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.

Prerequisite: ECCE222. Offered: Fall.

ECCE 424 - Electrical Power Distribution Systems (3)

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.

Prerequisite: ECCE421.

ECCE 425 - Power System Stability and Control (3)

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.

Prerequisite: (ECCE324, or ECCE322), ECCE421. Offered: Fall Spring.

ECCE 426 - Electric Drives and Renewable Resources (3)

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.

Prerequisite: ECCE423, ECCE322. Offered: Spring.

ECCE 427 - Power System Protection and Relays (3)

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.

Prerequisite: ECCE421. Offered: Spring.

ECCE 428 - Modern Control Systems (3)

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, pole-placement; disturbance rejection; state estimation;

Prerequisite: ECCE323. Offered: Fall Spring.

ECCE 429 - Digital Control Systems (3)

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.

Prerequisite: ECCE323. Offered: Fall.

ECCE 432 - Introduction Human-Computer Interfaces (3)

This course provides an introduction to and overview of the field of human-computer interaction (HCI). HCI theories, principle, and guidelines will be covered including HCI design and principles of user interface design. In addition, 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.

Prerequisite: (ECCE336, or SOFE201). Offered: Fall Spring.

ECCE 434 - Database Systems (3)

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.

Prerequisite: ECCE336. Offered: Fall Summer.

ECCE 436 - Software Testing and Quality Assurance (3)

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.

Prerequisite: ECCE336. Offered: Fall Spring.

ECCE 438 - Software Architecture (3)

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.

Corequisite: ECCE330. Offered: Fall Spring.

ECCE 440 - Distributed Systems (3)

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.

Prerequisite: ECCE354, ECCE356. Offered: Spring.

ECCE 444 - Computer Security (3)

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.

Prerequisite: ECCE354. Offered: Fall.

ECCE 446 - Network Security (3)

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.

Prerequisite: ECCE356. Offered: Spring.

ECCE 448 - Cloud Infrastructure and Services (3)

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.

Prerequisite: ECCE356, ECCE354. Offered: Fall.

ECCE 449 - iOS App Development (3)

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.

Prerequisite: ECCE230. Offered: Fall.

ECCE 450 - Embedded Systems (3)

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.

Prerequisite: ECCE316. Offered: Fall Spring Summer.

ECCE 454 - Artificial Intelligence (3)

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.

Prerequisite: ECCE342. Offered: Spring.

ECCE 456 - Image Processing and Analysis (3)

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.

Prerequisite: ECCE302. Offered: Spring.

ECCE 460 - Wireless Communications (3)

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.

Prerequisite: ECCE360. Offered: Fall Spring.

ECCE 461 - Advanced Digital Communications (3)

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.

Prerequisite: ECCE360. Offered: Spring.

ECCE 462 - Communication Systems Design and Prototyping (3)

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.

Prerequisite: ECCE362.

ECCE 463 - Information and Coding Theory (3)

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.

Prerequisite: ECCE362. Offered: Spring.

ECCE 470 - Antennas and Propagation (3)

This course introduces the students to antennas and wave propagation. The main topics include fundamental parameters of antennas, principles of radio wave propagation, radiation integral and potential functions, radiation from infinitesimal dipole, far-field approximation, dipole and monopole antennas, image techniques, loop antennas, antenna arrays, pattern multiplication, Fourier-transform method, field equivalence principle, evolving antenna technologies and applications.

Prerequisite: ECCE320. Offered: Spring.

ECCE 472 - Optical Communications and Networks (3)

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.

Prerequisite: ECCE320. Offered: Fall.

ECCE 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Summer.

ECCE 481 - Wireless Sensor Networks and Internet of Things (3)

Wireless sensor networks (WSN), Internet of Things (IoT), sensor nodes, sensor network applications, design challenges, performance metrics, medium access control, data routing, sensor localization, time synchronization, energy constraints, power management, Ardruino, XBee, Raspberry Pi.

Prerequisite: ECCE360, ECCE316. Offered: Fall Spring.

ECCE 482 - Broadband Telecommunications (3)

Prerequisite: ECCE356, or ECCE362. Offered: Spring.

ECCE 484 - Satellite and Space Communications (3)

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.

Prerequisite: (ECCE360, or ECCE356). Offered: Fall Spring.

ECCE 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

ECCE 495 - Special Topics in Electrical and Computer Engineering (3)

This course mainly deals with new trends in Electrical/ Computer Engineering and emerging technologies. Course is repeatable if title and content differ

Offered: Fall Spring.

ECCE 497 - Senior Design Project I (3)

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.

Prerequisite: ECCE312, ECCE316, Senior Standing. Offered: Fall Spring.

ECCE 498 - Senior Design Project II (3)

Prerequisite: ECCE497. Offered: Fall Spring.

ENGL - English

ENGL 001 - Preparatory English 1 (14)

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.

Offered: Fall Spring.

ENGL 002 - Preparatory English 2 (14)

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.

Offered: Fall Spring Summer.

ENGL 003 - IELTS Preparation (7)

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.

Offered: Fall Spring Summer.

ENGL 101 - Academic English I (3)

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.

Offered: Fall Spring Summer.

ENGL 102 - Academic English II (3)

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.

Prerequisite: ENGL101. Offered: Fall Spring Summer.

ENGL 111 - English Communication I (4)

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.

Offered: Fall Spring Summer.

ENGL 112 - English Communication 2 (4)

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.

Prerequisite: ENGL 101, ENGL 111. Offered: Fall Spring Summer.

ENGL 296 - Directed Studies (3)

Offered: Fall Spring.

ENGR - Engineering

ENGR 111 - Engineering Design (4)

Offered: Fall Spring.

ENGR 112 - Introduction to Computing Using C++ (4)

Offered: Fall Spring.

ENGR 113 - Introduction to Computing using Matlab (4)

Introduction to computer systems. Introduction to 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.

Corequisite: MATH 111. Offered: Fall Spring.

ENGR 114 - Introduction to Computing- Python (4)

Introduction to computer systems: computer hardware components, operating system, compiling, debugging, libraries, linking. Programming based problem solving that includes program development lifecycle. Imperative programming: data types, conditional expressions and statements, repetitive structures, arithmetic and logic operators, functions, arrays, strings, data structures (database, tuple), file I/O.

Offered: Fall Spring.

ENGR 202 - Data Science & AI (3)

Prerequisite: COSC114 or ENGR114. Offered: Fall Spring.

ENGR 291 - Independent Study (3)

Offered: Fall Spring Summer.

ENGR 295 - Special Topics in Engineering (3)

This course mainly deals with new trends in Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring Summer.

ENGR 296 - Directed Study (3)

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.

Offered: Fall Spring Summer.

ENGR 395 - Special Topics in Engineering (3)

This course mainly deals with new trends in Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring Summer.

ENGR 399 - Engineering Internship (1)

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.

Prerequisite: SDAS300. Offered: Fall Spring Summer.

ENGR 455 - Finite Element Analysis (3)

Prerequisite: ENGR 200, MATH 204. Offered: Fall Spring.

EPSS-Earth-Planetary-Science

EPSS 200 - Earth Systems Science (3)

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.

Prerequisite: CHEM115. Offered: Fall Spring.

EPSS 210 - Earth Materials (3)

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.

Prerequisite: EPSS200. Offered: Spring.

EPSS 211 - Physics of the Earth (4)

This course covers the physics of the Earth including the physics of the atmosphere, gravitational field, seismic waves, heat flow, and electromagnetic fields, and introduces related techniques to reveal the properties, processes, and structure of the Earth's interior. The course features an extensive laboratory component that offers students the chance to apply their newly acquired understanding of these concepts in practical settings.

Prerequisite: PHYS121.

EPSS 222 - The Evolving Earth (4)

The course introduces the origin of the solar system and the early Earth, and how the origin and evolution of life is documented in the geologic record. Principles of stratigraphy, age-dating methods, and tectonics are applied to explain the evolution of Earth's Systems with an emphasis on the geological evolution of the Middle East. In laboratory, students apply biostratigraphy, chronostratigraphy, palaeogeography, and fossil identification techniques. The course includes at least one all-day field trip.

Prerequisite: EPSS200, BIOL111. Offered: Spring.

EPSS 223 - Introduction to Geochemistry (3)

This course introduces the chemical principles that are used to explain the mechanisms that control geological systems and the evolution of these systems, including Earth's mantle, the crust, oceans and atmosphere, and the formation of the solar system. This course provides an introduction to the fundamental geochemical tools used in geology and Earth sciences.

Prerequisite: CHEM115, EPSS200.

EPSS 230 - Geological Maps (3)

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.

Prerequisite: EPSS200. Offered: Spring.

EPSS 293 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department.

EPSS 294 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department

Prerequisite: Students are advised to refer to the department.

EPSS 300 - MATLAB for Earth Scientists (3)

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.

Prerequisite: MATH231. Offered: Fall.

