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PREFACE

In this Bulletin detailed information is provided about engineering programs offered at the College of Engineering and Petroleum at Kuwait University. The College was established in 1975. The College grew from 3 departments to seven engineering departments and a department for Architecture. Lately the Department of Computer and the Department of Architecture have become parts of other Colleges. The College has six departments as will be highlighted later. The College suffered, like the most of the country, from the invasion and the Gulf War in 1990-1991.

The Bulletin begins with a brief introduction to Kuwait University followed by detailed information about the College of Engineering and Petroleum. The curricula and course descriptions of the six engineering programs that offer courses leading to B.Sc. degrees in Engineering are listed in this Bulletin. These programs are: Chemical; Civil; Electrical; Industrial and Management Systems; Mechanical and Petroleum Engineering. The curricula are designed according to reputable international standards adapted to Kuwait’s needs.

The engineering curricula provide:

- Extensive background in mathematics, basic sciences, and engineering sciences.
- Laboratory and computer-based experiences, which serve to combine elements of theory and practice.
- A major design experience that builds upon the fundamental concepts of mathematics, basic sciences, engineering topics, and communication skills.
- A coverage of languages, humanities and social sciences together with topics related to engineering practice such as ethics, economics and safety issues.
- An opportunity for students to combine their academic preparation with on-the-job practical training.

The information included in this Bulletin are current as of September 2011, and are subject to change and modification as seen necessary through the proper channels.

Professor Hussain Ali Al-Khaiat
Dean
INTRODUCTION

Kuwait University is a public university supported by the Kuwaiti Government and is currently the only public government university in Kuwait. It was established in 1966, five years after the State of Kuwait achieved full sovereignty. The inception of the University marked an era of vivid awareness that education and research were vital to the development and survival of the new nation.

Throughout the years of its operation, Kuwait University has expanded from a small institution of 418 students and a teaching faculty of 31, to a multi-campus complex of more than 31,000 students and a teaching faculty of more than 1900. Concurrently, the University's budget, principally appropriated by the Kuwaiti Government, has also risen steeply in the 45-year period, from approximately 1.3 to more than 200 million Kuwaiti Dinars, or a 160-fold increase. Such a sharp increase is evidence of the State's commitment to provide the most up-to-date educational methods available. A future enrollment expectation targets Kuwait University to have a student body of well above 35,000 students by the end of the second decade of the twenty first century. A comprehensive strategic plan is currently in the implementation stage to upgrade and expand the existing campuses to accommodate those students. The plan is supplemented by an Amiri Decree to establish this new campus of students by end of the year 2023.

MISSION

The institutional mission is to keep, develop, and disseminate human knowledge, in addition to developing national human resources in order to create leaders who are aware of national heritage and future needs in collaboration with other academic institutions of similar mission, through:

- Strengthening national, Arabic, and Islamic values and principles,
- Disseminating knowledge,
- Developing and investing in human resources,
- Achieving excellence and distinction in education, scientific research, and community services.
- Utilizing modern technology.

VISION

Kuwait University endeavors to provide world-class education, and is committed to advancing, preserving, and disseminating knowledge, in addition to preparing educated and qualified human resources in order to realize the society developmental needs.

These mission and vision statements have been restated periodically within the university strategic plan.
OBJECTIVES

The objectives of Kuwait University educational system are:

- To prepare specialists in various fields of knowledge in light of professional, Arabic and Islamic ethical values.
- To encourage scientific and applied research that serve society and humanity towards further development.
- To promote and foster studies related to Arabian Gulf, Arabian Peninsula, Islamic and international cultures.
- To contribute to the technical and cultural advancement of society.
- To strengthen the cultural and scientific interaction with local and international universities and institutions.

ORGANIZATION

Kuwait University operates under an Independent University Council, headed by the Minister of Education and Higher Education. The University Charter assigns to the Council the ultimate responsibility for policy and control. It assigns to the President, the Chief Executive Officer of the University, the responsibility for implementation of policy and administration of the University. Other highly-responsible University officials include the Secretary General in charge of Administrative and Financial Affairs and five Vice-Presidents in charge of Academic Affairs, Research, Planning, Academic Support Services, and Medical Sciences. The executive body of the University is the Deans Committee headed by the President, with the Secretary General, Vice-Presidents, and Deans as active members.

The academic organization of the University includes thirteen Undergraduate Academic Colleges and a Graduate Studies College. Two new Colleges under preparation; which are the College of Architecture and the College of Information Technology and Computer Engineering and Science. A Language Center supports the Colleges located in five separate campuses. The units of the Language Center follow the corresponding Colleges accordingly. The existing undergraduate colleges are: College of Medicine, College of Dentistry, College of Social Sciences, College of Pharmacy, College of Education; College of Administrative Sciences (Formerly College of Commerce, Economics, and Political Science), College of Engineering and Petroleum, College of Science, College of Allied Health Sciences and Nursing, College of Arts, College of Law, College of Shari’a and Islamic Studies; and College for Women. As mentioned earlier, Amiri decrees were issued to establish College of Architecture and College of Computer Science and Engineering.

The College of Graduate Studies awards numerous Master’s Degrees in a number of disciplines in the Arts, Basic Sciences, Business Administration, Education, Engineering, Law, Environmental Sciences, Medical Sciences, Shari’a and Islamic Studies and Social Sciences, and awards one Higher Diploma Degree in Public Administration. Also the College of Graduate Studies awards a Doctor of Philosophy in Chemistry and Mathematics (Basic Sciences), in Microbiology, Pathology and Physiology (Medical Sciences) and in Comparative Jurisprudence & Sources (Shari’a and Islamic Studies).
More than 1100 students are enrolled in the various graduate programs. The College of Engineering and Petroleum offers Master’s Degree in: Chemical, Civil, Computer, Electrical, Mechanical, Petroleum, Process Control ( Multi – disciplinary degree ), and Architecture ( recently approved ) with more than 236 students enrolled in the academic year 2011/2012. The Graduate Catalogue describes the programs in more detail.

There are few joint Master’s programs with other Colleges, such as:

- M.Sc. in Environmental Sciences (Engineering, Science and Law).
- M.Sc. in Petroleum Engineering and Geosciences (Engineering and Science).

The Language Center is the technical and administrative authority responsible for classroom instruction of all foreign language courses at the University as well as the Arabic language for foreign students. Foreign language courses (mainly English) are obligatory and comprise part of the general University requirements for graduation. The Center is responsible for specifying the general framework of the appropriate objectives and methods of foreign language instruction in each college. It also prepares and develops teaching materials that are compatible with the requirements of the various colleges. The Language Center is administered by College of Arts.

The University follows a course credit system except for the Colleges of Law and Medicine. The programs are offered over two, 15-week semesters in the Fall and the Spring in addition to an optional summer session. The language of instruction in the University is Arabic except in the Colleges of Science, Engineering and Petroleum, Medicine, Allied Health Sciences and Nursing, Pharmacy, Administrative Sciences and Dentistry, where instruction is in English.
COLLEGE OF ENGINEERING
AND PETROLEUM

The College of Engineering and Petroleum at Kuwait University is committed to providing quality engineering education for the twenty first century. The educational programs have been influenced by the needs of the society and the vision of the administration and faculty to make the College the leading college of engineering in the Middle East. The college mission, vision and goals are designed to reflect this and are highlighted below.

MISSION

The Mission of the College of Engineering and Petroleum at Kuwait University is:

- To provide students with quality engineering education,
- To advance and disseminate knowledge, and
- To lead the society in the continuous improvement of its welfare

VISION

The Vision of the College is to become the leading College of engineering in the Middle East, recognized for its outstanding education, research and outreach programs and for the quality, character and integrity of its graduates.

GOALS

The goals of the College of Engineering and Petroleum at Kuwait University are:

- To create a dynamic academic environment where faculty, students and staff cooperate in preparing individuals for successful careers.
- To keep pace with scientific and technological progress in engineering, and to contribute to its advancement to address the immediate and long-term needs of the society.
- To provide outreach programs that meet continuing education and training needs of the country and the region.

The goals of the Architecture Program are:

- To provide qualified Kuwaiti architects through an architectural program that emphasizes local culture, history, environment and resources as well as building design and science.
- To develop the realization and understanding of the profession of architecture on the administrative, professional and public levels.
- To establish an academic center that provides for architectural consultations.
BRIEF HISTORY

The vision of Kuwait University to develop the human resources and to lead society has prompted its leadership to strive to transfer technology through its initiation of the College of Engineering and Petroleum in September of 1975. The College began with three Departments: Civil Engineering, Mechanical Engineering, and Electrical Engineering; a year later the Department of Chemical Engineering was added. Computer Engineering program was introduced in 1985 within the Electrical Engineering Department, thereby changing its name to the Department of Electrical and Computer Engineering. The Department of Petroleum Engineering started in the Fall of 1989. The Industrial and Systems Engineering Program was introduced within the Mechanical Engineering Department in September, 1994 with a change in name to the Department of Mechanical and Industrial Engineering. In September 1997, the College of Engineering and Petroleum initiated the Architecture Department. In September 2000, the Computer Engineering Department was separated from the Electrical Engineering Department, and in September 2001 the Industrial and Management Systems Engineering was separated from the Mechanical Engineering Department.

Currently the College awards Bachelor of Science degrees in seven engineering majors: Chemical, Civil, Computer, Electrical, Industrial and Management Systems, Mechanical; and Petroleum and a Bachelor in Architecture. Once the new Colleges (College of Architecture, and College of Computer Science and Engineering) are formed the Computer Engineering Program will join the College of Computer Science and Engineering, and the Architecture Program will join College of Architecture. Graduate programs leading to Master of Science degrees in Chemical, Civil, Electrical, and Mechanical Engineering were introduced in September of 1985. The graduate program leading to the Master of Science degree in Computer Engineering was started in September, 1994 and the graduate program leading to a Master of Science degree in Petroleum Engineering was started in September, 2001. Multidisciplinary graduate programs provide the students with the ability to enroll in integrated programs, such as the Masters in Environmental Sciences, Geosciences and Masters in Process Control which have been approved recently.

Since its establishment in 1975, the College of Engineering and Petroleum has succeeded in becoming one of the top engineering schools in the region. The number of undergraduate students registered in the College has increased from 127 students in 1975 to more than 4600 in 2010/2011. Approximately 7000 students have thus far graduated with Bachelor of Science degrees, and more than 700 students have graduated with Masters of Science degrees in the various engineering disciplines offered. The size of the engineering faculty has also experienced significant growth over the thirty years history of the College. In 2011, the current faculty size represents approximately an 18-fold increase as compared to the 1975 faculty size of 12. Furthermore, particular attention has been paid to the scholarship program at the college where highly qualified Kuwaiti nationals are sponsored in their pursuit of doctorate degrees abroad. It is to the credit of this program that, currently, about 85 % of the engineering faculty is Kuwaiti nationals.

In October 2000, the Office of Academic Assessment was established in the College under the supervision of the Office of the Vice-Dean for Research and Academic Affairs. It is designed to foster continuous assessment for the purpose of achieving academic excellence.
The Engineering programs at Kuwait University are accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org)

The establishment of the Department of Architecture within the College of Engineering and Petroleum has gone through a comprehensive and exhaustive study. Several institutions were consulted regarding the academic and administrative structure of the program; some of which are the National Architectural Accrediting Board (NAAB) in the United States, Texas A&M University and King Saud University. The program of study which requires 166 credit hours covers the art and science of Architecture. The program is recognized as substantially equivalent to accredited programs by NAAB. It is worth mentioning that both ABET and NAAB evaluations are entirely voluntary and were initiated by the College for the sake of evaluating and improving its programs.

ORGANIZATION

The College Council is the central policy-making body. The Dean, the Chief Executive Officer of the College, is assisted by three Vice-Deans in charge of Academic affairs, Student Affairs, and Consultation, Career Development and Planning. The academic organization of the College includes eight Departments and an English Language Unit. Other supporting units are the Administrative Office, the Engineering Training Center, the Alumni Office, the Engineering Library, Office of Automation and Multimedia, E-government Center, Office of Academic Assessment and Transportation Center. The executive body of the College is the Chairmen Committee headed by the Dean, with Vice-Deans and Department Chairmen as active members.

The job responsibility of the offices of the Vice Deans, Office of Consultation and Career Development (OCCD), Center of Engineering and Laboratory Tests and Calibration, Kuwait University Production Research Center, Center of transport and traffic safety, Information Technology Excellence Center, Office of Strategic Planning and the Office of Academic Assessment are given below.

OFFICE OF THE VICE-DEAN FOR RESEARCH AND ACADEMIC AFFAIRS

- Scholarship Programs
- Undergraduate Program Curricula
- Office of Academic Assessment
- Funded Research Programs and Research Centers of Excellence
- Graduate Programs
- Assessment Process
- Library

OFFICE OF THE VICE-DEAN FOR CONSULTATION AND CAREER DEVELOPMENT

- College’s Strategic Planning
- Engineering Intensive Training Courses
- Consultations
- Engineering Services and Testing
OFFICE OF THE VICE-DEAN FOR
STUDENT AFFAIRS

Student Registration and Orientation
Student Advising
Follow-Up of Students' Academic Performance
Student Activities
Student Information System

OFFICE OF CONSULTATION AND CAREER DEVELOPMENT (OCCD)

The Office of Consultation and Career Development (OCCD) is an administrative unit that was established by the College of Engineering and Petroleum at Kuwait University in 1986 to provide several engineering services to industrial, commercial, and public organizations in the fields of training, consultation, calibration and laboratory testing.

The consultation office seeks to achieve total customer satisfaction through:

- Adequate training of the office staff.
- Total support to the college laboratories and their technical cadre.
- Adherence to certified work procedures.
- Total commitment to meet customer needs.
- Commitment to preserve the office policy in adopting the concept of on-going improvement.

Strategy and Values

The office strategy consists of three major dimensions:

- Customer-centered
  - Striving to exceed customer needs and expectations
  - Offering competitive prices
- Leveraging Resources
  - Highly qualified staff, consultants and trainers
  - Calibration and testing laboratories designed and operated according to international standards with state-of-the-art devices, equipment, computers and software.
  - Effective partnerships with distinguished outstanding affiliates.
  - Encouraging staff to maintain ongoing self-development.
  - Encouraging staff to work in the spirit of a single team.
- Pioneering
  - Capitalizing on the academic and research environment surrounding the OCCD.
  - Laying down a work system directed towards the sustainable development of the office.
CENTER OF ENGINEERING AND LABORATORY TESTS AND CALIBRATION

Objectives

To examine various kinds of building materials to ensure high quality and sustainability of the facilities in the public and private sectors.

Mission

After combining all the college laboratories under one umbrella, the Center of Engineering and Laboratory Tests and Calibration was established by the College of Engineering and Petroleum at Kuwait University in 2006 to be one of the biggest centers for engineering tests in the State of Kuwait.