EPSS 305 - Sedimentology (4)

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).

Prerequisite: EPSS200, EPSS210. Offered: Fall.

EPSS 310 - Remote Sensing and Geomatics (4)

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.

Prerequisite: EPSS300. Offered: Spring.

EPSS 312 - Reflection Seismology (4)

Students are advised to refer to the department.

EPSS 315 - Environmental Geology

This course deals with how people interact with Earthï¿½s 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 (4)

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.

Prerequisite: EPSS200, EPSS230, PHYS121. Offered: Fall.

EPSS 322 - Geomorphology and Geohazards (4)

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.

Prerequisite: Senior Standing or Department Approval.

EPSS 323 - Solid Earth Geophysics (4)

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.

Prerequisite: EPSS200, PHYS122. Offered: Spring.

EPSS 331 - Igneous &Metamorphic Petrology (3)

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.

Prerequisite: EPSS210. Offered: Fall.

EPSS 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Junior Standing.

EPSS 381 - Rock Mechanics and Reservoirs (3)

Students are advised to refer to the department.

EPSS 393 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department.

Prerequisite: Students are advised to refer to the department.

EPSS 394 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department.

Prerequisite: Students are advised to refer to the department.

EPSS 397 - Field Geology (4)

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.

Prerequisite: EPSS305, EPSS321. Offered: Summer.

EPSS 400 - Planetary Sciences (4)

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.

Prerequisite: EPSS310. Offered: Fall.

EPSS 401 - Petrophysics and Logging (4)

Students are advised to refer to the department.

EPSS 410 - Reservoir Geophysics (3)

Students are advised to refer to the department.

EPSS 411 - Atmosphere and Climate Dynamics (3)

This course covers the processes that drive weather patterns, the general circulation of the atmosphere and climate on Earth. Students are introduced to the structure and composition of the atmosphere, sources of energy that drive atmospheric processes, weather forecasting, and forces that create severe weather. The influence of humans on the atmosphere and factors that influence climate, climate variability and climate change are discussed.

Prerequisite: Senior Standing. Offered: Fall.

EPSS 412 - Hydrogeology (3)

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.

Prerequisite: Senior Standing.

EPSS 413 - Geology of Mars & Other Planet (4)

Students are advised to refer to the department.

Prerequisite: EPSS310.

EPSS 415 - Environmental Geology (3)

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.

Prerequisite: EPSS222.

EPSS 451 - (3)
EPSS 461 - Reservoir Characterization (4)

Students are advised to refer to the department.

EPSS 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Senior Standing.

EPSS 493 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department.

EPSS 494 - Special Topics in Earth and Planetary Sciences (1-3)

Students are advised to refer to the department.

EPSS 497 - Senior Research Project I (3)

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.

Prerequisite: Senior Standing. Offered: Fall.

EPSS 498 - Senior Design Project II (3)

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.

Prerequisite: EPSS497.

ESMA-Engr-Sys-Management

ESMA 200 - Engineering Economic Analysis (3)

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.

Prerequisite: BUSS201.

ESMA 201 - Introduction to Engineering Systems and Management (3)

This course offers a comprehensive overview of basic engineering systems and management concepts. It covers management theory and systems approaches specifically tailored to the engineering industry, delving into the processes and techniques of engineering environment management. Students will develop a deeper understanding of the leadership role an engineering manager plays in organizations through exploring positive attitudes that foster success.

Prerequisite: (MATH 112, or ENGR114, or COSC114).

ESMA 271 - Modern Methods of Manufacturing (4)

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.

Prerequisite: PHYS121,(COSC114, or ENGR114).

ESMA 311 - Quality & Reliability Engineering (4)

This course will introduce theory and practice of quality engineering tools, techniques and methodologies as well an introduction to reliability engineering and its associated methods. Topics covered include statistical process control, process capability analysis, strategies of industrial experimentation (e.g.: classical design of experiments and Taguchi robust design), quality joss function, failure mode and effect analysis, fault tree analysis, quality management system (ISO 9001: 2015), system reliability and design for reliability. The focus of the course is on the practical applications of various tools, techniques and methodologies used by quality and reliability professionals of today and tomorrow.

Prerequisite: MATH242.

ESMA 341 - Simulation Modeling &Analysis (4)

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.

Prerequisite: ESMA201, MATH242,(COSC114, or ENGR114).

ESMA 351 - Production and Operations Management (3)

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.

Prerequisite: MATH242, ESMA251.

ESMA 352 - Lean Manufacturing (3)

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.

Prerequisite: ESMA271.

ESMA 360 - Design for People (4)

An introduction to human capabilities and their limitations in engineered systems to increase productivity and work safely. Topics include the range of human motions, the incorporation of the human element into system and product design, and ergonomics and safety in workplace design. Students apply a wide range of design principles to design products and common workplace settings.

Prerequisite: ESMA201.

ESMA 361 - Data and Information Engineering (3)

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.

Prerequisite: ESMA201.

ESMA 362 - Systems Project Management (3)

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.

Prerequisite: BUSS201.

ESMA 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

ESMA 395 - Special Topins in ISYE (3)

This course mainly deals with new trends in Industrial and Systems Engineering and emerging technologies. Course is repeatable if title and content differ.

ESMA 401 - Advanced Systems Engineering (3)

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.

Prerequisite: ESMA201.

ESMA 411 - Operational Excellence (3)

This course teaches students principles and tools to create a

culture of excellence within an organization. It presents the application of lean six sigma and other soft skills for operational excellence in both service and manufacturing industries. Upon completion, students will possess the skills to effectively manage operations of varying scales and across diverse industries.

Prerequisite: ESMA311.

ESMA 422 - Reliability (3)

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.

Prerequisite: ESMA344.

ESMA 430 - Supply Chain and Logistics (4)

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.

Prerequisite: ESMA351.

ESMA 431 - Time Series Forecasting (3)

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.

Prerequisite: ESMA242.

ESMA 432 - Advanced Stochastic Processes (3)

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.

Prerequisite: ESMA331.

ESMA 433 - Advanced Statistics (3)

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.

Prerequisite: MATH242.

ESMA 440 - Fundamentals of Business Analytics (3)

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.

Prerequisite: ESMA311.

ESMA 441 - Advanced Simulation (3)

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.

Prerequisite: ESMA341.

ESMA 444 - Healthcare Analytics and Management (3)

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.

Prerequisite: MATH242, ESMA351.

ESMA 445 - Six-Sigma Methodology & Applications (3)

This course introduces the concept, deployment and practice of Six Sigma for process improvement and

process/product design using DMAIC methodology; 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.

Prerequisite: ESMA311, ESMA352.

ESMA 451 - Operations Research II (3)

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.

Prerequisite: ESMA251.

ESMA 461 - Engineering Psychology (3)

This course introduces the fundamentals of human information processing. It will introduce students to ways of designing human-machine systems so that they are compatible with the way a person perceives, thinks, remembers, decides, and responds to information. Methods and theories of human performance are introduced and several design examples and case studies will be presented to help students apply the concepts and principles in domains such as service, management, manufacturing, transportation and control systems

Prerequisite: ESMA360.

ESMA 462 - Engineering Systems Design (3)

Systems engineering is an engineering discipline that focuses on the comprehensive design of complex engineering systems, from concept to construction and operation. Key areas of study include the systems engineering and design process, modeling, integration and design, design requirements, architectural development, systems analysis, and the value of systems engineering.

Prerequisite: ESMA362.

ESMA 475 - Facilities Planning and Warehousing (4)

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.

Prerequisite: ESMA352.

ESMA 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

ESMA 480 - Financial Engineering (3)

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.

Prerequisite: MATH242, ESMA251.

ESMA 481 - Procurement and Supply Management (3)

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.

Prerequisite: ESMA351.

ESMA 485 - Stochastic Manufacturing And Service Systems (3)

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.

Prerequisite: ESMA331.

ESMA 495 - Special Topics in ISYE (3)

This course mainly deals with new trends in industrial and systems engineering and emerging technologies. Course is repeatable if title and content differ.

ESMA 497 - Senior Design Project I (3)

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.

Prerequisite: GENS101, ESMA311, ESMA341, Senior Standing.

ESMA 498 - Senior Design Project II (3)

Participation in team projects dealing with design and development of a product, process, or a system. A number of projects will be offered each year by the different departments, some of which will have a multi-disciplinary nature. This will be an opportunity to exercise initiative, engineering judgment, self-reliance and creativity, in a team environment similar to industry. The design projects require students to 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.

Prerequisite: ESMA497.

GENS - General Education

GENS 100 - Academic Development & Success (1)

This interactive student success course helps students apply positive behavioral principles through their university experience and beyond. The course delivers a blended learning experience designed to enhance students' self-awareness, orient them to KU resources and learning communities, make major declaration decisions, and adopt academic integrity. Students develop the growth mindset necessary to succeed in a global and ever-changing marketplace.

Offered: Fall.

GENS 101 - Grand Challenges (4)

This course highlights science and engineering approaches to interdisciplinary, real-world applications, especially addressing Grand Challenge problems facing humanity. The course introduces aspects of problem solving, from the formulation of questions and problems to the testing of hypotheses and trial solutions. Students work collaboratively on project-based activities as they discuss ethical issues; social, economic, and environmental aspects of sustainability; and the technicalities of Grand Challenges.

Offered: Fall Spring.

GENS 300 - Career Preparation (1)

This course equips learners with the mindset and skills for both internship and future careers. It includes employability workshops, deliberate practice and assessment, access to online learning materials, group discussions, and one-on-one guidance from a local employability and labor market specialist. This activity-based course is focused on field exploration, digital profile development, and professional communication, and is delivered in person and asynchronously.

Prerequisite: GENS100.

GENS 400 - Enhancing Employability and Job Readiness (1)

This asynchronous assignment series/course equips senior/graduating students to manage the transition from university to a professional work environment. As students navigate key principles such as emotional intelligence, effective communication, and professional enterprise, they autonomously acquire skills required to meet workplace expectations. Students practice scenario-based learning activities and put them into practice during their internship period(s) or work to improve their employability skills before entering a professional work environment.

Prerequisite: GENS300.

HUMA - Humanities

HUMA 100 - Arabic for Non Native Speakers (3)

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.

Offered: Fall Spring Summer.

HUMA 101 - Arabic Language (3)

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.

Offered: Fall Spring Summer.

HUMA 102 - Islamic Culture (3)

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 course will further introduce students to contemporary challenges and cultural dialogues, within the framework of modernity and from the vantage point of an Islamic perspective.

Prerequisite: HUMA101, or HUMA100. Offered: Fall Spring Summer.

HUMA 103 - Islamic Culture and Civilization (3)

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.

Prerequisite: ENGL 101, HUMA 100, HUMA 101. Offered: Fall.

HUMA 105 - Emirates Society (3)

The course acquaints students with the geographical, cultural, demographical, economic, and social aspects of UAE society. It highlights the evolution of the country from a traditional to a modern society. Topics such as UAE political system, family, population, migration, youth, and the development of civil society are addressed.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 106 - Emirates Studies (3)

The course acquaints students with the geographical, cultural, demographic, economic, and social aspects of UAE society. It highlights the evolution of the country from a traditional to a modern society. Topics such as the UAE political system, family, population, migration, youth, and the development of civil society are addressed. This course is taught in Arabic.

Prerequisite: HUMA108. Offered: Fall Spring Summer.

HUMA 107 - Introduction to Arabic and Islamic Heritage (3)

This course acquaints students with the basic tenets of Islam, its civilization, and intellectual heritage. Students are introduced to Arabic and Islamic culture from the pre-Islamic period through modern times. Islamic values and the Arabic language are discussed through selected Qur'anic and prophetic texts along with their various interpretations. This course is taught in English.

HUMA 108 - Arabic and Islamic Heritage (3)

This course offers students a theoretical and functional overview of Arabic language and Islamic heritage. It introduces students to a variety of classical and modern texts, and equips them with necessary skills to understand the nuances of the Arabic language and aspects of Islamic culture. These texts highlight the intellectual Arabic heritage as reflected in history, economics, theology, and law. This course is taught in Arabic.

HUMA 10X - Arabic/Islamic Heritage (3)
HUMA 110 - Middle East Studies (3)

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.

Corequisite: ENGL101. Offered: Fall Spring Summer.

HUMA 111 - Islamic History (3)

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.

Corequisite: ENGL 101, ENGL 111. Offered: Fall Spring Summer.

HUMA 112 - Sciences in Islam (3)

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.

Prerequisite: ENGL 101, ENGL 111. Offered: Fall Spring Summer.

HUMA 130 - Introduction to Linguistics (3)

Assessment consists of Coursework (60%) and a final examination (40%).

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 140 - Introduction to Psychology (3)

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.

Prerequisite: ENGL101. Offered: Fall Spring Summer.

HUMA 141 - Introduction to Sociology (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 142 - Introduction to Science and Technology Studies (3)

Prerequisite: ENGL102. Offered: Fall Spring.

HUMA 156 - Human Behavior and Well-Being (3)

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.

Offered: Fall Spring Summer.

HUMA 210 - Introduction to Islamic Law (3)

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 ï¿½schoolsï¿½ 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

Offered: Fall Spring Summer.

HUMA 211 - Islam and Modernity (3)

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.

Prerequisite: ENGL 102, ENGL 112. Offered: Fall Spring Summer.

HUMA 214 - Environment and Society (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring.

HUMA 215 - World Religions (3)

Prerequisite: ENGL102. Offered: Spring.

HUMA 220 - Public Speaking (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 221 - Intercultural Communication (3)

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 264 - Arabic Language II (3)

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.

Prerequisite: HUMA 101.

HUMA 265 - Sufism in Islam (3)

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.

Prerequisite: ENGL 102, ENGL 112. Offered: Fall Summer.

HUMA 268 - Western Civilization from 1500 (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 277 - Introduction to Logical Reasoning (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

HUMA 291 - Leadership by Design (3)

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.

Offered: Fall Spring Summer.

HUMA 295 - Special Topics in Humanities and Social Sciences (3)

This course mainly deals with various trends in Humanities and Social Sciences. Course is repeatable if title and content differ.

Offered: Fall Spring Summer.

HUMA 296 - Directed Studies (3)

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.

Offered: Fall Spring Summer.

HUMA 395 - Islam and the Discourse of the Enlightenment (3)

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.

Prerequisite: HUMA 211. Offered: Fall.

ISYE - Industrial Engineering

ISYE 200 - Engineering Economic Analysis (3)

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

Prerequisite: BUSS201. Offered: Fall Spring.

ISYE 201 - Introduction to Industrial & Systems Engineering (3)

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.

Prerequisite: ENGR114, or ENGR113. Offered: Fall Spring.

ISYE 251 - Operations Research 1 (4)

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.

Prerequisite: MATH211, or MATH204. Offered: Fall Spring.

ISYE 271 - Modern Methods of Manufacturing (4)

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.

Prerequisite: PHYS121, (ENGR112, or ENGR113) . Offered: Fall Spring.

ISYE 311 - Quality & Reliability Engineering (4)

This course will introduce theory and practice of quality engineering tools, techniques and methodologies as well an introduction to reliability engineering and its associated methods. Topics covered include statistical process control, process capability analysis, strategies of industrial experimentation (e.g.: classical design of experiments and Taguchi robust design), quality joss function, failure mode and effect analysis, fault tree analysis, quality management system (ISO 9001: 2015), system reliability and design for reliability. The focus of the course is on the practical applications of various tools, techniques and methodologies used by quality and reliability professionals of today and tomorrow.

Prerequisite: MATH242. Offered: Fall Summer.

ISYE 331 - Stochastic Processes (3)

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.

Prerequisite: ISYE341, MATH204, MATH206, or MATH211. Offered: Fall Spring.

ISYE 341 - Simulation Modeling and Analysis (4)

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.

Prerequisite: (ENGR112, or ENGR113, or ENGR114), ISYE201, MATH242. Offered: Fall Spring.

ISYE 351 - Production and Operations Management (3)

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

Prerequisite: ISYE251, MATH242. Offered: Fall Spring.

ISYE 352 - Lean Manufacturing (3)

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.

Prerequisite: ISYE 271. Offered: Fall Spring.

ISYE 360 - Design for People (4)

An introduction to human capabilities and their limitations in engineered systems to increase productivity and work safely. Topics include the range of human motions, the incorporation of the human element into system and product design, and ergonomics and safety in workplace design. Students apply a wide range of design principles to design products and common workplace settings.

Prerequisite: ISYE201. Offered: Fall Spring.

ISYE 361 - Data and Information Engineering (3)

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.

Prerequisite: ISYE201. Offered: Fall.

ISYE 362 - Systems Project Management (3)

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.

Prerequisite: BUSS201. Offered: Fall Spring.

ISYE 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

ISYE 391 - Independent Study 1 (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

ISYE 395 - Special Topics in Industrial and Systems (3)

This course mainly deals with new trends in Industrial and Systems Engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

ISYE 401 - Advanced Systems Engineering (3)

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.

Prerequisite: ISYE201.

ISYE 422 - Reliability (3)

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.

Prerequisite: ISYE321, or ISYE311. Offered: Fall Spring.

ISYE 430 - Supply Chain and Logistics (4)

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.

Prerequisite: ISYE351. Offered: Fall Spring.

ISYE 431 - Time Series Forecasting (3)

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.

Prerequisite: MATH242. Offered: Fall.

ISYE 432 - Advanced Stochastic Processes (3)

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.

Prerequisite: ISYE331.

ISYE 433 - Advanced Statistics (3)

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.

Prerequisite: MATH242.