Fields of work

Since its establishment, the Center has been providing a diversity of services to the Kuwait community in the fields of building and construction through the following dimensions:

- Conducting tests on building materials.
- Calibrations.
- Testing as third party which includes quality control on products during the process of manufacturing.
- Participation of some private affiliates in the study of complexes, commercial public markets, and private buildings and test their locations (tests of facilities loads) to ensure their safety and safeguard the masses of visitors from the citizens.
- Participation of the official authorities such as the Public Authority for Housing Welfare and the Ministry of Public Works in regulating, testing and evaluating the imported gravel for concrete and asphalt works after the issuance of a resolution that bans local quarries to preserve the Kuwaiti environment.
- The center continues offering consultation and participating in the special committees at the governmental level to lay down the accurate scientific foundations for all the emerging problems in relation to the construction process, specifications, and tests of all kinds of material.

KUWAIT UNIVERSITY PETROLEUM PRODUCTION RESEARCH CENTER

Mission

Kuwait University Production Research Center (KUPRC) is a cooperative Academia-Industry research center specialized in oil and gas production and transportation. It was established in 2007 to conducted applied and fundamental research on multiphase flow in petroleum production systems.
Objectives

- Conduct research studies to solve oilfield production operation/design problems.
- Provide resident education in which graduate students are trained to conduct scientific research studies.
- Provide engineering consultations and services to the oil industry in Kuwait and elsewhere.
- Provide academic support and services to the Petroleum Engineering department in Kuwait University.
- Promote collaboration between Kuwait University and the oil industry in Kuwait and worldwide.

Scope of work

The purpose of KUPRC is to conduct applied and fundamental research in multiphase flow production and transportation as follows:

- Multiphase flow in pipelines and wellbores.
- Multiphase flow across chokes and restrictions.
- Transient multiphase flow in pipes.
- Heavy oil (high viscosity) multiphase flow in production system.

In addition, KUPRC provides personal training on oil and gas production optimization and multiphase flow in pipes through the Office of Consultation and Career Development (OCCD) in the College of Engineering and Petroleum.

CENTER OF TRANSPORT AND TRAFFIC SAFETY

Objectives

The main objective of the center is to create a highly efficient sophisticated secure system of transport in the State of Kuwait that would absorb the steady progress in the various sectors in the country and be a driving force to the wheel of development. In its wider perspective, transport covers all types of transport whether by land, sea or air.

Mission

Center of Transport and Traffic Safety is an engineering office concerned with the field of transport and traffic engineering and safety and it is an affiliate to the College of Engineering and Petroleum at Kuwait University.

Fields of work

- Managing traffic and traffic congestions
- Urban planning
- Roads engineering
- Evaluation of the environmental impact of traffic
• Solutions of smart transport systems and geographical information systems
• Traffic safety
• Paving material
• Roads maintenance

INFORMATION TECHNOLOGY EXCELLENCE CENTER

Objectives

Through the Information Technology Excellence Center, a subsidiary of OCCD, the following goals can be achieved:

• Establishing a special local center concerned with acquiring knowledge about the best practices in the field of information technology (IT).
• Providing consultations, tests, and specialized training programs locally and regionally in the fields of IT.
• Enhance cooperation between Kuwait University and internationally recognized IT services providers.
• Matching information technology services with the latest scientific research and market studies.

Mission

The Information Technology Excellence Center is one of the distinguished service centers provided by the OCCD in the College of Engineering and Petroleum at Kuwait University. With the accelerated advancement of the IT market, it has become more challenging to decide the types of technologies and services that should be obtained. IT Excellence Center will provide help and guidance for these challenges.

Fields of work

The Information Technology Excellence Center, a subsidiary of OCCD, helps companies to take wise and correct decisions by providing them with advice and studies offered by highly qualified consultants who are equipped with the brilliant know-how in the various fields of IT. Here are some of the services provided by the Information Technology Excellence Center:

• Prepare IT strategies
• Analyze IT requirements
• Prepare tenders and follow up procedures
• Strategies and studies of acquisition alternatives
• Emergency plans and business continuity
• Certificates of information security
• Certificates of managing information projects
• Prepare three dimension samples, animated films and videos, and special effects
• Internet Publishing
• Multi-media applications
• Security for electronic websites
• Electronic trade
• Specialized training programs on the various fields of IT, planning and career development

OFFICE OF STRATEGIC PLANNING

Objectives:

• Prepare and follow up the implementation of the work centers’ operational plans in the College of Engineering and Petroleum
• Provide statistics from and to the college work centers
• Organize training courses and workshops for the college faculty members and support staff to raise their awareness of the importance of the college strategic plan, and follow it up.

Mission

Provide statistics and data analysis, and support the college administration in decision-making through special studies, using latest cutting edge techniques and methods. Thus, the implementation of the college strategic plan is completely monitored through information availability, integrity, and easy access. The office also contributes to serve the community through training courses and workshops.

Scope of Work

• Prepare annual operational plans for the college work centers
• Write annual and semi-annual follow up reports concerning the implementation of the college strategic plan
• Develop evaluation criteria and performance indicators for the college work centers, which help improving the planning process
• Conduct methodological studies to support the college strategic plan
• Establish, develop, link minor database specialized in teaching, student affairs and labor force in the college, and update the database quarterly or annually
• Ensure database security and accuracy
• Receive information from the college work centers and provide latest information, statistics, and annual reports
• Organize training courses and workshops for the college faculty members and support staff to come up with the executive plans of the college strategic plan, using latest techniques and methods to follow it up
• Hold courses and workshops for other institutions and authorities in the country
OFFICE OF ACADEMIC ASSESSMENT

The Office of Academic Assessment was established in October 2000 to serve the engineering academic programs, faculty, staff, and administration within the college. It is designed to foster continuous assessment for the purpose of achieving academic excellence. The **goals** of the office are:

- To help coordinate program assessment processes;
- To develop and implement regularly-scheduled and special-purpose student, alumni, and employer surveys;
- To assist academic, administrative, and student-support units with data from assessments, and to develop or evaluate their own assessment processes;
- To facilitate assessment training and awareness programs

THE ADVISORY COUNCIL

The College of Engineering and Petroleum has always realized the need to attune its academic programs and research activities towards fulfilling the needs of the local government and private industries. An Advisory Council, composed of experienced members from the public and private sectors, the Dean of the College, the Vice-Deans and Department Chairmen, was first established in 1994. The primary objectives of the Council are:

- To familiarize the engineering profession, through its representatives on the Council, with the capabilities of the College and the expertise of its faculty.
- To develop a joint strategy for emphasizing the role of the College in meeting the needs of the Kuwaiti Society through research, consultations, and continuing education programs.
- To identify and incorporate the views of the engineering profession on such vital issues as: the quality of the academic programs offered by the College and the level of preparation of its graduates; the engineering manpower requirements; the need for new engineering disciplines, etc.

SUPPORT FACILITIES

KUWAIT UNIVERSITY COMPUTER CENTER

Most of the departments and laboratories in the College of Engineering and Petroleum are provided with internet and internet facilities. Individual departments are connecting their network to respective campus backbone, which has the state-of-the-art facilities. Network is installed in the college and connected to other campuses and colleges, using an intercampus single mode fiber backbone. Our current Internet connection is made possible using our earth station in the college which connects to Teleglobe, Canada over Intelsat. Additional bandwidth over this link is continuously upgraded.

Downloading speed is enhanced by special high-speed satellite download link. Implementation of a Gigabit Network and upgrading our current Intercampus Backbones to fiber optic links is established. This will provide higher data rates for multimedia and...
video conferencing communications. In addition to providing necessary hardware and software support to PC/Mac users, KUCC offers variety of internet related services to employees and faculty members.

Currently, KUCC has powerful servers that share disk space through SAN (Storage Area Network) which holds adequate disk space. Centralised backup is performed using a state-of-the-art backup solution.

The applications which are installed on these Servers are as follows:

- Student Information System.
- Financial System running Oracle Applications.
- Payroll/ Personnel System on Oracle Server.

THE COLLEGE OF ENGINEERING AND PETROLEUM LIBRARY

The library of the college of Engineering and Petroleum was established in 1975. Its mission is to provide access to information in all formats to support teaching, learning and research functions of the University and local community. It operates an open stack principle, most materials is available on self-service basis. The library uses Horizon automated library system which can be accessed via http://library.kuniv.edu.kw where all the library sources can be accessed (OPAC, Databases, E-Journals, E-books, Book renewal, etc.)

The library has a subscription to the most leading databases, eleven full text databases and 15 bibliographic databases these databases can be search from University campus or off campus for faculty members and graduate students. An interlibrary loan and Document Delivery service is also available for faculty and graduate students from local, regional and international libraries.

Library holds 18 computers, central printer and wireless services, study rooms, reserve materials and audiovisual room is available. The library holds 25,014 English book titles, 4,111 Arabic book titles and 1,243 video films and DVDs.

The library publish “Newsletter” once a semester to keep its users up- to- date, number of brochures designed as quick reference guides to user , and some bibliographies as Nanotechnology, warfare in Gulf War and Islamic architecture .The library prepare tours and workshops for students and faculty members on request and at the beginning of the academic year.

The library contributes yearly in the Admission Exhibition which is held at the College of Engineering and the Libraries Day that is held by the Libraries Department. To contact the library via email: eng.lib@ku.edu.kw

There are bibliographic and full text engineering and petroleum databases and e-journals that are available on the libraries website. The Bibliographic Databases are Academic Search Complete, Applied Science & Technology, Avery Index to Architectural Periodicals, Design and Applied Arts Index, Engineering Village: Compendex, NTIS, Geobase, Environmental Science and Pollution Mgmt, Food Science & Technology

THE COLLEGE OF ENGINEERING AND PETROLEUM ENGLISH UNIT

All students who are admitted to the College of Engineering take an English Language placement test and according to the results are required to take at least two, or possibly three, English courses as part of their undergraduate program. As an English-medium college, the College of Engineering places emphasis on developing students’ English technical skills: reading, vocabulary, grammar and writing extended definition paragraphs, paraphrasing and/or summarizing short technical reading passages, writing a correctly formatted research report. Oral communication is another important skill practiced in the course in the form of an oral presentation on a technical topic of the student’s choice.

Teaching materials and course content are selected on the basis of their relevance to engineering students’ particular language needs and are regularly evaluated and updated. Each course is administered by a coordinator who is responsible for ensuring that course procedures and curriculum are carefully followed in all classrooms. Examinations are written, pre-tested, and normed by committees, under the overall coordination of the Unit Testing Representative and the unit supervisor.
ENGINEERING PROGRAMS

The College is committed to providing students with quality engineering education as part of its mission to ensure the preparation of graduates capable of coping with future challenges in engineering practice and education. The educational programs have thus been developed according to reputable international standards adapted to Kuwaiti needs. The following pertains to the Engineering programs at the College. Requirements for the Architecture program are detailed in the Architecture Program section.

A unique feature of these programs is the coherent curriculum designed to give students a strong background in the basics of engineering fields. It is divided almost evenly between a core component, common to all engineering students, and a set of compulsory and elective courses of direct relevance to the student’s field of specialization in addition to humanities and social science components. Corner-stone and cap-stone design courses are also offered in engineering programs to complement design concepts and experience in other major courses. Each engineering program requires 144 credits and it incorporates the following features:

**Mathematics and Basic Sciences.** Each Engineering Program curriculum contains eight courses in mathematics, physics and chemistry to provide students with a solid foundation in mathematics and basic sciences. These courses include three-semester sequence in Calculus; two-course sequence in Physics; and one course in each of the following: General Chemistry, Linear Algebra, Ordinary Differential Equations, Probability and Statistics, and Numerical Methods. Students requiring remedial preparation in Mathematics and basic sciences are required to take a Pre-Calculus Course and/or a General Pre-Chemistry Course.

**General Education Courses.** The social awareness of students is enhanced through exposure to topics in General education courses. The General education courses are classified into three categories: Languages, Social Studies and Humanities. This will enable graduates to better realize the social responsibilities and human dimension of engineering and its impact on society to better appreciate related factors in the decision-making process. Every student is required to take 21 credits of general education courses (9 credits compulsory and 12 credits elective as shown below).

**English Proficiency.** Students are required to take a two-course sequence in English designed to strengthen their technical communicational skills. Students requiring remedial English must also complete a 10-hour non-credit course.

**Engineering Breadth.** Several courses are required, or included as electives, to give students some breadth of study in engineering. All engineering students take background courses in Workshop, Engineering Graphics, Computer Programming, Electrical Engineering Fundamentals, Thermodynamics, and Engineering Economy. Many departments require Statics and/or Strength of Materials in their curricula. These and other related courses provide the basic engineering sciences that integrate smoothly the students’ knowledge in mathematics, physics and chemistry where engineering examples are presented and analyzed.

**Engineering Depth.** About two full years of study are devoted to the student’s major discipline in engineering. Most of the courses in this category are specified courses
designed to give the student the essential subject matter needed for specialization. Department electives are designed to provide more breadth and/or depth in a chosen area(s) of interest. In addition, curriculum is designed to provide cornerstone and capstone design courses along with a comprehensive design experience for each program as well as coverage of topics on professionalism, ethics, and safety aspects in engineering.

**Industrial Training.** Engineering students have the opportunity to participate in industrial training through a training course. This course provides students with an exposure to real-life engineering problems through a minimum of 180 hours of supervised, on-the-job training. The Engineering Training Course is currently compulsory for Petroleum Engineering students and is an elective course for other engineering students.

**CORE ENGINEERING CURRICULUM**

All Engineering students (except for Architecture students) must satisfactorily complete the following common courses as well as those specified for their respective programs as shown in subsequent sections.

### I. GENERAL EDUCATION COURSES (21 Credits)

#### A. Compulsory Courses (9 Credits)

**Languages**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>9988-098</td>
<td>Remedial English (if needed)</td>
<td>0</td>
</tr>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

**Humanities**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0330-100</td>
<td>Modern &amp; Contemporary History of Kuwait</td>
<td>3</td>
</tr>
</tbody>
</table>

#### B. Elective Courses (12 Credits)

1. The student chooses one course from the following track upon availability.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0200-102</td>
<td>Legal culture</td>
<td>3</td>
</tr>
<tr>
<td>0200-105</td>
<td>Human Rights</td>
<td>3</td>
</tr>
<tr>
<td>0200-106</td>
<td>Constitutional law in Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>History of Arab and Islamic Civilization</td>
<td>3</td>
</tr>
<tr>
<td>0360-108</td>
<td>Ethics and modern society</td>
<td>3</td>
</tr>
<tr>
<td>0900-102</td>
<td>Islamic Culture</td>
<td>3</td>
</tr>
<tr>
<td>0940-142</td>
<td>Islam and modern society</td>
<td>3</td>
</tr>
<tr>
<td>0940-145</td>
<td>Islam, science and technology issues</td>
<td>3</td>
</tr>
<tr>
<td>1360-103</td>
<td>Government and Politics of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0360-104</td>
<td>Public service and professional ethics</td>
<td>3</td>
</tr>
<tr>
<td>1360-108</td>
<td>Culture of dialogue and social peace</td>
<td>3</td>
</tr>
</tbody>
</table>
2. The student chooses three courses from any the following tracks upon availability.

**Languages**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0310-101</td>
<td>Arabic Communication Skills</td>
<td>3</td>
</tr>
<tr>
<td>0310-102</td>
<td>The Aesthetics of Arabic Literature</td>
<td>3</td>
</tr>
<tr>
<td>0310-408</td>
<td>Literature of the Arabian Gulf and Peninsula</td>
<td>3</td>
</tr>
<tr>
<td>0380-101</td>
<td>Introduction to Mass Media</td>
<td>3</td>
</tr>
<tr>
<td>0320-106</td>
<td>Varieties of Writing</td>
<td>3</td>
</tr>
<tr>
<td>0320-205</td>
<td>Oral Presentation</td>
<td>3</td>
</tr>
<tr>
<td>9989-201</td>
<td>French Language (1)</td>
<td>3</td>
</tr>
<tr>
<td>9989-202</td>
<td>French Language (2)</td>
<td>3</td>
</tr>
<tr>
<td>9989-301</td>
<td>French Language (3)</td>
<td>3</td>
</tr>
<tr>
<td>9989-302</td>
<td>French Language (4)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Social Studies**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1350-101</td>
<td>Introductory Psychology</td>
<td>3</td>
</tr>
<tr>
<td>1370-101</td>
<td>Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>1340-101</td>
<td>Man and Environment</td>
<td>3</td>
</tr>
<tr>
<td>1360-101</td>
<td>Introduction to Political Science</td>
<td>3</td>
</tr>
<tr>
<td>1360-103</td>
<td>Government and Politics of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0920-121</td>
<td>Doctrine</td>
<td>3</td>
</tr>
<tr>
<td>0930-140</td>
<td>Worship in Islam</td>
<td>3</td>
</tr>
<tr>
<td>0940-154</td>
<td>Introduction to Islamic Jurisprudence</td>
<td>3</td>
</tr>
<tr>
<td>1370-171</td>
<td>Introduction to Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>1360-201</td>
<td>Western Political Thought</td>
<td>3</td>
</tr>
<tr>
<td>0820-201</td>
<td>Principles of Education</td>
<td>3</td>
</tr>
<tr>
<td>1370-201</td>
<td>Social Problems</td>
<td>3</td>
</tr>
<tr>
<td>1370-202</td>
<td>History of Social Thought</td>
<td>3</td>
</tr>
<tr>
<td>1370-203</td>
<td>Social Organization</td>
<td>3</td>
</tr>
<tr>
<td>1350-203</td>
<td>Psychology of Learning</td>
<td>3</td>
</tr>
<tr>
<td>1370-205</td>
<td>Social and Cultural Change</td>
<td>3</td>
</tr>
<tr>
<td>1350-205</td>
<td>Social Psychology</td>
<td>3</td>
</tr>
<tr>
<td>1350-206</td>
<td>Physiological Psychology</td>
<td>3</td>
</tr>
<tr>
<td>1360-206</td>
<td>Comparative Political systems</td>
<td>3</td>
</tr>
<tr>
<td>1370-206</td>
<td>Social and Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>1360-207</td>
<td>Political Development in the Third World</td>
<td>3</td>
</tr>
<tr>
<td>1360-208</td>
<td>Psychology of Development I</td>
<td>3</td>
</tr>
<tr>
<td>1360-211</td>
<td>Introduction to International Politics</td>
<td>3</td>
</tr>
<tr>
<td>1360-212</td>
<td>International Organizations</td>
<td>3</td>
</tr>
<tr>
<td>1350-214</td>
<td>Motives and Emotions</td>
<td>3</td>
</tr>
<tr>
<td>1360-221</td>
<td>Governments and Politics of the Arab States</td>
<td>3</td>
</tr>
<tr>
<td>1360-227</td>
<td>Public Opinion and Political Propaganda</td>
<td>3</td>
</tr>
<tr>
<td>1370-401</td>
<td>Arab Gulf Society</td>
<td>3</td>
</tr>
<tr>
<td>1350-415</td>
<td>Environmental Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>
Humanities

0330-101  Modern Arab History  3
0360-101  Philosophy of Science  3
0360-102  An Introduction to Logic  3
0900-102  Islamic Culture  3
0360-103  Principles of Philosophy  3
0200-105  Human Rights  3
0200-106  Constitutional law in Kuwait  3
0360-214  History of Science  3
0330-220  History of the Beginning of Islam  3
0360-227  Moral Philosophy  3
0360-302  Mathematical Logic  3
0330-363  History of the Modern Europe  3
0330-389  Modern and Contemporary History of Arabian Gulf  3
0810-414  Education Planning  3
0810-415  Economic of Education  3
0360-429  Philosophy of Language  3

II. MATHEMATICS AND BASIC SCIENCE COURSES

A. Required for all Majors  (27 Credits)

0410-101  Calculus I  3
0410-102  Calculus II  3
0410-111  Linear Algebra  3
0410-211  Calculus III  3
0410-240  Ordinary Differential Equations  3
0420-101  General Chemistry I  3
0420-105  General Chemistry I Laboratory  1
0430-101  Physics I  3
0430-105  Physics I Laboratory  1
0430-102  Physics II  3
0430-107  Physics II Laboratory  1

Students requiring remedial Mathematics and/or Basic Science Courses must take:

0410-091  Pre-Calculus  (3 contact hours)  0
and/or
0420-092  General Chemistry (Pre-Chemistry Course)  (3 contact hours)  0

B. Required for some Majors

0420-102  General Chemistry II  3
0420-106  General Chemistry II Laboratory  1
0420-234  Analytical Chemistry  3
0420-269  Organic Chemistry  4
III. **CORE ENGINEERING COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Required for all Majors (21 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering</td>
<td>0</td>
</tr>
<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>0600-200</td>
<td>Computer Programming for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>0600-207</td>
<td>Electrical Engineering Fundamentals Lab.</td>
<td>1</td>
</tr>
<tr>
<td>0600-208</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-209</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>0600-304</td>
<td>Engineering Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>0600-308</td>
<td>Numerical Methods in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>B. Required for some Majors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0600-102</td>
<td>Workshop</td>
<td>1</td>
</tr>
<tr>
<td>0600-202</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>0600-203</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-204</td>
<td>Strength of Materials</td>
<td>3</td>
</tr>
</tbody>
</table>
DESCRIPTION OF ENGLISH LANGUAGE COURSES

9988-098 Remedial English  
(No-credit Pass/ Fail, 10 contact hours/week)

(Pre-requisites: Placement Test)

This course focuses on: reading, writing, grammar, vocabulary, and multi-media practice. It introduces and develops the skills required for reading a large variety of texts. Through reading, students study a wide range of vocabulary in context. It provides instruction and practice in writing, developing the ability of students to write coherent paragraphs and short essays. In Grammar, key structures are focused on and students have ample opportunities to practice these through extensive and varied exercises. The multimedia component of the course promotes the development of all language skills.

9988-123 Intermediate Writing Skills  
(3 credits, 5 contact hours/week)

(Pre-requisites: ENGL 090 or Placement Test Equivalent)

English 123 is the first credit course offered at the intermediate level. It develops all language skills with particular emphasis on reading and writing. Students learn to comprehend scientific reading passages and develop their writing skills from the sentence to the paragraph level. Students learn to expand their understanding of terms used within the various departments of the College. It also increases the clarity, precision, accuracy, and fluency of students’ reading and writing skills through grammar and rhetoric.

9988-221 Technical Writing  
(3 credits, 3 contact hours/week)

(Pre-requisites: 9988-123; Completion of 50 Credit hours)

English 221 is an advanced writing course designed to improve the technical writing skills that students need both for their engineering courses at the University and for their future careers. The goal of this course is to help students read and understand technical texts, conceptualize, synthesize, and organize the ideas of these texts, and produce or write their own scientific texts, in the form of abstracts and research reports. Oral communication is another important skill practiced in this course in the form of an oral presentation on a technical topic of the student’s choice.
DESCRIPTION OF MATH AND SCIENCE COURSES

0410-091 Pre-Calculus

Set theory, real numbers, inequalities, straight lines and circles, trigonometry, Exponential and Logarithmic Functions.

0410-101 Calculus I

(Pre-requisites: 0410-091 or Placement Test Equivalent)

Limits, continuous functions, the derivative, formulas of differentiation, differentials, related rates, extrema, rolle’s and mean value theorems, graph sketching optimization, Indefinite integrals, definite integrals, fundamental theorem of calculus, applications of definite integrals to find area, volume and arc length.

0410-102 Calculus II

(Pre-requisites: 0410-101)

Logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, techniques of integration, indeterminate forms and improper integrals, conic sections, plane curves and polar coordinates, vectors and surfaces in $\mathbb{R}^3$.

0410-111 Linear Algebra

(Pre-requisites: None)

Systems of Linear equations, matrices and matrix operations, vector spaces, linear transformations, eigenvalues and eigenvectors.

0410-211 Calculus III

(Pre-requisites: 0410-102, 0410-111)

Sequences, infinite series, partial differentiation and its applications, multiple integrals and their applications, green's and divergence theorem.

0410-240 Ordinary Differential Equations

(Pre-requisites: 0410-111; Co-requisites: 0410-211)


0420-092 General Chemistry (Pre-Chemistry Course)

(Pre-requisites: Placement Test)

Basic concepts, electron configuration of the atom, chemical bonding, nomenclature, chemical reactions, reaction rates and chemical equilibrium, organic chemistry.
0420-101 General Chemistry I  
(Pre-requisites: 0420-092 or Placement Test Equivalent)  
(3-0-3; one hour tutorial)  
Electronic structure of atoms, periodic table, chemical bonds, stoichiometry, introduction to chemistry of the elements, introduction to nuclear and radiochemistry, introduction to organic chemistry.

0420-102 General Chemistry II  
(Pre-requisites: 0420-101, 0420-105)  
(3-0-3; one hour tutorial)  
Theory of gases, properties of liquid and solid substances, properties of solutions, chemical thermodynamics, chemical kinetics, chemical equilibrium, acid bases and ionic equilibrium, electrochemistry.

0420-105 General Chemistry Laboratory I  
(Pre-requisites: 0420-092 or Placement Test Equivalent, Co-requisites: 0420-101)  
(0-3-1)  
Experiments related to 0420-101 General Chemistry I.

0420-106 General Chemistry Laboratory II  
(Pre-requisites: 0420-101, 0420-105; Co-requisites: 0420-102)  
(0-3-1)  
Experiments related to 0420-102 General Chemistry II.

0420-234 Analytical Chemistry  
(Pre-requisites: 0420-102, 0420-106)  
(1-6-3; one hour tutorial)  
Introduction to Chemical Analysis, basic principles in analytical chemistry, chemical gravimetric and volumetric analysis, errors in chemical analysis and sampling, electrical methods, optical methods, separations, related experiments will be carried out to cover these topics.

0420-269 Organic Chemistry  
(Pre-requisites: 0420-102, 0420-106)  
(3-3-4; one hour tutorial)  
Bonding and structural effects, classes of organic reactions and reagents, structures, nomenclature, properties and reactions of hydrocarbons, isomerism and stereo-chemistry, economic importance of hydrocarbons, organic functional groups, structure, nomenclature properties and reactions, metals in organic chemistry, organometallics and catalysts, organic synthesis and processes, organic chemical industry, organic pollutants, diagnosis and control.

0430-101 General Physics for Physical Scientists and Engineers (I)  
(Pre-requisites: 9988-090 or 9988-123, Co-requisites: 410-101)  
(3-0-3; one hour tutorial)  
A calculus based course in mechanics covering vectors, one dimensional motion, motion in a plane, force & particle dynamics, work, energy, systems of particles, collision, rotational kinematics and dynamics and harmonic motion.
0430-102 General Physics for Physical Scientists and Engineers (II)  
(Pre-requisites: 0430-101) (3-0-3; one hour tutorial)  
A calculus based course covering electrostatics (Coulomb’s force, electric field, Gauss’s law, potential and capacitors), direct current, magnetostatics (magnetic field, Biot-Savart law and Ampere’s law), magnetic induction and inductance.

0430-105 General Physics Laboratory I  
(Co-requisites: 0430-101) (0-3-1)  
Experiments in instrumentation, measurements, mechanics, and optics.

0430-107 General Physics Laboratory II  
(Pre-requisites: 0430-105; Co-requisites: 0430-102) (0-3-1)  
Experiments in electricity, electric circuits’ measurement devices and magnetism.

0430-209 Modern Physics  
(Pre-requisites: 0610-220 or 0430-206) (3-0-3)  
The special theory of relativity, particle like properties of radiation (blackbody radiation, photoelectric effect, Compton scattering), wave like properties of particles and de Broglie’s hypothesis, Bohr model of hydrogen atom and atomic spectra, and Schrödinger theory.

0460-101 Physical Geology  
(Pre-requisites: 9988-090 or 9988-123) (2-3-3)  
Introduction to earth sciences, study of minerals and rocks, weathering, agents of erosion, deposition, and formation of sedimentary rocks, earth interior, formation of igneous and metamorphic rocks, rock deformation and accompanied large scale tectonic movements, earthquakes, volcanoes and synthesis of plate tectonics, natural resources and introduction to geologic time scale.
DESCRIPTION OF CORE ENGINEERING COURSES

0600-099 Introduction to Engineering Programs (1-0-0)
(Pre-requisites: None)

Introduction to Engineering including chemical, civil, computer, electrical, industrial, mechanical and petroleum programs, focus on history, background, courses required, ethics, safety and team work, job opportunities, technical societies.

0600-102 Workshop (0-3-1)
(Pre-requisites: None)

Demonstration and practice in safety regulations regarding machines and hand tools, shop organization and set up, practice with hand tools and machine operations: filing, cutting, drilling, chiseling, shaping, turning, boring, threading, milling, arc and gas welding.

0600-104 Engineering Graphics (1-3-2)
(Pre-requisites: None)

Demonstration and practice in surface identification and projection techniques, orthographic multi-views projection, missing views, dimensioning, sectioning, axonometric projection, fits and tolerances, Fasteners and Assembly drawing, instrument drawing and computer-aided applications.

0600-200 Computer Programming for Engineers (3-2-3)
(Pre-requisites: 0410-101, 0410-111)

Algorithmic problem solving in the context of a modern programming language, Terminology-Arithmetic computations-Simple& formatted I/O- if structures, while loop, do loop, for loop, nesting, data files, arrays (1D &2D), functions, strings and pointers, structures.

0600-202 Statics (3-0-3)
(Pre-requisites: 0430-101, 0600-104, 9988-098)
(Requirement for CE, ME, PE, & IMSE)

Vectors, equilibrium of particles, principle of transmissibility, moment of forces, couples, equilibrium of rigid bodies, analysis of trusses, forces in beams and cables, shear and moment diagrams, center of Gravity, center of mass, centroid for a body, moments of inertia, radius of gyration.

0600-203 Dynamics (3-0-3)
(Pre-requisites: 0600-202)

Kinematics and Kinetics of a particle and a system of particles, space mechanics, impulsive motions, Kinematics and Kinetics of rigid bodies in plane motion, introduction to mechanical vibrations.
0600-204 Strength of Materials (3-0-3)
(Pre-requisites: 0600-202)

Simple states of stress and strain, torsional stresses, bending and shearing stresses in beams. Compound stresses, analysis of plane stress, combined stresses, analysis of thin-walled pressure vessels, deflection of beams.