ISYE 440 - Fundamentals of Business Analytics (3)

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.

Prerequisite: ISYE311. Offered: Spring.

ISYE 441 - Advanced Simulation (3)

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.

Prerequisite: ISYE341. Offered: Fall.

ISYE 444 - Healthcare Analytics and Management (3)

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.

Prerequisite: MATH242, ISYE351. Offered: Fall.

ISYE 445 - Six-Sigma Methodology and Applications (3)

This course introduces the concept, deployment and practice of Six Sigma for process improvement and process/product design using DMAIC methodology; 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.

Prerequisite: ISYE311, ISYE352. Offered: Fall Spring.

ISYE 451 - Operations Research 2 (3)

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.

Prerequisite: ISYE251. Offered: Fall Summer.

ISYE 461 - Engineering Psychology (3)

This course introduces the fundamentals of human information processing. It will introduce students to ways of designing human-machine systems so that they are compatible with the way a person perceives, thinks, remembers, decides, and responds to information. Methods and theories of human performance are introduced and several design examples and case studies will be presented to help students apply the concepts and principles in domains such as service, management, manufacturing, transportation and control systems.

Prerequisite: ISYE360. Offered: Spring.

ISYE 475 - Facilities Planning and Warehousing (4)

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.

Prerequisite: ISYE352. Offered: Fall Spring.

ISYE 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

ISYE 480 - Financial Engineering (3)

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.

Prerequisite: ISYE 251, MATH 242. Offered: Spring.

ISYE 481 - Procurement and Supply Management (3)

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.

Prerequisite: ISYE351. Offered: Fall Spring.

ISYE 485 - Stochastic Manufacturing And Service Systems (3)

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.

Prerequisite: ISYE331.

ISYE 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

ISYE 495 - Special Topics in Industrl Eng (3)

This course mainly deals with new trends in industrial and systems engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

ISYE 497 - Senior Design Project I (3)

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.

Prerequisite: (ENGR111, or GENS101), ISYE341, ISYE311, Senior Standing. Offered: Fall Spring.

ISYE 498 - Senior Design ProjectII (3)

Prerequisite: ISYE497. Offered: Fall Spring.

JAPN - Japan

JAPN 101 - Elementary Japanese I (3)

This course is designed for those who have no prior knowledge of Japanese. By completing this course, students are expected to become familiar with Japanese language and culture. The course teaches basic language skills, builds up vocabulary, and develops an understanding of grammar and basic sentence structures as a foundation for communication.

Offered: Fall Spring.

JAPN 102 - Elementary Japanese II (3)

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.

Prerequisite: JAPN101. Offered: Fall.

KORA - Korean

KORA 101 - Elementary Korean I (3)

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.

Offered: Fall Spring.

KORA 102 - Elementary Korean II (3)

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.

Prerequisite: KORA101. Offered: Fall Spring.

LTCM - Literature and Composition

LTCM 150 - Academic Reading (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

LTCM 213 - Short Stories from around the World (3)

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.

Prerequisite: ENGL102.

LTCM 221 - Intercultural Communication (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

LTCM 224 - Digital Composition (3)

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.

Prerequisite: ENGL102.

LTCM 225 - Media Literacy (3)

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.

Prerequisite: ENGL102.

LTCM 240 - Introduction to Linguistics (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

LTCM 260 - Writing About Innovation (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

LTCM 280 - Studying Human Language (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring.

LTCM 311 - Technical Communications (3)

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.

Prerequisite: ENGL102. Offered: Fall Spring Summer.

LTCM 325 - Travel Writing (3)

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.

Prerequisite: ENGL102.

LTCM 328 - Digital Public Speaking (3)

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.

Prerequisite: ENGL102. Offered: Fall.

LTCM 330 - Thinking through Technology (3)

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.

Prerequisite: ENGL102.

LTCM 332 - Communications Ethics (3)

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.

Prerequisite: ENGL102.

LTCM 335 - Games and Narrative (3)

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.

Prerequisite: ENGL102.

LTCM 337 - Visual Communications (3)

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.

Prerequisite: ENGL102.

LTCM 340 - Language & Intercultural Communications (3)

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.

Prerequisite: ENGL102. Offered: Fall.

LTCM 345 - Science Journalism (3)

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.

Prerequisite: ENGL102.

LTCM 370 - Global Media (3)

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.

Prerequisite: ENGL102.

MATH - Mathematics

MATH 101 - Fundamentals of Mathematical Reasoning (3)

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.

Offered: Fall Spring.

MATH 111 - Calculus I (4)

This course introduces students to the theory and techniques of single variable differential and integral calculus. The emphasis is on problem solving. Topics include studying the exponential, logarithmic, trigonometric, and polynomial functions. Their limits, continuity, derivatives, and extrema are studied. Integration is introduced and students learn to compute the area under a curve as well as volumes by slicing, disks, washers, and cylindrical shells.

Offered: Fall Spring Summer.

MATH 112 - Calculus II (4)

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.

Prerequisite: MATH111. Offered: Fall Spring Summer.

MATH 121 - (3)
MATH 204 - Linear Algebra (3)

This course introduces properties of matrices, determinants, and solution techniques for systems of linear equations. The course presents basic properties of vector spaces, subspaces, linear independence, span, basis, and coordinates. Students study linear transformations and their matrix representations. The course examines eigenvalues, eigenvectors, and diagonalization. Finally, Euclidean inner product, orthogonality, and the Gram-Schmidt process are presented.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 206 - Differential Equations (3)

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.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 211 - Differential Equations and Linear Algebra (4)

This course introduces ordinary differential equations with linear algebra. The course covers basic topics of linear algebra, including linear systems, basic properties of matrices, vector spaces, and eigenvalues and eigenvectors. The course also covers solution techniques for first-order differential equations, higher-order linear equations with constant coefficients, linear and almost linear systems of differential equations, and Laplace transforms.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 214 - Mathematical and Statistical Software (3)

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.

Prerequisite: (MATH204, or MATH211), (MATH242, or MATH243 or MATH244), (ENGR114, or COSC114). Offered: Fall Spring.

MATH 231 - Calculus III (3)

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.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 232 - Engineering Mathematics (3)

This course covers selected topics from mathematical analysis with engineering applications, including complex numbers, partial derivatives, gradient vectors, multiple integrals, and Fourier series.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 234 - Discrete Mathematics (3)

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.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 242 - Introduction to Probability and Statistics (3)

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.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 243 - Probability and Statistical Inference (3)

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.

Prerequisite: MATH112. Offered: Fall Spring Summer.

MATH 244 - Probability (3)

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.

Prerequisite: MATH112. Offered: Fall.

MATH 245 - Mathematical Statistics (3)

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.

Prerequisite: (MATH244, or, MATH243, or MATH242). Offered: Spring.

MATH 251 - Operations Research I (4)

This course introduces operations research and deterministic mathematical modeling with a focus on linear programming. Topics include graphical interpretation of linear optimization problems, simplex method, duality sensitivity analysis and general solution strategies. Emphasis is given to modeling industry problems and interpretation of the solutions obtained. Students learn to use modern modeling languages and software to find optimal solutions for large-scale problems.

Prerequisite: MATH204, or MATH211.

MATH 252 - Introduction to Applied Statistics (3)

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.

Prerequisite: MATH112. Offered: Spring.

MATH 295 - Special Topics in Mathematics (3)

Offered: Spring.

MATH 296 - Directed Studies (3)

Offered: Fall Spring Summer.

MATH 315 - Advanced Linear Algebra with Applications to Data Science (3)

This course presents the mathematical structure of vector spaces and multilinear 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. Applications of these concepts to data science are emphasized throughout the course.

Prerequisite: MATH204, or MATH211. Offered: Fall Spring.

MATH 316 - Partial Differential Equations (3)

The course introduces the modern theory of partial differential equations in classical formulation. Students will have the chance to study some of the following topics: PDEs and their classifications, well-posedness, solutions of first and second order PDEs using transforms.

Prerequisite: (MATH204, or MATH206, or MATH324, or MATH352). Offered: Spring.

MATH 317 - Nonparametric Statistics (3)

The course provides an overview of modern nonparametric statistics and aims at familiarizing students with a wide range of ideas in this field. A combination of theoretical results and computational techniques will be presented with the clear goal of developing a thorough understanding of a number of useful methods in analyzing data.

Prerequisite: MATH214, MATH245. Offered: Spring.

MATH 318 - Multivariate Statistics (3)

This course introduces statistical learning methods with emphasis on analysis of categorical data and application to real data sets. Students learn different types of regression models (linear, logistic and nonparametric). Classification methods (discriminant analysis and support vector machines) are presented along with dimensionality reduction techniques (principal component analysis and clustering). Resampling techniques and model selection methods are also discussed.

Prerequisite: MATH214, MATH231, MATH245. Offered: Fall Spring.

MATH 319 - Numerical Analysis I (3)

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.

Prerequisite: MATH214, MATH204, MATH206. Offered: Fall Spring Summer.

MATH 320 - Mathematical Foundations of General Relativity (3)

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.

Prerequisite: MATH204, MATH206, MATH231. Offered: Spring.

MATH 324 - Real Analysis I (4)

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.

Prerequisite: MATH101, MATH112. Offered: Fall Spring.

MATH 331 - Stochastic Processes (3)

This course introduces stochastic processes and their applications. Topics covered include discrete and continuous time Markov processes, branching processes, Poisson process and basic queuing models. Students learn to use stochastic processes to model and analyze problems in engineering, biology and finance.

Prerequisite: MATH204, MATH211.

MATH 333 - Applied Engineering Mathematics (3)

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.

Prerequisite: MATH204, MATH206, (ENGR114, or COSC114). Offered: Fall Spring.

MATH 352 - Complex Functions (3)

This course introduces the theory of analytic functions of a complex variable. Students use Fourier series, transforms and integrals to solve boundary-value problems. The complex Laplace transform and its inverse are also studied. The course presents theory of residues in relation to Fourier and Laplace integrals and transforms as well as conformal mapping. Students learn Cauchy's integral formula, Cauchy-Riemann equations, and calculate Taylor's and Laurent's expansions.

Prerequisite: MATH231. Offered: Fall Spring.

MATH 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

MATH 391 - Direct Studies (3)

Offered: Fall Spring Summer.

MATH 395 - Special Topics in Mathematics (4)

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.

Offered: Fall.

MATH 399 - Internship (1)

The internship provides students with practical, on-the-job experience. 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.

Prerequisite: SDAS300. Offered: Spring Summer.

MATH 410 - Introduction to Topology (3)

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

Prerequisite: MATH231, MATH324. Offered: Fall.

MATH 411 - Modern Algebra (3)

Survey of properties of fundamental elements of modern algebra such as groups, rings, and fields and their applications to engineering. Topics include: sets and functions, fundamental theorems of groups, rings, and fields; homomorphism theorems; Galois theory; applications to number theory and encryption, coding theory and error-correcting codes.

Prerequisite: MATH315, or MATH324. Offered: Fall.

MATH 412 - Optimization (3)

This course introduces main optimization techniques and their applications in physics, engineering, economics and social sciences. The course covers unconstrained optimization algorithms and methods to solve linear and nonlinear constrained optimization problems. The course is completed by a particular emphasis on convex optimization and recently developed machine learning algorithms.

Prerequisite: MATH204, MATH231. Offered: Fall Spring.

MATH 413 - Game Thoery (3)

Introduction to the mathematical theory of games and game theoretic analysis. Topics include: combinatorial and strategic games, Zermelo's algorithm, strictly competitive games, minimax theorem; non-cooperative games and Nash equilibrium; games with mediated communication, repeated games and finite automata; common knowledge and incomplete information; applications in economics, biology, and political science.

Prerequisite: MATH315. Offered: Spring.

MATH 414 - Discrete Mathematics (3)

Review of propositional and predicate calculus. Introduction to naÃ¯ve 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.

Prerequisite: MATH315. Offered: Spring.

MATH 415 - Design of Experiments (3)

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.

Prerequisite: MATH318, or ESMA311. Offered: Fall Spring.

MATH 416 - Sample Survey Design and Analysis (3)

The course focuses on methodological issues regarding the design, implementation, analysis, and interpretation of surveys and questionnaires in variety of applied areas, such as education, healthcare, and social sciences.

Prerequisite: MATH214, MATH245. Offered: Spring.

MATH 417 - Measure and Probability Theory (3)

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.

Prerequisite: MATH244, MATH324.

MATH 419 - Numerical Analysis II (3)

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.

Prerequisite: MATH316, MATH319. Offered: Fall Spring.

MATH 421 - Econometrics (3)

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.

Prerequisite: MATH317, MATH318.

MATH 422 - Stochastic Differential Equations (3)

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.

Prerequisite: MATH314, or MATH324. Offered: Fall Spring.

MATH 423 - Financial Risk Analysis (3)

This course provides an overview of the main theoretical concepts underlying the analysis of financial risk. The course presents applications of theoretical concepts in practice in a variety of financial contexts. Additionally, students learn to solve risk analysis problems numerically using optimization methods and numerical simulations.

Prerequisite: MATH412, (MATH242, or MATH243, or MATH244). Offered: Spring.

MATH 424 - Optimal Control Thoery (3)

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.

Prerequisite: MATH214, MATH316, MATH412. Offered: Fall Spring.

MATH 425 - Financial Portfolio Management (3)

This course introduces relevant financial management problems that are solved and analyzed using optimization techniques. These techniques are applied to several case studies using linear and nonlinear programming, dynamic programming, and stochastic programming. Financial topics covered include asset-liability management, option pricing and hedging, risk management, and portfolio selection.

Prerequisite: MATH245, MATH412.

MATH 426 - Finance in Discrete Time (3)

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.

Prerequisite: MATH214, MATH231 (MATH243, or MATH245). Offered: Fall Spring.

MATH 431 - Discrete Mathematical Models in Biology (3)

This course applies mathematical theory and techniques to biological and biomedical applications with an emphasis on discrete mathematical modelling. The course introduces discrete deterministic/probabilistic modelling methods, such as difference equations, cellular automata or surface-energy models, agent-based models and network models. Cell migration and growth dynamics of bacterial colonies, tumors and epidemiology are explored..

Prerequisite: (ENGR114, or COSC114), MATH206, (MATH242, or MATH243, or MATH245). Offered: Fall.

MATH 432 - Continuous Mathematical Models in Biology (3)

This course applies mathematical theory and techniques to biological and biomedical applications. The course focuses on continuous mathematical modelling techniques with applications to single species and interacting population

dynamics. The course introduces modeling of infections, cell populations, single-cell decision-making, tissue pattern formation, and cancer modeling. Biological models are analyzed and interpreted using mathematical tools such as phase portraits, bifurcation diagrams, and perturbation theory.

Prerequisite: MATH231, MATH206, (MATH242, or MATH243, or MATH244), MATH316. Offered: Spring.

MATH 433 - Biostatistisc (3)

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.

Prerequisite: MATH318, BMED211.

MATH 434 - Bioinformatics (3)

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.

Prerequisite: MATH433, BMED202.

MATH 435 - Mathematical Imaging (3)

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.

Prerequisite: MATH317, MATH318, MATH412.

MATH 467 - Introduction to Mathematics Teaching (3)

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.

MATH 468 - Teaching Key Concepts in Mathematics (3)

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.

Prerequisite: MATH467.

MATH 475 - Model Calibration and Uncertainty Quantification (3)

This course introduces students to uncertainty quantification for physical and biological models. Course topics include parameter selection techniques, sensitivity analysis, and frequentist and Bayesian model calibration. Propagation of uncertainties in the models is studied along with the construction of surrogate models and stochastic spectral methods. Applications include climate, engineering, biological and biomedical phenomena.

Prerequisite: (ENGR114, or COSC114, or MATH 214), (MATH204, or MATH211), (MATH242, or MATH243) or MATH 244, MATH319.

MATH 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

MATH 485 - Nonlinear Dynamics (3)

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.

Prerequisite: MATH204, MATH206, MATH231. Offered: Fall.

MATH 495 - Selected Topics (3)

Offered: Spring.

MATH 497 - Senior Research Project I (3)

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.

Prerequisite: Senior standing. Offered: Fall Spring.

MATH 498 - Senior Research Project II (3)

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.

Prerequisite: MATH497. Offered: Fall Spring.

MDBS - MDBS

MEEN - Mechanical Engineering

MEEN 180 - Computer Aided Design (3)

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.

Offered: Fall.

MEEN 200 - Statics (3)

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.

Prerequisite: PHYS121. Offered: Fall Spring.

MEEN 201 - Engineering Dynamics (3)

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.

Prerequisite: MEEN200. Corequisite: MATH211. Offered: Fall Spring.

MEEN 225 - Engineering Materials (4)

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.

Prerequisite: CHEM115, PHYS121. Offered: Fall Spring.

MEEN 240 - Thermodynamics (3)

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.

Prerequisite: PHYS121. Offered: Fall Spring.

MEEN 300 - System Dynamics and Control (3)

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.

Prerequisite: MATH211. Offered: Fall.

MEEN 301 - Introduction to Artificial Intelligence and its Applications in Mechanical Engineering (3)

This course provides an overview of the general artificial intelligence and machine learning approaches and techniques used to solve mechanical engineering problems. The course covers the concepts of the three main techniques of machine learning: supervised learning, unsupervised learning and reinforcement learning, and provides an introduction to physical and embodied intelligence and their applications in mechanical engineering.

Prerequisite: MATH211, MATH243, (ENGR114, or COSC114). Offered: Fall.

MEEN 325 - Mechanics of Solids (4)

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.