0600-205 Electrical Engineering Fundamentals (3-0-3)
(Pre-requisites: 0430-102; Co-requisites: 0410-240, 0600-207)

Circuit variables and elements, circuit laws and simple resistive circuits, nodal and mesh analysis, Thevenin’s theorem, Norton theorem, superposition theorem, natural and step responses of first-order RL and RC circuits, natural and step responses of series and parallel RLC circuits, sinusoidal steady-state analysis, phasor analysis, power calculations for single-phase circuits, pspice analysis

0600-207 Electrical Engineering Fundamentals Laboratory (0-3-1)
(Pre-requisites: 0430-107; Co-requisites: 0600-205)

Training in component identification, electrical schematics and soldering techniques, laboratory experiments related to 0600-205 course contents, laboratory experiments illustrating electrical systems in everyday life: Automotive Systems, Power Supply Design, Electric Energy Consumption, …etc.

0600-208 Engineering Thermodynamics (3-0-3)
(Pre-requisites: 0430-102, 0410-102)

Fundamental concepts, properties of a pure substance, equations of state, tables, thermodynamic surfaces, work and heat, first law of thermodynamics, applications to systems and control volumes, second law of Thermodynamics, heat engines, refrigerators, and heat pumps, principle of Carnot cycles, principle of the increase of entropy, applications to systems and control volumes, irreversibility and availability, power and refrigeration cycles.

0600-209 Engineering Economy (3-0-3)
(Pre-requisites: Completion of 45 Credit hours)

This course covers the basic concepts of engineering economics as applied to the evaluation of capital investment alternatives in both the private and public sectors of our economy. Attention is given to the time value of money by showing the concepts and techniques for evaluating the worth of products, systems, structures, and services in relation to their cost, economic and cost concepts, calculating economic equivalence, comparison of alternatives, replacement economy, economic optimization in design and operations, cost estimation of products and systems.

0600-303 Creativity in Engineering Design (3-0-3)
(Pre-requisites: Completion of 60 Credit hours)

In this course the students are introduced to the proper procedure in engineering design. This procedure includes: Problem formulation, Brain Storming, Selection of best idea,
Implementation of the idea and testing it. The principles in each of these steps are explained and clarified using carefully selected case studies, homework, and class work assignments. This course is offered as an elective course for all engineering students.

0600-304 Engineering Probability and Statistics (3-0-3)
(Pre-requisites: 0410-211)

Probability theory, discrete and continuous probability distributions, statistics in engineering. Descriptive Statistics Sampling distributions, estimation and confidence intervals, hypothesis testing, simple regression.

0600-308 Numerical Methods in Engineering (3-0-3)
(Pre-requisites: 0410-240, 0600-200)

Numerical solution of linear and nonlinear systems, numerical differentiation and integration, curve fitting and interpolation, numerical solution of initial value problems, boundary and reign value problems.

0600-310 Engineering Ethics (3-0-3)
(Pre-requisites: 9988-221)

Engineering ethics, meaning importance and implementation, professional concepts, methods of ethics analysis, local and international code of ethics and case studies.
ADMISSION OF STUDENTS

Starting in the academic year 1999-2000, high school students are admitted to the College of Engineering and Petroleum as engineering students without declaring a major and they remain in this category until they satisfy the requirements to declare a major within four academic semesters of study. To be admitted as an engineering student, a student must be a graduate from secondary school with science major or its equivalent with a minimum score or GPA of 80%, and an average of admission score or GPA of 65%.

The admission score to the College of Engineering & Petroleum is calculated as weighted average of the following items:

- Secondary school score or GPA 70 %
- English Placement Test 15 %
- Math Placement Test 15%

The college accepts only the quota set by the College Council and approved by the University Council. Engineering students may declare a major upon satisfying the following requirements and provided that the quota for the desired engineering program is not filled.

- The student should not be on the warning list.
- Passing remedial English course 9988-098.
- Passing also the following 18 credit hours with a minimum GPA of 2.0 out of 4.0.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Course Number</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>9988-123</td>
<td>3</td>
</tr>
<tr>
<td>Calculus I</td>
<td>0410-101</td>
<td>3</td>
</tr>
<tr>
<td>Calculus II</td>
<td>0410-102</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry I</td>
<td>0420-101</td>
<td>3</td>
</tr>
<tr>
<td>Physics I</td>
<td>0430-101</td>
<td>3</td>
</tr>
<tr>
<td>Physics II</td>
<td>0430-102</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Engineering</td>
<td>0600-099</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

A student must declare a major within four academic semesters excluding the preliminary semester, and any study interruption approved by the Dean of the College and approval of Students’ Affairs Committee, and Summer Semesters. Students who are not able to fulfill the above conditions ought to transfer to other colleges through the University Registration Office.

During the first four semesters at the college and before declaring a major, engineering students are supervised and guided by **Freshmen Engineering Students Unit** that helps to:

- Familiarize students with the University, main regulations of the course system, probation system, Engineering College central acceptance policy, and students’ honors.
- Involve students in the sports and social activities at the College.
- Train freshmen to use online facilities at the University.
- Provide a resource or contact person for critical periods during freshman year.
- Assist freshmen to select their major engineering discipline.
DEPARTMENT OF ELECTRICAL ENGINEERING

Electrical Engineering, being a very dynamic area, has become a broad and diverse field. The expanding role of electrical engineers in today's society reflects the potential, variety and scope of this exciting profession. To achieve the distinct qualifications expected today from engineers and scientists joining this profession, the Electrical Engineering Department offers an undergraduate program leading to a Bachelor of Science degree in Electrical Engineering. The Electrical Engineering Department is committed to providing a healthy academic environment by attracting high quality students, faculty and staff. The curriculum is thoroughly based on mathematics, science, engineering science and design to fully prepare students for their careers.

Mission

The mission of the Electrical Engineering Program is:

- To provide a quality and broad engineering education.
- To conduct strong basic and applied research, to dissemination of knowledge, and to contribute to advancement of science and technology.
- To serve the industry, the profession, and the community at large through innovative solutions.

Vision

The vision of the program is to gain regional and international recognition for providing a quality engineering education, outstanding research programs and exceptional community service. In addition, it is envisioned that the graduates of the program will be successful in their professional careers and/or graduate studies, prepared for professional creativity and leadership, and lead productive lives that contribute to improvement of society.

Program Educational Objectives

The general objectives of the undergraduate Program in Electrical Engineering at Kuwait University are related to the overall mission of the College and the University. In keeping with this mission, the Electrical Engineering Department is offering an educational program that is highly designed to meet internationally recognized standards and criteria. The Program Educational Objectives are the expected accomplishments of graduates during the first several years following graduation. The EE Program has adopted the following Educational Objectives. The graduates of the EE program will:

- successfully engage in careers in the broad range of electrical engineering areas to serve the needs of both private and public sectors.
- engage in continuous professional development activities, seek learning opportunities including graduate studies, and adapt to the rapid changes in work environment.
- contribute to the well-being of the society and environment through responsible practice of engineering profession.
Therefore, the Electrical Engineering program is designed to provide the student with a fundamental background in basic theoretical concepts and technological principles which constitute the foundations of modern electrical engineering and, at the same time, to give the student the opportunity to emphasize subject areas in which he/she has a particular interest. The curriculum requirements are flexible enough so that the student, with the assistance and approval of a program advisor, should be able to achieve depth in one or more of the main specializations areas, i.e., Electronics, Power Engineering, Communications and Control Systems. In order to strengthen the design experience for the students, the EE Curriculum includes a compulsory cornerstone design course EE 297 as well as a compulsory capstone design course EE 497.

Student Outcomes

The Electrical Engineering Program shall provide the graduates with:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- A broad education necessary to understand the impact of engineering solutions in a global and societal context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Knowledge of probability and statistics, including applications appropriate to the program objectives.
- Knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.
- An ability to analyze, design, and implement systems containing hardware and software components.

CURRICULUM

Each student majoring in Electrical Engineering must satisfactorily complete a minimum of 144 credits. In addition to the 21-credit general education component, Electrical Engineering students must satisfactorily complete 27 credits of mathematics and basic sciences courses, 21 credits of core engineering courses, 47 credits of core Electrical Engineering courses, 8 credits of Computer Engineering courses, and 20 credits of electives courses in Electrical engineering.
I. GENERAL EDUCATION COURSES (21 Credits)

A. Compulsory (12 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0330-100</td>
<td>Modern and Contemporary History of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

II. MATHEMATICS AND BASIC SCIENCE COURSES (27 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>0410-102</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>0410-111</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>0410-211</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>0410-240</td>
<td>Ordinary Differential Equation</td>
<td>3</td>
</tr>
<tr>
<td>0420-101</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>0420-105</td>
<td>General Chemistry I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0430-101</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>0430-105</td>
<td>General Physics I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0430-102</td>
<td>General Physics II</td>
<td>3</td>
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<tr>
<td>0430-107</td>
<td>General Physics II Laboratory</td>
<td>1</td>
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</table>

III. COLLEGE OF ENGINEERING REQUIREMENT (21 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering Programs</td>
<td>0</td>
</tr>
<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>0600-200</td>
<td>Computer Programming for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>0600-207</td>
<td>Electrical Engineering Fundamentals Lab</td>
<td>1</td>
</tr>
<tr>
<td>0600-208</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-209</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>0600-304</td>
<td>Engineering Probability &amp; Statistics</td>
<td>3</td>
</tr>
<tr>
<td>0600-308</td>
<td>Numerical Methods in Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

IV. MAJOR REQUIREMENTS (75 Credits)

A. Compulsory Courses (55 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0610-212</td>
<td>Advanced Mathematics for Electrical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0610-213</td>
<td>Linear Circuits Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0610-230</td>
<td>Introduction to Semiconductor Materials and Devices</td>
<td>3</td>
</tr>
<tr>
<td>0610-233</td>
<td>Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>0610-234</td>
<td>Electronics Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>0612-262</td>
<td>Fundamentals of Digital Logic</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>0612-264</td>
<td>Digital Logic Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-297</td>
<td>Cornerstone Design</td>
<td>3</td>
</tr>
<tr>
<td>0610-312</td>
<td>Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>0610-318</td>
<td>Introduction to Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>0610-320</td>
<td>Electromagnetic Field Theory</td>
<td>3</td>
</tr>
<tr>
<td>0610-333</td>
<td>Electronics II</td>
<td>3</td>
</tr>
<tr>
<td>0610-334</td>
<td>Electronics Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>0610-343</td>
<td>Energy Conversion I</td>
<td>3</td>
</tr>
<tr>
<td>0610-345</td>
<td>Energy Conversion Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>0610-350</td>
<td>Power System Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>0612-363</td>
<td>Introduction to Embedded Systems</td>
<td>3</td>
</tr>
<tr>
<td>0612-364</td>
<td>Introduction to Embedded Systems Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-370</td>
<td>Control Theory I</td>
<td>3</td>
</tr>
<tr>
<td>0610-374</td>
<td>Control Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>0610-381</td>
<td>Communication Theory</td>
<td>3</td>
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<tr>
<td>0610-384</td>
<td>Communication Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-497</td>
<td>Engineering Design</td>
<td>3</td>
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</tbody>
</table>

### B. Elective Courses

Students choose 20 credits from the following list of Electrical Engineering Elective Courses.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0610-399</td>
<td>Electrical Engineering Field Training</td>
<td>3</td>
</tr>
<tr>
<td>0610-410</td>
<td>Active Filter Design</td>
<td>3</td>
</tr>
<tr>
<td>0610-415</td>
<td>Instrumentation and Measurements Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-416</td>
<td>Instrumentation and Measurements</td>
<td>3</td>
</tr>
<tr>
<td>0610-417</td>
<td>Network Synthesis</td>
<td>3</td>
</tr>
<tr>
<td>0610-420</td>
<td>Antenna and Propagation</td>
<td>3</td>
</tr>
<tr>
<td>0610-421</td>
<td>Microwave Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0610-422</td>
<td>Fiber Optics</td>
<td>3</td>
</tr>
<tr>
<td>0610-423</td>
<td>Computational Electromagnetic</td>
<td>3</td>
</tr>
<tr>
<td>0610-424</td>
<td>Microwave Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-425</td>
<td>Electromagnetic Compatibility</td>
<td>3</td>
</tr>
<tr>
<td>0610-426</td>
<td>Introduction to Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>0610-428</td>
<td>Wireless Communication Networks</td>
<td>3</td>
</tr>
<tr>
<td>0610-430</td>
<td>Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>0610-432</td>
<td>Analog Integrated Circuits</td>
<td>3</td>
</tr>
<tr>
<td>0610-433</td>
<td>Digital Integrated Electronics</td>
<td>3</td>
</tr>
<tr>
<td>0610-434</td>
<td>Digital Integrated Electronics Laboratory</td>
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</tr>
<tr>
<td>0610-436</td>
<td>VLSI design Laboratory</td>
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</tr>
<tr>
<td>0610-437</td>
<td>Introduction to VLSI Design</td>
<td>3</td>
</tr>
<tr>
<td>0610-438</td>
<td>CAD for VLSI Design</td>
<td>3</td>
</tr>
<tr>
<td>0610-443</td>
<td>Energy Conversion II</td>
<td>3</td>
</tr>
<tr>
<td>0610-444</td>
<td>Energy Conversion Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>0610-446</td>
<td>Introduction to Power Electronics</td>
<td>3</td>
</tr>
<tr>
<td>0610-452</td>
<td>Power System Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>0610-454</td>
<td>Power System Analysis II Laboratory</td>
<td>1</td>
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<tr>
<td>0610-455</td>
<td>Computer Methods in Power System Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0610-456</td>
<td>Power Apparatus and Systems</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credit</td>
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<tr>
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<tr>
<td>0610-458</td>
<td>Electric Power Distribution Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0610-460</td>
<td>Communication Networks</td>
<td>3</td>
</tr>
<tr>
<td>0610-470</td>
<td>Digital Control Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0610-472</td>
<td>Control Theory II</td>
<td>3</td>
</tr>
<tr>
<td>0610-473</td>
<td>Digital Control</td>
<td>3</td>
</tr>
<tr>
<td>0610-475</td>
<td>Industrial Controls</td>
<td>3</td>
</tr>
<tr>
<td>0610-476</td>
<td>Nonlinear Control</td>
<td>3</td>
</tr>
<tr>
<td>0610-477</td>
<td>Optimization Techniques</td>
<td>3</td>
</tr>
<tr>
<td>0610-478</td>
<td>Intelligent Control</td>
<td>3</td>
</tr>
<tr>
<td>0610-479</td>
<td>Adaptive Control Techniques</td>
<td>3</td>
</tr>
<tr>
<td>0610-482</td>
<td>Digital Communication</td>
<td>3</td>
</tr>
<tr>
<td>0610-485</td>
<td>Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>0610-487</td>
<td>Radar Technology</td>
<td>3</td>
</tr>
<tr>
<td>0610-488</td>
<td>Digital Image Processing</td>
<td>3</td>
</tr>
<tr>
<td>0610-489</td>
<td>Artificial Neural Systems</td>
<td>3</td>
</tr>
<tr>
<td>0610-490</td>
<td>Special Topics in Electrical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0610-495</td>
<td>Senior Project</td>
<td>3</td>
</tr>
</tbody>
</table>
ELECTRICAL ENGINEERING COURSES

0610-212 Advanced Mathematics for Electrical Engineering (3-0-3)
(Pre-requisites: 0600-205)

Fourier series and Fourier transform and their applications to electrical circuit and analysis, solution of partial differential equations applied to static electric potential, advanced linear algebra and state space representation of electrical systems, vector calculus and vector integration applied to Maxwell’s equations, complex variables, discrete mathematics, relevant MATLAB Toolboxes.