Prerequisite: MEEN200. Offered: Fall Spring.

MEEN 335 - Fluid Mechanics (4)

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.

Prerequisite: MATH231. Corequisite: MEEN240. Offered: Fall Spring.

MEEN 343 - Heat Transfer (4)

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.

Prerequisite: MATH231, MEEN240. Corequisite: MEEN335. Offered: Fall Spring.

MEEN 350 - Dynamic Systems and Vibration (3)

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.

Prerequisite: PHYS122, MEEN201, MATH211. Offered: Fall Spring.

MEEN 356 - Computer-Controlled Systems (4)

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.

Prerequisite: MEEN350. Offered: Fall Spring.

MEEN 360 - Computational Methods for Mechanical Engineers (3)

Understand the concept of numerical methods and their application in solving computational problems related to mechanical engineering using MATLAB.

Prerequisite: ENGR114, or COSC114. Corequisite: MATH211. Offered: Fall.

MEEN 370 - Introduction to Manufacturing Processes (4)

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.

Corequisite: MEEN325. Offered: Spring.

MEEN 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods

and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

MEEN 380 - Introduction to Polymer Science and Engineering (3)

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.

Prerequisite: CHEM115, PHYS122.

MEEN 387 - Machine Element Design (3)

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.

Prerequisite: MEEN325. Offered: Spring.

MEEN 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring.

MEEN 395 - Special Topics in Mechanical Engineering (3)

This course mainly deals with new trends in mechanical engineering and emerging technologies. Course is repeatable if title and content differ

Offered: Fall Spring.

MEEN 405 - Vibration Analysis (3)

This course covers 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, energy methods, Holzer method and vibration of continuous systems such as bars, plates, beams and shafts.

Prerequisite: MEEN350. Offered: Fall Spring.

MEEN 410 - Viscous and Boundary Layer Flows (3)

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.

Prerequisite: MEEN335. Offered: Fall Spring.

MEEN 420 - Materials: Strength & Fracture (3)

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.

Prerequisite: MEEN225. Offered: Spring.

MEEN 421 - Mechanics of Deformable Solids (3)

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.

Prerequisite: MEEN325.

MEEN 422 - Fatigue and Fracture Analysis (3)

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.

Prerequisite: MEEN325. Offered: Spring.

MEEN 423 - Physical Metallurgy (3)

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.

Prerequisite: MEEN225. Offered: Fall.

MEEN 435 - Turbomachinery (3)

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.

Prerequisite: MEEN335. Offered: Fall Spring.

MEEN 439 - Kinematics and Dynamics of Machines (3)

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.

Prerequisite: MEEN350.

MEEN 441 - Applied Thermodynamics (3)

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.

Prerequisite: MEEN240. Offered: Fall Spring.

MEEN 446 - Internal Combustion Engines (3)

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.

Prerequisite: MEEN240. Offered: Fall Spring.

MEEN 450 - Vehicle Engineering (3)

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.

Prerequisite: MEEN350. Offered: Spring.

MEEN 454 - Refrigeration, Air Conditioning and Cryogenics (3)

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.

Prerequisite: MEEN343. Offered: Fall Spring.

MEEN 455 - Finite Element Analysis (3)

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.

Prerequisite: MEEN200, MATH211.

MEEN 465 - Bioengineering (3)

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.

Prerequisite: MEEN225, MEEN325, MEEN335. Corequisite: MEEN225.

MEEN 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall.

MEEN 484 - Mechatronics (3)

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.

Prerequisite: MEEN350. Offered: Fall Spring.

MEEN 485 - Introduction to Robotics (3)

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.

Prerequisite: MEEN350. Offered: Fall Spring.

MEEN 486 - Renewable & Sustainable Energy (3)

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.

Prerequisite: MEEN240. Offered: Fall Spring.

MEEN 487 - Advanced Mechatronics (3)

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.

Prerequisite: MEEN484, (ECCE300 or ECCE302).

MEEN 488 - Mechatronics Systems Design (3)

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.

Prerequisite: MEEN485. Corequisite: MEEN487.

MEEN 489 - Kinematics and Dynamics of Machines (3)

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.

Prerequisite: MEEN350.

MEEN 491 - Independent Study II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Fall Spring Summer.

MEEN 495 - Special Topics in Mechanical Engineering (3)

This course mainly deals with new trends in mechanical engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

MEEN 497 - Senior Design Project I (3)

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.

Prerequisite: Senior Standing. Corequisite: MEEN370, MEEN387, MEEN350. Offered: Fall Spring.

MEEN 498 - Senior Design Project II (3)

Prerequisite: MEEN 497. Offered: Fall Spring.

NUCE - Nuclear Engineering

NUCE 301 - Radiation Science & Health Physics (3)

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

Prerequisite: (PHYS121, MATH206, (MATH204, or CHEG312). Offered: Fall Spring.

NUCE 302 - Applied Mathematics for Nuclear Engineering (3)

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.

Offered: Fall Spring.

NUCE 303 - Mechanics & Thermal-hydraulics Principles for Nuclear Engineering (3)

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.

Prerequisite: PHYS121. Offered: Fall Spring.

NUCE 304 - Evaluative Methods for Nuclear Non-proliferation and Security (3)

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.

Offered: Fall.

NUCE 352 - Materials in Nuclear Power Plants (3)

The course covers materials (metals, alloys, ceramics, polymers, and concrete) used in nuclear power plants. Topics covered include understanding of material behavior; the effects of structure, properties, and processing of materials used in nuclear systems on their behavior in radiation environments. Emphasis is on the effect of radiation on the microstructure, mechanical, electrical, thermal and corrosion properties of materials

Prerequisite: CHEG350.

NUCE 401 - Introduction to Nuclear Reactor Physics (3)

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.

Corequisite: NUCE301. Offered: Fall Spring Summer.

NUCE 402 - Introduction to Nuclear Systems and Operation (3)

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.

Prerequisite: (NUCE303, or MEEN240, or CHEG230), (MEEN335, or CHEG232). Offered: Fall Spring.

NUCE 403 - Introduction to Nuclear Technology and Reactor Systems (3)

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.

Prerequisite: NUCE401, MEEN240, (NUCE303, or

MEEN335). Offered: Summer.

PEEG - Petroleum Engineering

PEEG 218 - Reservoir Rock Properties (3)

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.

Prerequisite: GENS101. Offered: Fall Summer.

PEEG 219 - Reservoir Fluid Properties (3)

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.

Prerequisite: CHEM116, MEEN240. Offered: Spring.

PEEG 252 - Statics and Mechanics of Materials for PE (3)

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.

Prerequisite: MATH112, PHYS121. Offered: Spring.

PEEG 302 - Fluid Mechanics and Heat Transfer (3)

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.

Prerequisite: MEEN240. Offered: Spring.

PEEG 314 - Well Logging (3)

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. Well log analysis is further supported by machine learning techniques to estimate formation properties.

Prerequisite: PEEG218, PHYS122. Corequisite: PEEG322. Offered: Fall.

PEEG 315 - Reservoir Characterization (3)

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. This is added for estimation of formation properties using machine learning techniques.

Prerequisite: PEEG219, PEEG314, PGEG311. Offered: Spring.

PEEG 322 - Drilling Engineering I (3)

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.

Prerequisite: PEEG252. Corequisite: PEEG314. Offered: Fall.

PEEG 326 - Drilling Engineering II (3)

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 along with AI/ML-related techniques.

Prerequisite: PEEG322, PEEG302. Offered: Spring.

PEEG 331 - Reservoir Engineering I (3)

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. The students will be introduced to AI techniques on decline curve analysis.

Prerequisite: PEEG218, PEEG219, PEEG302. Offered: Fall Summer.

PEEG 334 - Reservoir Engineering II (4)

Prerequisite: MATH 206, PEEG 331. Offered: Spring.

PEEG 336 - Well Testing (3)

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.

Prerequisite: PEEG331, PEEG314, MATH206. Offered: Spring.

PEEG 341 - Completion and Workover (3)

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.

Prerequisite: PEEG322. Offered: Spring.

PEEG 360 - Petroleum Economics & Risk Analysis (4)

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.

Prerequisite: HUMA150, or BUSS150. Offered: Spring.

PEEG 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

PEEG 391 - Independent Study I (3)

Prerequisite: Department Approval and Junior standing. Students must have a CGPA of 3.3 or more.

PEEG 394 - Research Topics in Petroleum Engineering (3)

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 (3)

This course mainly deals with new trends in petroleum engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall Spring.

PEEG 397 - Petroleum Engineering Internship (3)

Offered: Summer.

PEEG 420 - Well Treatment (3)

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.

Prerequisite: PEEG341. Offered: Fall.

PEEG 423 - Horizontal and Multilateral Well Technology (3)

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.

Prerequisite: PEEG326.

PEEG 424 - Underbalanced Drilling Technology (3)

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.

Prerequisite: PEEG326.

PEEG 425 - Pressure Control (3)

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.

Prerequisite: PEEG326.

PEEG 434 - Reservoir Engineering II (4)

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.

Prerequisite: PEEG331, PEEG315, MATH206. Offered: Fall Spring.

PEEG 436 - Well Testing (3)

Prerequisite: MATH 206, MATH 261, PEEG 314, PEEG 331. Offered: Fall.

PEEG 437 - Natural Gas Engineering (3)

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.

Prerequisite: PEEG331. Offered: Fall.

PEEG 442 - Surface Production Facilities (3)

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.

Prerequisite: PEEG302. Offered: Fall.

PEEG 443 - Production System Design and Analysis (3)

This course utilizes Nodal Analysis techniques for the design and performance analysis of the production system starting from the formation up to the production separator. Topics include inflow performance relationships, multiphase flow in horizontal, vertical and inclined pipes, overall well performance evaluation considering various nodes within the production system, and applications to design and analysis situations. In addition to applications to flowing wells, the application of NODAL analysis methods is discussed to the most important two versions of artificial lift techniques: gas lifting and production by electrical submersible pumps.

Prerequisite: PEEG331, PEEG341. Offered: Fall.

PEEG 445 - Production Enhancement (3)

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.

Prerequisite: PEEG341, PEEG443. Offered: Spring.

PEEG 447 - Production Engineering (3)

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.

Prerequisite: PEEG341. Offered: Fall.

PEEG 456 - Petroleum Related Rock Mechanics (3)

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.

Prerequisite: PEEG252.

PEEG 460 - Petroleum Economics and Risk Analysis (4)

Prerequisite: BUSS 150, H&SS 251, H&SS 350. Offered: Spring.

PEEG 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more.

PEEG 491 - Petroleum Engineering Design Project II (3)

Prerequisite: Department Approval and Senior Standing. Students must have a CGPA of 3.3 or more. Offered: Spring.

PEEG 494 - Research Topics in Petroleum Engineering (3)

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 (3)

This course mainly deals with new trends in petroleum engineering and emerging technologies. Course is repeatable if title and content differ.

Offered: Fall.

PEEG 497 - Senior Design Project I (3)

Comprehensive and team-based field development and design experience in petroleum engineering. SDP-I has two modules. Module-1 covers reservoir characterization

and evaluation based on given geological, geophysical, and well test data. Module-2 covers well drilling and completion design. SDP II has three modules. Module-3 covers reservoir management surveillance strategies. Module 4 covers the design of the Oil Gas processing facility and Module 5 covers project economics, HSE, and risk analysis. This course provides an opportunity to exercise initiatives, engineering judgment, self-reliance, and creativity, in a team environment similar to the EP industry. The projects require students to use engineering standards and realistic constraints in their design process, develop suitable criteria for equipment selection based on their acquired engineering skills, experience, and other pertinent resources, and perform a comprehensive economic analysis, with due consideration to the issues relating to safety and ethics in oilfieldoperations.

Prerequisite: PEEG322, PEEG315, PEEG336, PEEG360. Corequisite: PEEG434, PEEG447. Offered: Fall.

PEEG 498 - Senior Design Project II (3)

Comprehensive and team-based field development and design experience in petroleum engineering. SDP-I has two modules. Module-1 covers reservoir characterization and evaluation based on given geological, geophysical, and well test data. Module-2 covers well drilling and completion design. SDP II has three modules. Module-3 covers reservoir management surveillance strategies. Module 4 covers the design of the Oil Gas processing facility and Module 5 covers project economics, HSE, and risk analysis. This course provides an opportunity to exercise initiatives, engineering judgment, self-reliance, and creativity, in a team environment similar to the EP industry. The projects require students to use engineering standards and realistic constraints in their design process, develop suitable criteria for equipment selection based on their acquired engineering skills, experience, and other pertinent resources, and perform a comprehensive economic analysis, with due consideration to the issues relating to safety and ethics in oilfield operations.

Prerequisite: PEEG497. Offered: Spring.

PGEG-Geo-Sciences

PGEG 210 - Earth Materials (3)

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.

Prerequisite: CHEM116, PGEG221. Offered: Spring.

PGEG 220 - Geology of the Middle East (3)

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 Earthï¿½s 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.

Prerequisite: PGEG 221. Offered: Spring.

PGEG 221 - Intro to Geology & Geophysics (3)

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; Earthï¿½s 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.

Offered: Fall Spring.

PGEG 222 - The Evolving Earth (4)
PGEG 230 - Geological Maps (3)

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 geologistï¿½s 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.

Prerequisite: PGEG 221. Offered: Spring.

PGEG 293 - Special Topics in Petroleum Geosciences (3)

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.

PGEG 300 - Matlab for Earth Scientists (3)

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.

Prerequisite: ENGR 112, ENGR 113, MATH 212, MATH 231. Offered: Fall.

PGEG 311 - Sedimentary Petrology (4)

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.

Prerequisite: PGEG 220, PGEG 221. Offered: Fall.

PGEG 312 - Reflection Seismology (4)

This course covers the fundamental wave theory that is the basis for the method, and the seismic data acquisition, processing, and display techniques in such a way that one can map the underground and describe its characteristics. The course has a significant theoretical component, and includes class exercises using seismic software and display systems on real-world seismic data. A major component of the course is to design, acquire data, and interpret a seismic reflection survey. The course requires fieldwork.

Prerequisite: PGEG221, PHYS122, MATH231. Offered: Fall.

PGEG 321 - Structural Geology (4)

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.

Prerequisite: PGEG 121, PGEG 221, PGEG 230, PHYS 121, PHYS 191. Offered: Fall.

PGEG 324 - Remote Sensing for Earth Sciences Applications & GIS (3)

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.

Prerequisite: ENGR 150, MATH 212, PHYS 241.

PGEG 331 - Igneous and Metamorphic Petrology (3)

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.

Prerequisite: PGEG 210. Offered: Fall.

PGEG 341 - Paleontology (3)

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.

Prerequisite: PGEG220. Offered: Fall.

PGEG 351 - Applied Geophysics (4)

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.

Prerequisite: PGEG 221, PHYS 122. Offered: Spring.

PGEG 361 - Sedimentology and Stratigraphy (3)

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.

Prerequisite: PGEG 220, PGEG 311. Offered: Spring.

PGEG 371 - Data Analysis and Geostatistics (4)

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.

Prerequisite: MATH 231, PGEG 221. Offered: Spring.

PGEG 381 - Rock Mechanics and Reservoirs (3)

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.

Prerequisite: PGEG 321. Offered: Spring.

PGEG 393 - Special Topics in Petroleum Geosciences (4)

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.

Offered: Spring Summer.

PGEG 394 - Research Topics in Petroleum Geosciences (3)

The course focuses on research-driven topics. A student can take multiple Research Topics courses with different content for credit subject to program approval.

Offered: Spring.

PGEG 396 - Independent Study in Petroleum Geosciences (6)

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).

PGEG 397 - Field Petroleum Geology (4)

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.

Prerequisite: PGEG321, PGEG361, SDAS300. Offered: Summer.

PGEG 398 - Geophysics Internship (3)

Students are assigned to a variety of ADNOCï¿½s 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 industryï¿½s working environment. Each student is required to submit a written report and deliver a presentation on his/her work assignment.

Prerequisite: PGEG312, PGEG351, PGEG361, SDAS300. Offered: Spring Summer.

PGEG 400 - Seismic Data Acquisition and Processing (3)

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.

Prerequisite: MATH 206, MATH 261, PGEG 300, PGEG 312, PGEG 411. Offered: Fall.

PGEG 401 - Petrophysics and Logging (4)

The course presents the physical principles of well logging. PGEG401 introduces students to geophysical measurements made under borehole and lab conditions. The course also demonstrates methods to correlate geophysical measurements and rock properties and prepares students to perform basic well log and core data interpretation. The course covers concepts of rock properties and their application in the oil industry; lab measurements of rock properties (porosity, permeability, density, resistivity, fluid saturation); lithology logs, porosity logs, fluid saturation and permeability estimation from well logs; and full well log interpretation. The course refers to rock mechanics from core and well log data.

Prerequisite: PGEG361, PGEG371. Offered: Fall.

PGEG 410 - Reservoir Geophysics (4)

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.

Prerequisite: PGEG 351, PGEG 400, PGEG 401. Offered: Spring.

PGEG 412 - Seismic Reflection Interpretation (4)

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.

Prerequisite: PGEG 312. Corequisite: PGEG 461. Offered: Spring.

PGEG 413 - Micropaleontology (3)

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.

Prerequisite: PGEG 341.

PGEG 451 - Environmental Geology (3)

This course deals with how people interact with Earthï¿½s 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.

Prerequisite: CHEM 116, PGEG 221. Offered: Spring.

PGEG 461 - Reservoir Characterization Project (4)

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.