0610-213 Linear Circuit Analysis (3-0-3)
(Pre-requisites: 0600-205; 0600-207)

Damped sinusoidal forcing function, frequency response as a function of $\sigma$, parallel and series resonance, quality factor and bandwidth, balanced three-phase circuits, magnetically coupled circuits, mutual inductance, the linear transformer and the ideal transformer, two-port networks, admittance, impedance and $h$-parameters, complex form of the Fourier series, Fourier Transform, Reviews of Laplace transform, circuit response using Laplace transform.

0610-230 Introduction to Semiconductor materials and Devices (3-0-3)
(Co-requisite: 0610-233)

Review of the modern view of atoms & electrons, basic semiconductor properties, charge carriers and carrier concentrations at thermal equilibrium, excess carriers, generation recombination, drift & diffusion, The PN junction: Structure, static characteristics, regions of operation, device modeling and applications, MOSFET: Structure, static & dynamic characteristics, regions of operation, device modeling and applications, BJT: Structure, static & dynamic characteristics, regions of operation, device modeling and applications, Semiconductor device fabrication.

0610-233 Electronics I (3-0-3)
(Co-requisites: 0610-213; 0610-234)

Signal amplification and amplifier models, operational amplifiers characteristics and configurations, diodes characteristics and circuits, Field Effect Transistors (FET) and bipolar junction transistors (BJT): characteristics, biasing, large/small signal models, and single-stage amplifiers configurations.

0610-234 Electronics Laboratory I (0-3-1)
(Pre-requisite: 0600-207; Co-requisite: 0610-233)

Laboratory experiments related to 0610-233 course contents.

0610-297 Cornerstone Design (2-3-3)
(Pre-requisites: 0610-233; 0610-234; 0600-209)

Introduction to design process, creativity in design, development of skills needed for design including: project specifications, planning and scheduling, circuits/components
selection, circuit simulation using computer tools, circuits construction and testing. Effective application of communication skills and teamwork. Considerations are given to realistic constraints such as economic factors, safety, reliability, and ethics. Students are expected to work on multiple hands-on engineering projects.

0610-312 Signals and Systems (3-0-3)
(Pre-requisites: 0610-213; 9988-221)

Introduction to signals and systems, continuous and discrete, differential and difference equations, analysis of continuous and discrete signals, convolution and its properties, solution of differential and difference equations, Laplace transform review, frequency domain analysis of linear systems, transfer functions, sampling, Z-transform - BIBO Stability, introduction to digital filters, introduction to state space analysis.

0610-318 Introduction to Digital Signal Processing (3-0-3)
(Pre-requisites: 0610-312; 0612-262)

Discrete time signals and systems, Fourier transform of sequences, analog to digital conversion, Z-transform, discrete Fourier transform, circular convolution, Fast Fourier Transform (FFT), introduction to digital filters, application of DSP principles.

0610-320 Electromagnetic Field Theory (3-0-3)
(Pre-requisites: 0610-213; 0610-212)

Plane waves in lossless and lossy media, plane waves in good conductors, Poynting’s theorem, Reflection and transmission of plane waves at planar interfaces, total internal reflection and zero reflection, transmission lines and matching schemes using Smith chart, Waveguides and resonators, topics of waves with applications, introduction to antennas.

0610-333 Electronics II (3-0-3)
(Pre-requisites: 0610-213; 0610-233; 0610-234; Co-requisites: 0610-334 and 0610-230)

Integrated circuit biasing and amplifiers, high and low frequency responses of amplifiers, differential and multistage amplifiers, output stages, negative feedback properties and topologies, data converter and oscillator circuits.

0610-334 Electronics Laboratory II (0-3-1)
(Pre-requisite: 0610-234; Co-requisite: 0610-333)

Laboratory experiments related to 0610-333 course contents.

0610-343 Energy Conversion I (3-0-3)
(Pre-requisite: 0610-213)

Magnetic circuits, electromechanical fundamentals, review of balanced three-phase systems, single-phase power transformers, synchronous generators, induction motor, and DC motors.
0610-345 Energy Conversion Laboratory I (Pre-requisite: 0610-343) (0-3-1)

Laboratory experiments related to 0610-343 course contents.

0610-350 Power System Analysis I (Pre-requisites: 0600-308; 0610-343; Co-requisite: 0610-345) (3-0-3)

Review of single and three-phase circuits, AC power and the per unit system, determination of transmission line parameters, transmission line models in the transient and the steady state, power system modeling, power system Admittance matrix and network calculations, load flow solutions and control.

0610-370 Control Theory I (Pre-requisite: 0610-312; Co-requisite: 0610-374) (3-0-3)

Features of feedback control systems, modeling of specific control systems examples, transfer functions, block diagram and signal flow graph, time domain analysis of control systems, stability of linear systems, basic control actions and response of control systems, root locus analysis and design, frequency domain analysis and design of control systems.

0610-374 Control Laboratory I (Co-requisite: 0610-370) (0-3-1)

Laboratory experiments related to the contents of 0610-370.

0610-381 Communication Theory (Pre-requisites: 0610-312; 0600-304; 0610-320) (3-0-3)

Introduction to communication Systems, signal spectral analysis, signal transmission and channel characterization, amplitude modulation (Analog), angle modulation (Analog), behavior of analog communication systems in the presence of noise, PCM and delta modulation schemes, introduction to digital communication systems.

0610-384 Communication Laboratory (Co-requisite: 0610-381) (1-0-1)

Laboratory experiments related to 0610-381 course contents.

0610-399 Electrical Engineering Field Training (Pre-requisite: Completion of 90 credit hours and consent of the Engineering Training Center) (0-10-3; 200 hours of training)

Students should attend a training program at one of the approved institutions engaged in electrical engineering practices. The objective is to gain practical experience in real engineering problems. The student should submit a formal report related to the program attended at the end of the training period. A minimum of 200 hours of supervised training is required.
0610-410 Active Filter Design (3-0-3)  
(Pre-requisites: 0610-233; 0610-234; 0610-312)

The approximation theory, Passive Butterworth LP filter design, frequency band transformation and the design of Passive HP, BP and BE Butterworth filters, design of Passive Chebyshev LP, HP, BP and BE filters, design of inverse Chebyshev LP and HP filters, delay equalization, sensitivity analysis, active Filter Design with Operational amplifiers and their finite gain effects, bilinear and biquadratic transfer functions and their RC-op amp realizations, cascade realization of higher-order filters- Leap frog filters, synthetic L and FDNR Simulations.

0610-415 Instrumentation and Measurements Laboratory (0-3-1)  
(Co-requisite: 0610-416)

Laboratory experiments related to 0610-416 course contents.

0610-416 Instrumentation and Measurements (3-0-3)  
(Pre-requisites: 0610-333; 0610-334)

Electrical sensors and transducers, analog and digital signal conditioning techniques, A/D and D/A converters, signal multiplexing, digital signal processing of data, data acquisition systems, microprocessor based instrumentation, noise sources.

0610-417 Network Synthesis (3-0-3)  
(Pre-requisite: 0610-213)

Properties of positive real functions, Foster’s and Cauer’s methods for LC-RC and RL networks, Brunei’s impedance synthesis method, lossless two-port networks, Cauer’s two-port method, transfer function, partial pole removal, zero shifting, the synthesis of doubly terminated reactance two-port network, transducer parameter H(s), relations between H(s) and Z or Y parameters, reactance ladder realization, approximation theory, Butterworth and Chebyshev approximations, design of filters.

0610-420 Antenna and Propagation (3-0-3)  
(Pre-requisite: 0610- 320)

Retarded potentials, radiation from a short current element and linear wire antenna, antenna parameters, radiation from arbitrary current distribution, antenna impedance, arrays: uniform, binomial, Chebyshev, aperture-type antenna, receiving antenna, line of sight propagation, ground-wave propagation, ionospheric propagation.

0610-421 Microwave Engineering (3-0-3)  
(Pre-requisite: 0610-320)

Passive microwave circuit components, reciprocal and nonreciprocal, CAD tools, scattering matrix representation of microwave circuit, microstrip line circuits, microwave measurements, active Microwave sources and amplifiers.
### 0610-422 Fiber Optics  (Pre-requisites: 0610-320; 0610-381)  (3-0-3)

Theory of light guidance on planar dielectric sheets and on dielectric rods, signal loss and dispersions on fibers, attenuation and dispersion measurements, principles of optical sources and detectors, system design, lab work on OTDR and dispersion measurement sets.

### 0610-423 Computational Electromagnetics  (Pre-requisite: 0610-320)  (3-0-3)


### 0610-424 Microwave Lab  (Pre-requisite: 0610-320; Co-requisite: 0610-421)  (0-3-1)

Laboratory experiments related to 0610-421 course contents

### 0610-425 Electromagnetic Compatibility  (Pre-requisite: 0610-320)  (3-0-3)

Introduction to Electromagnetic Fields, sources of electromagnetic interference, conducted and radiated interference, grounding and shielding, electromagnetic interference filtering, electromagnetic compatibility standards, compatibility measurements and Testing.

### 0610-426 Introduction to Remote Sensing  (Pre-requisite: 0610-381)  (3-0-3)

Radiation Characteristics, airborne and space-born sensors and instruments, satellite systems, ultispectral/Hyperspectral Data Compression, transmission, archiving, and distribution, spectral signature characteristics of soil, vegetation, water, and cloud, Multispectral/Hyperspectral Data Processing, analysis, and classification, active radar and microwave remote sensing, applications of remotely sensed data in reconnaissance, agriculture, geology, hydrology, forestry, oceanography, meteorology, & ecosystem studies

### 0610-428 Wireless Communication Networks  (Pre-requisite: 0610-381)  (3-0-3)

Introduction to wireless communication principles, the cellular concept-system design issues, signal propagation and link budgets for wireless links, communication over fading channels, modulation, multiplexing, and multiple access techniques, channel coding for wireless systems, speech coding for wireless networks, and wireless communication networks.
0610-430 Semiconductor devices (3-0-3)
(Pre-requisites: 0610-233; 0610-234; 0610-230)

Review of solid state physics fundamentals, solid state energy band structure, electron and hole statistics, theory of electric conduction in semiconductors, generation recombination phenomena, PN junction static and dynamic behavior, non-ideal PN junction behavior, operation at microwave frequencies, the PIN diode, metal semiconductor contacts, the MOS capacitor, the MOSFET transistor, ideal and non-ideal behavior of the MOSFET transistor, short channel effects in MOSFETs, hot electron effects in MOSFETs, the Bipolar Junction Transistor, long base and short base BJT: ideal and non-ideal behavior, the Early effect, the Kirk effect, operation at microwave frequencies, hetero-junction devices, photonic devices, semiconductor device processing, novel processing techniques, new applications of semiconductor materials and devices.

0610-432 Analog Integrated Circuits (3-0-3)
(Pre-requisites: 0610-333; 0610-334; 0610-312)

Types of signals and systems, thin and thick film (hybrid) technology, MOS and Bipolar technology and modeling, switched capacitor (SC) resistor simulation, MOS SC integrators, first order SC building blocks, SC biquads, basic analog building blocks, current mirrors, comparators, Transconductance and Operational amplifiers, realization and design, examples of Non-Linear Circuits.

0610-433 Digital Integrated Electronics (3-0-3)
(Pre-requisites: 0610-233; 0610-234; 0612-262)

Overview of digital circuit design, CMOS inverter, CMOS logic gate circuits, Pseudo-NMOS logic circuits, pass transistor logic circuits, dynamic logic circuits, latches and flip-flops, multivibrator circuits, semiconductor memories (RAM and ROM), Bipolar Transistor Transistor Logic (TTL), Bipolar Emitter coupled logic circuits (ECL), BiCMOS digital circuits.

0610-434 Digital Integrated Electronics Laboratory (0-3-1)
(Co-requisite: 0610-433)

Laboratory of 0610-433.

0610-436 VLSI Design Laboratory (0-3-1)
(Pre-requisites: 0610-233; 0610-234; Co-requisite: 0610-437)

Laboratory experiments related to 0610-437 course contents.

0610-437 Introduction to VLSI design (3-0-3)
(Pre-requisites: 0610-233; 0610-234; 0612-262)

Introduction to MOS technology, gate level minimization, scaling of MOS technology and circuits, layout algorithms and techniques, combinational CMOS digital blocks, aspects of system timing, synchronous and asynchronous sequential logic, register transfer level, programmable logic and FPGA’s, introduction to HDL, design project.
0610-438 CAD for VLSI design (3-0-3)
(Pre-requisites: 0612-262; and (0610-433 or 610-437))

Implementation strategies for digital IC’s, interconnects, more on timing issues in digital circuits, design of arithmetic building blocks, finite state machines, design of memories and array structures, introduction to digital circuit simulation, placement and routing and synthesis design tools, configuration and implementation of designs on FPGA’s, Testing and Verification techniques of digital circuits, design project.

0610-443 Energy Conversion II (3-0-3)
(Pre-requisites: 0610-343; 0610-345)


0610-444 Energy Conversion Laboratory II (0-3-1)
(Co-requisite: 0610-443)

Laboratory experiments related to 0610-443 course contents

0610-446 Introduction to Power Electronics (3-0-3)
(Pre-requisites: 0610-233; 610-312)

Specifications of Diodes, Thyristors and Transistors, switches and switch matrix, Diodes and Thyristor rectifiers with AC and DC source excitation, AC voltage controllers, single, and three-phase controlled rectifier circuits, DC-DC converters (Choppers), DC-AC inverters, switching losses and snubber circuits.

0610-452 Power System Analysis II (3-0-3)
(Pre-requisite: 0610-350)

Economic dispatch operation of power system, Bus impedance model, Symmetrical three-phase fault, calculation of symmetrical components for Unsymmetrical faults, Unsymmetrical faults, power system stability, steady state and transient stability.

0610-454 Power System Analysis II Laboratory (0-3-1)
(Co-requisite: 0610-452)

Laboratory experiments related to the contents of 0610-452: Electrical Power systems II.

0610-455 Computer Methods in Power System Analysis (3-0-3)
(Pre-requisite: 0610-452)

0610-456 Power Apparatus and Systems (Pre-requisite: 0610-350) (3-0-3)

Power network protection, circuit breakers, electromagnetic transients, economics of power supply.

0610-458 Electric Power Distribution Engineering (Pre-requisite: 0610-350) (3-0-3)

Power distribution, load characteristics, distribution transformers, subtransmission networks, design of primary and secondary systems, voltage drop and loss calculations, capacitor applications, distribution system voltage regulation.

0610-460 Communication Networks (Pre-requisites: 0610-213; 0612-262; Completion of 100 credits) (3-0-3)

Introduction to networking, network Protocols & Architecture, LAN/WAN, Circuit Switching and Packet Switching Networks, Network Design, Network Resource management, Networks' performance evaluation, and Network’s security.

0610-470 Digital Control Laboratory (Co-requisite: 0610-473) (0-3-1)

Laboratory experiments related to the contents of 0610-473.

0610-472 Control Theory II (Pre-requisites: 0610-370; 0610-374) (3-0-3)

Matrix Theory, eigenvalues and eigenvectors, diagonal form representation, jordan form matrix representation, state variables and state diagrams, solution of linear time, invariant state equations, controllability and observability, feedback design: state and output feedback design, observer design and observer-based control schemes, separation principle, case studies.

0610-473 Digital Control (Pre-requisite: 0610-370) (3-0-3)

Review of z-transform, difference equations, sampling and reconstruction, D/A and A/D converters, open loop discrete-time control systems, closed loop discrete-time control systems, stability of discrete-time control systems, design of digital controllers, design of estimators for discrete-time control systems, case studies.

0610-475 Industrial Control (Pre-requisites: 0610-370; 0610-374) (3-0-3)

Basic components of industrial control systems, design and Tuning of feedback controllers for industrial systems, advanced control techniques for industrial systems, multivariable industrial control, case studies.
0610-476 Nonlinear Control  
(Pre-requisite: 0610-472)  
(3-0-3)

Introduction and fundamentals of nonlinear systems, phase plane analysis, Lyapunov stability, feedback linearization, sliding mode control, output feedback control, back stepping control, case studies.

0610-477 Optimization Techniques  
(Pre-requisite: 0610-312)  
(3-0-3)

Introduction to optimization and Mathematical review, formulation of optimization problems, linear programming: the simplex method, duality, applications of linear programming, nonlinear programming: unconstrained single variable and multivariable optimization, constrained single variable and multivariable optimization, case studies.

0610-478 Intelligent Control  
(Pre-requisites: 0610-370; 0610-374)  
(3-0-3)

Mathematics of fuzzy sets and logic, fuzzy rule based and fuzzy inference engines, Fuzzifiers and defuzzifiers, fuzzy systems and their properties, design of fuzzy controllers using clustering and table look-up scheme, introduction to other AI techniques.

0610-479 Adaptive Control Techniques  
(Pre-requisite: 0610-472)  
(3-0-3)


0610-482 Digital Communications  
(Pre-requisite: 0610-381)  
(3-0-3)


0610-485 Digital Signal Processing  
(Pre-requisite: 0610-318)  
(3-0-3)

0610-487 Radar Technology (Pre-requisite: 0610-381) (3-0-3)


0610-488 Digital Image Processing (Pre-requisite: 0610-312) (3-0-3)

An image model, sampling and quantization and basic relationships between pixels, Imaging geometry, two dimensional Fourier transforms, image enhancement: spatial, domain and frequency-domain methods, image restoration, image segmentation.

0610-489 Artificial Neural Systems (Pre-requisite: 0610-312) (3-0-3)

Artificial neural system: preliminaries, fundamental concepts and models of artificial neural system, single layer preceptor classifiers, multi-layer feed forward networks, single layer feedback networks, associative memories, matching and self organizing networks, applications of neural algorithms and systems, neural network implementation.

0610-490 Special Topics in Electrical Engineering (Pre-requisite: Completion of 110 Credits) (3-0-3)

Formal classroom instruction of a new topic.

0610-495 Senior Project (Pre-requisite: Completion of 100 Credits; Consent of the Department) (0-9-3)

The student undertakes an independent project (theoretical and/or practical under the supervision of a faculty advisor. The objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout his course in an actual problem. The student must document his study in a technical report and give an oral presentation.

EE 497 Engineering Design (Pre-requisites: 0610-297; 0610-334; Completion of 110 credit; Consent of the Department) (3-0-3)

Application of basic sciences, mathematics and engineering sciences to the design, construction and operation of components, equipments or systems, consideration is given to realistic constraints such as economic, environmental, and social factors. Safety, reliability, aesthetics, and ethics are also considered.
DEPARTMENT OF COMPUTER ENGINEERING

The Computer Engineering Department fosters one of the most dynamic and active fields of study. The undergraduate Computer Engineering curriculum was designed after the IEEE-CS/ACM 2004 model program. It consists of core programs of required lecture and laboratory courses that provide the students with a well-balanced, broad education comprising the different facets of the Computer Engineering profession. The program also provides depth through a major design experience as well as a wide range of senior technical electives that enable students to specialize in technical areas of their choice. Equal emphasis is placed on the theoretical and practical aspects of the field.

Vision

The vision of computer engineering department is to be recognized regionally and internationally as a provider of high-quality undergraduate and graduate education that emphasizes scholastic excellence, practical skills, and professional competency to become leaders in exploring new frontiers in computing. In addition, our vision is to conduct state-of-the-art research and deliver community services.

Mission Statement

The mission of the undergraduate program in computer engineering is to foster excellence in computing by:

- Providing a high quality, accredited educational experience that prepares students for success in engineering practice and advanced studies.
- Serving the academic, professional, and business computing communities in the State of Kuwait.
- Creating, expanding and disseminating knowledge through scholarly activities.

Program Educational Objectives

Our Computer Engineering Program Educational Objectives have been established that highlight the areas of student achievement that will satisfy constituents’ needs, both now and in the future, and fulfill the program’s mission. Educational objectives of the undergraduate computer engineering program at Kuwait University are to produce graduates who will be:

- Practitioners of computer engineering with productive careers in computing professions in public and private organizations and academia.
- Engaged in professional development and learning activities by pursuing advanced studies or training in engineering or other disciplines.
- Contributors to the welfare of society, and the development of their business and professional environments.
Student Outcomes

Graduates of the Computer Engineering Program shall have the knowledge and skills described below:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments as well as analyze and interpret data.
- An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively in oral and written form.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- Recognition of the need for, and an ability to engage in life-long learning.
- Knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Knowledge of probability and statistics, including their applications to computer engineering.
- A knowledge of mathematics through differential and integral calculus, and basic, computer, and engineering sciences, necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to computer engineering.
- Knowledge of discrete mathematics.

CURRICULUM

Each student majoring in Computer Engineering must satisfactorily complete a minimum of 144 credits, which are divided into four components:

- UNIVERSITY REQUIREMENTS (21 credits)
- MATHEMATICS AND BASIC SCIENCE REQUIREMENTS (27 credits)
- BASIC ENGINEERING REQUIREMENTS (21 credits)
- DEPARTMENT REQUIREMENTS:

1. Computer Component (50 credits)
2. Electrical Component (13 credits)
3. Elective Component (12 credits)
### I. General Education Courses (21 credits)

#### A. Compulsory (12 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>0330-100</td>
<td>Modern and Contemporary History of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>History of Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
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</tbody>
</table>

#### B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

### II. Mathematics and Basic Science Requirements (27 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>0410-102</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>0410-111</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>0410-211</td>
<td>Calculus III</td>
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</tr>
<tr>
<td>0410-240</td>
<td>Ordinary Differential Equations</td>
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<tr>
<td>0420-101</td>
<td>General Chemistry I</td>
<td>3</td>
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<tr>
<td>0420-105</td>
<td>General Chemistry Laboratory I</td>
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<td>0430-101</td>
<td>Physics I</td>
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<tr>
<td>0430-105</td>
<td>Physics Laboratory I</td>
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<td>0430-102</td>
<td>Physics II</td>
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<td>0430-107</td>
<td>Physics Laboratory II</td>
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### III. College of Engineering Requirements (21 Credits)

<table>
<thead>
<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering Programs</td>
<td>0</td>
</tr>
<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
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<tr>
<td>0600-200</td>
<td>Computer Programming for Engineers</td>
<td>3</td>
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<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals</td>
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<tr>
<td>0600-207</td>
<td>Electrical Eng. Fundamentals Laboratory</td>
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<tr>
<td>0600-208</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-209</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>0600-304</td>
<td>Engineering Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>0600-308</td>
<td>Numerical Methods in Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

### IV. Major Requirements (75 Credits)

#### A. Compulsory Courses (63 Credits)

**Computer Engineering Courses (50 Credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>0612-201</td>
<td>Object-Oriented Paradigm</td>
<td>3</td>
</tr>
<tr>
<td>0612-203</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>0612-207</td>
<td>Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>0612-210</td>
<td>Computer Ethics and Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>0612-221</td>
<td>Introduction to Software Engineering</td>
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<tr>
<td>Course Code</td>
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<td>Credits</td>
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<tr>
<td>0612-262</td>
<td>Fundamentals of Digital Logic</td>
<td>3</td>
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<td>0612-264</td>
<td>Digital Logic Laboratory</td>
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<tr>
<td>0612-300</td>
<td>Design and Analysis of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>0612-325</td>
<td>Human-Computer Interaction</td>
<td>3</td>
</tr>
<tr>
<td>0612-356</td>
<td>Computer Networks I</td>
<td>3</td>
</tr>
<tr>
<td>0612-363</td>
<td>Introduction to Embedded Systems</td>
<td>3</td>
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<tr>
<td>0612-364</td>
<td>Embedded Systems Laboratory</td>
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<tr>
<td>0612-368</td>
<td>Computer Organization</td>
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<tr>
<td>0612-395</td>
<td>Computer Systems Engineering</td>
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<tr>
<td>0612-445</td>
<td>Operating System Principles</td>
<td>3</td>
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<tr>
<td>0612-456</td>
<td>Computer Networks II</td>
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<tr>
<td>0612-468</td>
<td>Computer Architecture</td>
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<td>0612-469</td>
<td>Computer Architecture Laboratory</td>
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<tr>
<td>0612-495</td>
<td>Capstone Design</td>
<td>3</td>
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</table>

**Electrical Engineering Courses**

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>0610-213</td>
<td>Linear Circuit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0610-233</td>
<td>Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>0610-234</td>
<td>Electronics I Laboratory</td>
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<tr>
<td>0610-312</td>
<td>Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>0610-433</td>
<td>Digital Integrated Electronics</td>
<td>3</td>
</tr>
</tbody>
</table>

**B. Elective Courses**

Students choose 4 courses from the following list of electives. However, the program requires that at least one CpE course be selected from each of the two categories.

**Category I**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>0612-320</td>
<td>Software Construction</td>
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<tr>
<td>0612-321</td>
<td>Software Quality Assurance</td>
<td>3</td>
</tr>
<tr>
<td>0612-322</td>
<td>Software Requirement Analysis</td>
<td>4</td>
</tr>
<tr>
<td>0612-333</td>
<td>Intelligent Systems</td>
<td>3</td>
</tr>
<tr>
<td>0612-341</td>
<td>Database Systems I</td>
<td>3</td>
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<tr>
<td>0612-399</td>
<td>Engineering Training</td>
<td>3</td>
</tr>
<tr>
<td>0612-402</td>
<td>Introduction to Internet Technologies</td>
<td>3</td>
</tr>
<tr>
<td>0612-404</td>
<td>Principles of Compiler Design</td>
<td>3</td>
</tr>
<tr>
<td>0612-406</td>
<td>Simulation Systems</td>
<td>3</td>
</tr>
<tr>
<td>0612-410</td>
<td>Programming Languages and Automata Theory</td>
<td>3</td>
</tr>
<tr>
<td>0612-413</td>
<td>Distributed Computing</td>
<td>3</td>
</tr>
<tr>
<td>0612-424</td>
<td>Value Engineering Applications</td>
<td>3</td>
</tr>
<tr>
<td>0612-434</td>
<td>Robotics</td>
<td>3</td>
</tr>
<tr>
<td>0612-435</td>
<td>Expert Systems</td>
<td>3</td>
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<tr>
<td>0612-436</td>
<td>Machine Learning</td>
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<tr>
<td>0612-437</td>
<td>Intelligent Algorithms</td>
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<tr>
<td>0612-438</td>
<td>Computer Graphics</td>
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<tr>
<td>0612-441</td>
<td>Database Systems II</td>
<td>3</td>
</tr>
<tr>
<td>0612-442</td>
<td>Distributed Database Systems</td>
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COMPUTER ENGINEERING COURSES

0612-201 Object-Oriented Paradigm (Pre-requisites: 0600-200) (3-2-3)

A continuation coverage of computing fundamentals given in 0600-200, topics include data and procedural abstraction, software design principles and use of O-O design to develop solutions to simple problems, ethical issues involved in computer use, basic object-oriented design techniques (encapsulation and information-hiding, separation of behavior and implementation, classes and subclasses, inheritance, polymorphism, class hierarchies), iterators as abstraction mechanisms, linked structures, event-driven programming, API programming, the laboratory projects include use of object-oriented design concepts with detailed documentation.

0612-203 Discrete Structures (Pre-requisites: 0410-102, 0410-111) (3-0-3)

Basic logic (propositional logic, predicate logic, limitations, applications in computing), sets, relations, and functions, proof techniques (formal proofs, direct, contraposition, contradiction, and induction), basics of counting (permutations and combinations, counting arguments, pigeonhole principle, and generating functions), graphs and trees (spanning trees, shortest path, Euler and Hamiltonian cycles, and traversal strategies), recursion (definitions, developing and solving recursive equations), the focus of materials is on the applications side of computer engineering.

0612-207 Data Structures (Pre-requisites: 600-200, 0612-201, 0612-203) (3-2-3)

Fundamental data structures (stacks; queues; linked lists; hash tables; trees; graphs), basic algorithmic analysis (asymptotic analysis; identifying differences among best, average, and worst case, empirical measurements of performance; time and space tradeoffs in algorithms), fundamental computing algorithms, sorting algorithms; hash tables and hashing, heaps, priority queues, binary search trees, balanced binary search trees, AVL trees; representations of graphs and graph traversals, recursion, the course includes weekly laboratory sessions and a significant programming project with detailed documentation and implementation.

0612-210 Computer Ethics and Professional Practice (Pre-requisites: 0600-200) (2-0-2)

History of computing, social context of computing (privacy, profiling, anonymity, data matching and mining, censorship and offensive materials), methods and tools of moral analysis, professional and ethical responsibilities, risks and liabilities of computer-based systems, intellectual property, privacy and civil liberties (privacy enhancing technology, OPS and P3P, filtering, blocking and rating), computer crimes, economic issues in computing (monopolies, labor and computing), philosophical frameworks, encryption, identification, anonymization, information technology and the law.
0612-221 Introduction to Software Engineering (3-2-3)
(Pre-requisites: 0612-201, Co-requisite: 9988-221)

The course introduces the basic concepts of software engineering, methodologies, and process models. The course covers the followings: Software life cycle, models and methods for software specification, analysis and design. Object oriented analysis and design using UML, patterns, frameworks, and APIs, architectural design, distributed system architectures, the course also introduces the use of state-of-the-art tools for computer-aided software engineering, in this first course in the sequence, students are introduced to the laboratory environment and work on assigned tasks as members of project teams.