Prerequisite: PGEG 361. Corequisite: PGEG 412. Offered: Spring.

PGEG 493 - Special Topics in Petroleum Geosciences (3)

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.

PGEG 494 - Research Topics in Petroleum Geosciences (3)

The course focuses on research-driven topics. A student can take multiple Research Topics courses with different content for credit subject to program approval.

Offered: Fall Spring.

PGEG 496 - Independent Study in Petroleum Geosciences (6)

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).

PGEG 497 - Senior Research Project I (3)

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.

Offered: Fall.

PGEG 498 - Senior Research Project II (3)

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 Earth and Planetary Sciences Program. The course consists mostly of independent project work.

Prerequisite: PGEG497. Offered: Fall Spring.

PGEG 499 - Research in Oil Reservoir Pro (3)

PHYS - Physics

PHYS 103 - Orientation to Physics (4)

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.

Offered: Fall Spring.

PHYS 121 - University Physics I (4)

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.

Prerequisite: MATH111. Offered: Fall Spring Summer.

PHYS 122 - University Physics II (4)

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.

Prerequisite: PHYS121, MATH112. Offered: Fall Spring Summer.

PHYS 201 - Physics Instrumentation I (3)

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.

Prerequisite: PHYS122. Offered: Fall Spring.

PHYS 203 - Introduction to Astronomy (4)

This course is an introduction to astronomy. The topics cover the structure and evolution of the solar system stars. The stellar structure and evolution. History of Astronomy, Astronomical instruments and types of telescopes.

Prerequisite: PHYS121. Offered: Fall Spring.

PHYS 211 - Computational Physics (4)

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.

Prerequisite: PHYS122. Offered: Spring.

PHYS 213 - University Physics III (4)

This course provides an introduction to quantum mechanics. The need for a fundamental revision of physics is explained and the SchrÃ¶dinger equation is introduced and applied. Students learn about operator formalism and Dirac notation with their applications in simple systems such as harmonic oscillators. In addition, orbital and spin angular momenta along with Pauli matrices are discussed.

Prerequisite: PHYS122. Offered: Spring.

PHYS 231 - Optics (4)

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.

Prerequisite: PHYS122. Offered: Spring.

PHYS 250 - Mathematical Physics (4)

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.

Prerequisite: MATH204, MATH206, MATH231, PHYS122. Offered: Spring.

PHYS 295 - Introduction to Quantum Mechanics for Scientists and Engineers (3)

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.

Prerequisite: PHYS122, MATH204, MATH206. Offered: Fall.

PHYS 311 - Intermediate Mechanics (3)

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.

Prerequisite: PHYS213, PHYS250. Offered: Fall.

PHYS 321 - Electricity and Magnetism I (4)

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.

Prerequisite: PHYS250. Offered: Fall.

PHYS 331 - Quantum Physics I (4)

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.

Prerequisite: PHYS250. Corequisite: PHYS321. Offered: Fall.

PHYS 340 - Thermal & Statistical Physics (4)

This course covers the principles of thermodynamics and statistical mechanics. Students learn and relate concepts such as heat flow, temperature, entropy, and energy. Furthermore, applications of thermodynamics laws and molecular statistics, including phase transitions, are discussed in depth. Additionally, the course introduces basic concepts of quantum statistics including density of states and distribution functions.

Prerequisite: PHYS211, PHYS250. Offered: Spring.

PHYS 350 - Introduction to Nanophysics (3)

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.

Prerequisite: PHYS122. Offered: Fall Spring.

PHYS 351 - Advanced laboratory I (3)

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.

Prerequisite: PHYS331. Offered: Spring.

PHYS 361 - Engineering Physics I (3)

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.

Prerequisite: MATH111.

PHYS 362 - Engineering Physics II (3)

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.

Prerequisite: PHYS361.

PHYS 363 - Physics Instrumentation II (3)

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.

Prerequisite: PHYS201.

PHYS 371 - (3)
PHYS 372 - (3)
PHYS 377 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Junior standing.

PHYS 381 - Introduction to Biological Physics (3)

The course offers a macroscopic and microscopic view of elementary biological systems that are useful in engineering problem solving, following the Energy-Information-Life paradigm and its potential applications. The course combines the pre-existing knowledge of general science and treats cells and nerves through their chemo-electro-mechanical model from energy and information processing viewpoint. The course relies on general science concepts of dissipation, diffusion, random walks, and entropy to introduce processes of engineering interest such as self-assembly, molecular motors, and neural networks.

Prerequisite: PHYS250. Offered: Fall.

PHYS 391 - Independent study I (3)

Prerequisite: Department Approval and Junior standing. Offered: Fall.

PHYS 399 - Physics Internship (1)

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.

Prerequisite: SDAS300. Offered: Summer.

PHYS 403 - Observational Stellar and Galactic Astrophysics (3)

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.

Prerequisite: PHYS203. Offered: Fall.

PHYS 404 - High-Energy Astrophysics (3)

This course covers the physics of stars, galaxies and their characteristics. Students learn about the inner workings of stars, their structure and evolution, and the death of stars: from star formation to neutron stars and black holes. In addition, the properties of galaxies, interstellar dust and gas, galaxy clusters, and interstellar magnetic fields are discussed.

Prerequisite: PHYS203.

PHYS 412 - Advanced Mechanics (3)

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.

Prerequisite: PHYS311.

PHYS 420 - Atomic and Molecular Physics (3)

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.

Prerequisite: PHYS331. Offered: Fall.

PHYS 422 - Electricity and Magnetism II (3)

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.

Prerequisite: PHYS321. Offered: Spring.

PHYS 431 - Solid State Physics (3)

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.

Prerequisite: PHYS321, PHYS331.

PHYS 432 - Quantum Physics II (4)

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 mportant 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.

Prerequisite: PHYS331. Offered: Spring.

PHYS 441 - Space Physics (3)

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.

Prerequisite: PHYS403.

PHYS 450 - Nuclear and Particle Physics (3)

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).

Prerequisite: PHYS331.

PHYS 452 - Advanced Laboratory II (3)

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.

Prerequisite: PHYS351.

PHYS 471 - Physics Education Practicum I (3)

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.

Prerequisite: PHYS372.

PHYS 472 - Physics Education Practicum II (3)

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.

Prerequisite: PHYS471.

PHYS 477 - Undergraduate Research (3)

This course provides an opportunity for students, working individually or in small groups, to develop an enhanced understanding and application of specific research methods and/or creative practices. The course assists students to enhance their education and become integrated into the KU community by actively and successfully engaging in research, creative, and/or scholarly projects under the supervision of a faculty member. This course serves as a free or technical elective.

Prerequisite: Department Approval and Senior Standing. Offered: Spring.

PHYS 482 - Introduction to Medical Physics (4)

This course focuses on making connection between intermediate physics courses and their biomedical applications. Topically, biological and medical instrumentation, its design principles and applications are at the heart of the course. The course bridges fundamental physical principles and medical application in a way that contemporary medical instrumentation and its future developments are heavily reliant on the knowledge of physics.

Prerequisite: PHYS213.

PHYS 497 - Senior Project I (3)

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.

Prerequisite: PHYS321, PHYS331, Senior Standing. Offered: Fall Spring.

PHYS 498 - Senior Project II (3)

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.

Prerequisite: PHYS497. Offered: Fall Spring.

SCED - Science in Teaching

SCED 467 - Introduction to Science Teaching (3)

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.

Prerequisite: PHYS122, CHEM116. Offered: Spring.

SCED 468 - Assessment and Practical Work in the Science Classroom (3)

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.

Prerequisite: SCED467.

SCIE - Science

SCIE 202 - Data Science & AI for Scientists (3)

This course introduces the key concepts, techniques, and tools of data science and artificial intelligence (AI) with an emphasis on applications in various science domains. Course topics include data analysis and visualization, machine learning, deep learning, and ethics considerations. Students apply their developing skills to real-world problems using popular AI and data science tools and libraries.

Prerequisite: MATH112, (ENGR114, or COSC114).

SDAS-Student-Development-Success

SDAS 100 - Student Development and Academic Success (1)

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.

Offered: Fall Spring.

SDAS 200 - Experiential Learning

Prerequisite: Sophomore Standing.

SDAS 295 - Selected Topics (1)

Offered: Spring Summer.

SDAS 300 - Career Development (0)

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.

Prerequisite: Junior Standing. Offered: Fall Spring.

SPAN - Spain

SPAN 101 - Elementary Spanish I (3)

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.

Offered: Fall Spring Summer.

SPAN 102 - Elementary Spanish II (3)

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).

Prerequisite: SPAN101. Offered: Fall Spring.

STEM-Integrated-Math-Science

STEM 001 - STEM 1 (12)

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.

Prerequisite: , . Offered: Fall Spring Summer.

STEM 002 - STEM 2 (12)

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.

Prerequisite: STEM001. Offered: Fall Spring Summer.