0612-262 Fundamentals of Digital Logic (3-0-3)
(Pre-requisites: 0600-200, 0600-205, 0600-207, Co-requisite: 0612-264)

Number Systems, logic gates and Boolean algebra, design and analysis of combinational circuits, logic function minimization, modular design of combinational circuits, arithmetic circuits, programmable logic devices (PLDs) and field-programmable gate arrays (FPGAs), PLAs, ROMs, PALs and complex PLDs, memory elements: latches and flip-flops, design and analysis of synchronous sequential circuits, simulation and synthesis of digital circuits from HDL models.

0612-264 Digital Logic Laboratory (0-3-1)
(Co-requisite: 0612-262)

Hands-on design and implementation of digital logic circuits, use of CAD tools for schematic capture and Verilog HDL based simulation and synthesis, implementations of digital circuits using sophisticated logic devices such as CPLDs and FPGAs.

0612-300 Design and Analysis of Algorithms (3-0-3)
(Pre-requisite: 0612-207)

Overview of algorithms and complexity, basic algorithmic analysis, models of computation, classes of techniques for designing efficient algorithms including recursion, divide-and-conquer, randomization, greedy algorithms, and dynamic programming. Fundamental computing algorithms: sorting, searching, and graph algorithms, the classes of P, NP, and NP-complete problems.

0612-320 Software Construction (3-0-3)
(Pre-requisite: 0612-207)

General principles and techniques for disciplined low-level software design, basics of formal languages; syntax and semantics; grammars; Back Naur Form (BNF), principles and techniques for Parsing concepts, parse trees; and context free grammars, overview of programming languages and criteria for selecting programming languages and platforms, formal languages, state-transition and table-based software design, formal methods for software construction. tools for automating software design and construction, students will gain hands-on experience in the lab by using software engineering tools to create designs and using parser generators to generate languages, the course also introduces the use of state-of-the-art tools for computer-aided software engineering.
0612-321 Software Quality Assurance (3-0-3)
(Pre-requisite: 0612-221)

Quality: how to assure it and verify it, and the need for a culture of quality, avoidance of errors and other quality problems, inspections and reviews, testing, verification, and validation techniques. Process assurance versus product assurance, quality process standards, problem analysis and reporting, statistical approaches to quality control, lab assignment will permit students to test and inspect a wide variety of software, the course also introduces the use of state-of-the-art tools for computer-aided software engineering.

0612-322 Software Requirements Analysis (3-3-4)
(Pre-requisite: 0612-221)

Domain engineering, techniques for discovering and eliciting requirements, languages and models of representing requirements, analysis and validation techniques, including need, goal, and use case analysis, requirements in the context of system engineering, specifying and measuring external qualities: performance, reliability, availability, safety, security, etc., specifying and analyzing requirements for various types of systems: embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers, resolving feature interactions, requirements documentation standards, traceability, human factors, requirements in the context of agile processes, requirements management: Handling requirements changes, an important component of the course is a group project about writing and analyzing software requirements specification of a large software system, the laboratory component will provide hands-on experience on topics and the use of state-of-the-art tools for computer-aided software engineering.

0612-325 Human-Computer Interaction (3-0-3)
(Pre-requisite: 0612-221)

Psychological principles of human-computer interaction, building a simple graphical user interface (principles of GUIs, GUI toolkits), human-centered software evaluation and development, graphical user-interface design and programming (HCI aspects of common widgets, interaction techniques, screen design, GUI builders and GUI programming environments), intelligent systems (artificial intelligence concepts), HCI aspects of multimedia systems (categorization and architectures of information, HCI design of multimedia information systems, speech recognition and natural language processing). This course includes hands-on laboratories and projects for prototyping and evaluation of user interfaces.

0612-333 Intelligent Systems (3-0-3)
(Co-requisite: 0612-300)

Topics include: history and overview of intelligent systems, overview of technologies, fundamental issues in intelligent systems, intelligent system design methodologies, search and constraint satisfaction, knowledge representation and reasoning, and agents.
0612-341 Database Systems I (Pre-requisite: 0612-207) (3-2-3)

Principles of database systems: History and motivation, DBMS functions, database architectures, use of a database query language, data modeling: conceptual models, object-oriented model, and relational data model. Relational databases: conceptual schema and relational schema, and integrity constraint, relational algebra and relational calculus, functional dependencies and normal forms, database query languages. Relational database design, the course stresses basic concepts and presents many examples from existing database systems, a database design and implementation project of a real world application is required, using modern database management tools.

0612-356 Computer Networks I (Pre-requisites: 0612-207, 0600-304) (3-0-3)

Overview of modern computer communications network architectures and services, Networking devices (repeaters, bridges, switches, routers, and gateways) and basic network topologies (bus, tree, ring, and mesh), protocol layers (the ISO/OSI standard and the TCP/IP protocol stack), protocol specifications (syntax, semantics, timing), switching and multiplexing techniques, the web as an example of client-server computing (web technologies: client-side and server-side programming, characteristics of web servers), application-specific protocols, network programming interfaces (e.g., sockets), transport layer design, principles of reliable data transfer, principles of congestion control, addressing and routing, data link layer and physical layer networking concepts (Ethernet, Token Ring, and Gigabit Ethernet LAN technologies, multiple access protocols, error detection and correction technologies).


Embedded system building blocks, embedded microcontrollers architecture, embedded programs: instruction set, interrupts, timers and programming in assembly language, memory technologies (EPROM, DRAM FLASH etc.), basic I/O devices, embedded microcontroller interfacing to memory and I/O devices such as keypad and LCD. Embedded operating systems, design methodologies of embedded systems.

0612-364 Embedded Systems Laboratory (Co-requisite: 0612-363) (0-3-1)

This lab component provides sufficient detailed knowledge and hands-on experience of a microcontroller so that students can breadboard and program a microcontroller and demonstrate its function in a real-time application. It is accomplished by a sequence of assigned labs, followed by a final project of the student's choice, emphasizing creativity and uniqueness.

0612-368 Computer Organization (Pre-requisites: 0612-363, 0612-364) (3-0-3)

CPU organization of von-Neumann computers, instructing set architecture and instruction encoding, addressing modes, register transfer logic, data path and hardwired/microprogrammed control units design. Computer arithmetic: fast adders,
multipliers, restoring/non-restoring division and floating-point arithmetic. ALU design, bus organization and control, introduction to I/O subsystem: programmed I/O, interrupts and DMA. I/O interface circuits and bus standards such as USB etc.

**0612-395 Computer Systems Engineering**  
(Pre-requisites: 0600-209, 0612-210, 0612-221, 0612-363)  
(3-0-3)

Approaches to the development of systems in computer engineering; the special problems and the issues, concept of a life-cycle, nature of life cycle models, and phases of typical life cycles, quality issues; process and process improvement, issue of teams, team selection, roles in teams, and elements of team work. Selection of support tools, standards and technologies, techniques and approaches associated with the different phases, special problems of design and the issues associated with tradeoffs, special problems of hardware/software tradeoffs; testing, maintenance, project management.

**0612-399 Engineering Training**  
(Pre-requisites: Completion of 90 credit hours and consent of the Department and the Engineering Training Centre)  
(0-10-3)

Students should attend a training program at one of the approved companies/institutions engaged in computer engineering practices. The objective is to gain practical experience in real engineering problems. The student should submit a formal report at the end of the training period. A minimum of 200 hours of supervised training is required.

**0612-402 Introduction to Internet Technologies**  
(Pre-requisite: 0612-356 or 0612-466)  
(3-0-3)

This course will introduce the essential topics of Internet Programming: Interactive WWW pages using Java, HTML, XML, and CGI. Manipulates different forms of data such as hypertext, graphics, video, and sound. Advanced interactive/executable web pages will be developed. Course can include also protocols, client-server model, html forms programming, CGI scripting, Java programming and applications development over the net, Java applets, server-side Java, remote method invocation, and Java beans. Creating executable content on the web will be the main focus of the course. As the Internet evolves, new technologies emerged; the course may introduce these state-of-the-art technologies. The course is project-oriented.

**0612-404 Principles of Compiler Design**  
(Pre-requisite: 0612-207, 0612-363)  
(3-0-3)

Introduction to compilers, lexical analysis, syntax analysis: LL parsing and LR parsing, semantic analysis: type checking and attributed grammars, memory management, error handling. Code generation, code optimization, bootstrapping, students will be exposed to real compiler implementations, this course includes a project developed in a team.

**0612-406 Simulation Systems**  
(Pre-requisite: 0600-304, 0612-363)  
(3-0-3)

Introduction to the concepts, definitions and techniques applicable to the modeling and simulation of systems with emphasis on discrete systems, discrete simulation programming languages and their use in the modeling and simulation of various kinds of systems such as computer systems and computer networks, discrete event simulation,
statistical tests, random number generators, experimental design of simulation experiments, introduction to simulation packages such as NS-2 and OPNET. The course usually involves a project.

**0612-410  Formal Languages and Automata Theory**  
*(Pre-requisite: 0612-300)*  
(3-0-3)

Role of formal languages and automata in the study of computability and complexity, finite state automata and regular expressions, pushdown automata and context-free grammars, parsing techniques, turning machines and computable functions, computational complexity.

**0612-413  Distributed Computing**  
*(Pre-requisites: 0612-300)*  
(3-0-3)

History and overview of distributed systems, fundamentals of distributed systems and algorithms, problems, methodologies, paradigms and models that are necessary for understanding and designing distributed applications, theoretical concepts will be complemented with practical examples.

**0612-424  Value Engineering Applications**  
*(Pre-requisite: 0600-209, 0600-304)*  
(3-0-3)

Value Engineering techniques and methodologies, methods of integrating Value Engineering concepts and methodologies in engineering project management, case studies and examples of using Value Engineering to study alternatives in software engineering and other engineering disciplines, project management to produce systems that are of higher quality and lower cost, students will be working in teams to conduct case studies in their discipline.

**0612-434  Robotics**  
*(Pre-requisite: 0612-363)*  
(3-2-3)

The nature of robotics and the role of intelligence in the context of robotics, overview of robotic systems: state-of-the-art robot systems, planning vs. reactive control, uncertainty in control, sensing, and world models, configuration space, the role of planning in robotics and relevant techniques, robot programming; the range of software that supports robotic activity, navigation and control, strategies for particular environments, ethical issues associated with robotics and intelligent behavior.

**0612-435  Expert Systems**  
*(Pre-requisite: 0612-333, 0600-304)*  
(3-0-3)

Topics include building decision support and expert systems, knowledge representation and knowledge processing, tools for building expert systems logic programming, expert system shells (Clips, Jess, etc.), emphasis on the use of domain-specific knowledge to obtain expert performance in programs.
CpE-436 Machine Learning
(Pre-requisite: 0612-333, 0600-304) (3-0-3)

Concept Learning, decision tree learning, artificial neural networks, Bayesian learning, genetic algorithms, learning sets of rules, analytical learning, combining inductive and analytical learning, and reinforcement learning.

CpE-437 Intelligent Algorithms
(Pre-requisite: 0612-300) (3-0-3)


0612-438 Computer Graphics
(Pre-requisite: 0612-207) (3-0-3)

Graphic systems: Raster graphics systems, features, and output primitives, graphics hardware, graphics Algorithms: drawing and clipping primitives such as lines, circles, rectangles, polygons and arcs, generating characters, representing of curves and surfaces, 3D viewing; simple color models, geometric transformations: primitives transformations, homogeneous coordinates and matrix representation of primitives transformations, composition of primitives transformations, computer animation: conventional and computer-assisted animation, animation languages, basic rules of animation.

0612-441 Database Systems II
(Pre-requisite: 0612-341 or 0612-401) (3-0-3)

Advanced techniques in commercial and research oriented databases systems including catalogs, physical storage techniques, query processing, optimization, transaction management, concurrency control, disaster recovery, security, integrity, extended data types, triggers and rules, distributed databases, warehouses and parallelism.

0612-442 Distributed Database Systems
(Pre-requisite: 0612-341 or 0612-401) (3-0-3)

Distributed database architectures and models, Distributed data storage: data fragmentation, replication, and allocation, distributed query processing, distributed transaction model, concurrency control, homogeneous and heterogeneous solutions, client server, peer-to-peer, mobile databases, distributed view materialization and World Wide Web architectures.

0612-443 Multimedia Systems and Applications
(Pre-requisite: 0612-207) (3-0-3)

Multimedia authoring and data representations, examining image data, video data, and audio data in detail, multimedia data compression methods such as: JPEG still-image compression standards, MPEG video standards, MP3 audio compression techniques, multimedia communication and retrieval, content-based retrieval in digital libraries and interactive multimedia, carry out multimedia projects using software tools.
0612-445 Operating System Principles  (Pre-requisite: 0612-207, 0612-363)  (3-0-3)

History and overview of operating systems, operating system function and design, operating system principles, concurrency, scheduling and dispatch, memory management, virtual memory and paging, device management, file systems and protection, examples of operating systems such as Windows, UNIX and Solaris, students complete several small projects that exercise their understanding of the material presented in class.


Advanced topics in operating systems such as: multithreading, disk management, file management, distributed operating systems, protection and security and current trends in operating systems, source code for an existing multi-process operating system is studied and emphasis is on operating system simulation project.

0612-451 Wireless and Mobile Networking  (Pre-requisite: 0612-356 or 0612-466)  (3-0-3)

Introduction to concepts, principles and practice of wireless and mobile communications and networking, multiples access protocols for wireless networks, mobile Internet protocol, mobile aware adaptation, extending the client-server model to accommodate mobility, the role of middleware and support tools, performance issues, security and legal implications of wireless communications, emerging technologies.

0612-453 Cryptography and Network Security  (Pre-requisite: 0612-356 or 0612-466)  (3-0-3)

Introduction to the theory and practice of using formal methods in computer and communication networks security, fundamentals of secure networks and cryptography, application of number theory to cryptography, encryption and privacy: public key and symmetric key, authentication and integrity methods and protocols, key distribution and management, packet filtering, firewalls, virtual private networks, transport layer security, wireless technologies and security implications.

0612-454 Performance Evaluation of Computer Networks  (Pre-requisites: 0600-304, (0612-356 or 0612-466))  (3-0-3)

Theory and application of analytic methods for evaluating the performance and for capacity planning of computer networks, review of the basic probability theory, advanced methods in probabilistic analysis, random processes, markovian queuing models, network protocols, traffic modeling, event driven simulation.

0612-456 Computer Networks II  (Pre-requisites: 0612-356 or 0612-466)  (3-2-3)

High speed and broadband networks, link layer techniques in high-speed networks, multicast routing, mobility and the network layer, building web applications (protocols at the application layer, web engineering, RPC, support tools, enterprise-wide web-based applications), multimedia networking, network security issues (cryptography,
secret/public-key algorithms, authentication protocols, digital signatures and firewalls), network management (passwords and access control mechanisms, domain names and name service, performance and failure recovery).

0612-458 Network Programming
(Pre-requisites: 0612-356 or 0612-466)

Introduction to the design, architecture and implementation of client and server programs in the client-server model of computing, overview of the TCP/IP suite of protocols and some application specific protocols, the client-server model of computing, interprocess communication and network programming interfaces, server architectures, use of scripting languages in providing client-side and server-side processing in web based applications, security issues.

0612-461 Design of Digital Systems
(Pre-requisites: 0612-262, 0612-264)

Logic minimization, programmable logic devices (PLAs, PLDs, FPGAs), their structure and applications in digital circuit design, finite state machine theory and implementation, advanced concepts in state machines including algorithmic state machines, asynchronous circuit analysis and design procedures are covered through the use of flow-tables, error detection and correcting codes, design considerations such as oscillations, races, and hazards are discussed.

0612-462 Computer Arithmetic
(Pre-requisites: 0612-368)

Review of number systems, algorithms for fixed point addition, multiplication and division, decimal arithmetic, floating-point representation, algorithms for floating point addition, multiplication and division, hardware and software implementation of arithmetic units, advanced topics in computer arithmetic.

0612-463 Real Time Systems
(Pre-requisite: 0612-363, (0612-445 or 0612-405))

Issues in the design and analysis of computer systems for real-time applications, system specifications and architecture, modeling and analysis with time constraints, hardware and software support for guaranteeing timeliness with and without failures, resource management, time-constrained communication and scheduling, real time systems design, real-time kernels and case studies.

0612-464 Testing of Digital Systems
(Pre-requisite: 0612-368)

Test economics, introduction to fault modeling, fault simulation, testability measures, testing of stuck-at faults, Automatic Test Pattern Generation (ATPG) for combinational circuits (D-algorithm, PODEM) and sequential circuits (time frame expansion method, checking experiments), scan-based design and design for test approaches (DFT and BIST).
0612-465 Design Automation of Digital Systems (3-0-3) (Pre-requisites: 0612-207, 0612-262)
Partitioning problems, floor planning problem, placement problems, interconnection of elements, net selection, minimal spanning trees, Steiner trees, layering ordering, pin assignment, routing algorithms.

0612-468 Computer Architecture (3-0-3) (Pre-requisites: 0612-368)
Evolution of computers, performance metrics and Amdahl's Law, trends in computers, pipelined design techniques, data and control hazards, memory system design, cache and virtual memories, Storage and RAID systems, introduction to multiprocessor systems.

0612-469 Computer Architecture Laboratory (0-3-1) (Co-requisite: 0612-468)
Hands-on design and implementation of computer system design, use of CAD tools for schematic capture and Verilog HDL based simulation and synthesis, design and implementation of data path functional units and I/O subsystem of traditional computer systems using sophisticated logic devices such as CPLDs and FPGAs.

0612-471 Fault Tolerant Computing (3-0-3) (Pre-requisites: 0612-368, 0600-304)
Introduction to defects, faults and errors, fault models and reliability modeling, error detection and correction methods, hardware and software redundancy methods and fault diagnosis, self-checking circuits, software reliability modeling and fault tolerance.

0612-472 Logic for Computer Engineers (3-0-3) (Pre-requisites: 0612-203, 0612-363)
Propositional and predicate logics: syntax and semantics, validity and inference, etc., deductive tableaux notation and its rules: resolution, equality, equivalence, and rewriting, axiomatic theories and theories with induction, verification of implementation and specification using deductive tableaux.

0612-474 ASIC Design (3-0-3) (Pre-requisite: 0610-233, 0612-368)
ASIC design flow, design hierarchy, computer aided design (CAD) tools, design modeling using HDL, design verification: formal, simulation and timing analysis, automated synthesis, semi-custom design with programmable logic devices, system-on-chip (SOC) design and intellectual property (IP) cores.

0612-477 Hardware Description Language-Based Design (3-0-3) (Pre-requisites: 0612-207, 0612-368)
Modeling of digital systems at various levels of abstraction with state-of-the-art hardware description languages (HDLs), introduction to modern HDLs, HDL-based design
methodology, HDL-based modeling of digital systems at behavioral-level, structural-level, RTL-level and gate-level, HDL-based synthesis, simulation and verification of digital circuits. This is a project-oriented course.

0612-491 Undergraduate Research (3-0-3)
(Pre-requisites: Completion of 100 credit hours and consent of the department)

This course is designed for senior level students in computer engineering. The course allows the student to study a new area not included in any of the regular courses and to undertake an engineering project that will allow him/her to apply the knowledge and skills that he/she have learned in previous courses. It must be based on a prearranged work proposal and must be approved by the faculty member who will supervise the study.

0612-493 Special Topics in Computer Engineering (3-0-3)
(Pre-requisites: 0612-300)

This course is designed for senior level students in computer engineering. It gives them exposure to special topics in computer engineering. Topics may vary each time the course is offered. Details of the course including: prerequisites, textbook, objectives, and topics to be covered, course specific outcomes etc. should be posted on the course page of the department at the time of offering.

0612-495 Capstone Design (3-6-3)
(Pre-requisites: 0612-395, 0612-368, 0612-356)

This course contributes a capstone design experience in Computer Engineering. Typically it would require the student to build on the aggregated knowledge gained in previous years. Students will have design experience involving hardware and/or software systems to meet the desired needs within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability. Students will acquire skills in design tools and practices, functional teaming, oral and written technical communication.

0612-499 Advanced Topics in Computer Applications (3-0-3)
(Pre-requisites: 0612-207, 0612-363)

This course is designed for senior level students in computer engineering. It gives them exposure to new and advanced topics in the application of hardware or software systems. Topics may vary each time the course is offered. Details of the course including: prerequisites, textbook, objectives, topics to be covered, etc. should be posted on the course page of the department at the time of offering.
DEPARTMENT
OF
CIVIL ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING

Civil Engineering is one of the oldest engineering professions. It is committed to the control and improvement of our environment, and to the planning, design and construction of systems and physical facilities such as: buildings, bridges, roads, airports, transportation systems, offshore and coastal structures, flood and pollution control systems for rivers, estuaries and lakes, inland navigation systems, dams, water resources projects, urban development projects, water supply and drainage systems and waste management, environmental control systems and coastal engineering.

The general character of the Civil Engineering curriculum is oriented both towards providing the student with fundamental training in Civil Engineering disciplines and towards enabling him/her to acquire the capabilities needed to adapt to the rapidly changing technological and scientific requirements of Kuwait and the region. In order to achieve the overall objectives of this curriculum, the Department has established extensive instructional and research laboratories. Through various combinations of electives, the student is able to go into more depth in one of the sub-disciplines of Civil Engineering, or develop his/her interest more generally. The sub-disciplines presently offered are:

- Structural Engineering
- Construction Management and Engineering
- Geotechnical Engineering
- Transportation Engineering
- Coastal Engineering
- Water Resources and Environmental Engineering

The philosophy of the program reflects the interdisciplinary nature of civil engineering and embodies flexibility and choice variation to suit a multitude of needs. The department emphasizes the need for continuing professional education by offering a wide spectrum of training courses covering practical and technical aspects of civil engineering.

Mission

The mission of the CE program is to serve the people of the State of Kuwait by providing a broad and high-quality education to its students for a successful professional career, to conduct strong basic and applied research for national needs, and to serve the industry, Civil Engineering profession, and community at large through innovative solutions, dissemination of knowledge, and advancement of Civil Engineering in major areas of the profession.

Vision

The vision of the CE program is to establish an outstanding program of regional and international reputation for providing a quality engineering education, excellent research and services to the profession and the community; to produce top-quality civil engineers; and to employ principles of continual quality improvement to enhance its program.
Program Education Objectives

The graduates of the CE program will,

- Engage in professional careers in a broad range of civil engineering areas in public and private sectors in Kuwait, or successfully pursue advanced studies and careers in academia or in other research environments;
- Advance in responsibility and leadership in their careers and engage in continuous professional development to respond to rapidly evolving technological and social challenges; and
- Contribute to the welfare of the society and the development of the profession through responsible practice of engineering and involvement in professional organizations.

Student Outcomes

- Ability to apply knowledge of mathematics, basic sciences and engineering in modeling and analyzing engineering systems.
- Ability to design and conduct experiments, and to analyze and interpret data.
- Ability to design a system, component, or process to meet desired needs within realistic constraints in recognized major civil engineering areas.
- Ability to function as members or managers on multidisciplinary teams.
- Ability to identify, formulate and solve engineering problems.
- Understanding of professional and ethical responsibility.
- Ability to communicate effectively.
- Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
- Recognition of the need for, and an ability to engage in life-long learning.
- Awareness of emerging technologies in local and global context, and involvement in discussions of contemporary issues related to society.
- Ability to utilize state-of-the-art hardware and software tools for problem solving and design that are necessary for engineering practice.
- Proficiency in design at the entry level and recognition of professional practice issues in recognized major areas of civil engineering.

CURRICULUM

Each student majoring in Civil Engineering must satisfactorily complete a minimum of 144 credits distributed as follows:

I. GENERAL EDUCATION COURSES (21 Credits)

A. Compulsory (12 Credits)

0330-100 Modern and Contemporary History of Kuwait 3
0330-102 Arab and Islamic Civilization (or equivalent) 3
9988-123 Intermediate Writing Skills 3
9988-221 Technical Writing 3

B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

II. MATHEMATICS AND BASIC SCIENCE COURSES (27 Credits)

0410-101 Calculus I 3
0410-102 Calculus II 3
0410-111 Linear Algebra 3
0410-211 Calculus III 3
0410-240 Ordinary Differential Equations 3
0420-101 General Chemistry I 3
0420-105 General Chemistry I Laboratory 1
0430-101 General Physics I 3
0430-105 General Physics I Laboratory 1
0430-102 General Physics II 3
0430-107 General Physics II Laboratory 1

III. COLLEGE OF ENGINEERING REQUIREMENTS (21 Credits)

0600-099 Introduction to Engineering Programs 0
0600-104 Engineering Graphics 2
0600-200 Computer Programming for Engineering 3
0600-205 Electrical Engineering Fundamentals I 3
0600-207 Electrical Engineering Fundamentals I Laboratory 1
0600-208 Engineering Thermodynamics I 3
0600-209 Engineering Economy 3
0600-304 Probability and Statistics for Engineering 3
0600-308 Numerical Methods for Engineering 3

IV. MAJOR REQUIREMENTS (75 Credits)

A. Compulsory Courses (63 Credits)

0460-101 Physical Geology 3
0600-202 Statics 3
0600-203 Dynamics 3
0600-204 Strength of Materials 3
0620-201 Introduction to Design 3
0620-236 Construction Surveying 2
0620-252 Engineering Materials 3
0620-271 Structural Analysis I 3
0620-310 Fluid Mechanics 3
0620-311 Water Resources 4
0620-312 Environmental Engineering 3
B. Elective Courses (12 Credits)

Students must complete four courses (12 credits) of elective course work, including at least 3 credits from the list of restricted electives. However, 3 credits may be substituted, with the approval of the department, by a suitable selection from science or other engineering offerings at 200 level or higher.

1. Restricted Electives

The List of Restricted Elective Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0620-403</td>
<td>Coastal Processes and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>0620-411</td>
<td>Water and Wastewater Treatment</td>
<td>3</td>
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<tr>
<td>0620-412</td>
<td>Open Channel Hydraulics</td>
<td>3</td>
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<tr>
<td>0620-414</td>
<td>Hydraulic Engineering</td>
<td>3</td>
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<tr>
<td>0620-434</td>
<td>Construction Estimation and Cost Control</td>
<td>3</td>
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<tr>
<td>0620-452</td>
<td>Earth and Earth Retaining Structures</td>
<td>3</td>
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<tr>
<td>0620-461</td>
<td>Traffic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0620-463</td>
<td>Highway Materials and Construction</td>
<td>3</td>
</tr>
<tr>
<td>0620-476</td>
<td>Computer Applications in Structural Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Free Electives

The List of Free Elective Courses offered by the Civil Engineering Department

a. General Elective Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0620-395</td>
<td>Engineering Training</td>
<td>3</td>
</tr>
<tr>
<td>0620-404</td>
<td>Advanced Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>0620-409</td>
<td>Mechanisms of Sand Movement and Desertification</td>
<td>3</td>
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<tr>
<td></td>
<td>Management</td>
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</tbody>
</table>

b. Coastal Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0620-401</td>
<td>Coastal Engineering Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

b. Construction Engineering and Management

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0620-436</td>
<td>Construction Work Improvement</td>
<td>3</td>
</tr>
<tr>
<td>0620-437</td>
<td>Concrete Construction and Technology</td>
<td>3</td>
</tr>
</tbody>
</table>
0620-449  Civil Engineering Systems  3  

d. Geotechnical Engineering  
0620-455  Computer Applications in Geotechnical Engineering  3  
e. Structural Engineering  
0620-471  Steel Design I  3  
0620-474  Steel Design II  3  
0620-475  Pre-stressed Concrete  3  
0620-478  Reinforced Masonry  3  
0620-481  Advanced Topics in Reinforced Concrete Design  3  
f. Transportation Engineering  
0620-462  Traffic Control Systems  3  
0620-464  Urban Transportation Planning  3  
0620-465  Pavement Design  3  
g. Water Resources and Environmental Engineering  
0620-413  Groundwater Hydraulics  3  
0620-419  Environmental Pollution Control  3  
0620-425  Computer Applications in Water Resources and Environmental Engineering  3  
0620-429  Groundwater Contamination  3  
0620-498  Building Systems for Environmental Control  3
CIVIL ENGINEERING COURSES

0620-201 Introduction to Design (2-3-3)
(Pre-requisites: 0600-202; Co-requisites: 0620-252)

Engineering approach to design process: conceptual, preliminary, intermediate, and final, design methodology in problem recognition and identification, design requirements and constraints, design alternatives, final design and design documentation, importance of environmental factors, team-work effort and ethics in engineering design projects, use of creative problem solving technique and software in documentation and oral presentation of design, practical examples and case studies in different civil engineering disciplines.

0620-236 Construction Surveying (1-3-2)
(Pre-requisites: 0600-104)

This is an intensive field work course, the main objective of this course is the understanding of basic surveying for construction, different methods of measurements are provided along with the use of different instrumentation and computing techniques.

0620-252 Engineering Materials (2-3-3)
(Pre-requisites: 0600-204)

This course aims at providing students in-depth knowledge of construction materials and their utilization in Civil Engineering fields. The course covers manufacturing process of cements; types and properties of cements; properties of aggregates and their gradation; preparation of concrete materials; factors affecting workability, tensile, compressive and flexure strengths of concrete; durability of concrete; and mix design of concrete. Students will have experience with manufacturing bituminous binders; properties of bituminous binders and mixtures; design and uses of bituminous mixtures; manufacturing process of steel, various steel composition and structure of steel, heat treatment of steel, and alloy steels.

0620-271 Structural Analysis (3-0-3)
(Pre-requisites: 0600-204)

Analysis and deformation of determinate trusses, beams and frames, analysis of statically indeterminate structures by the consistent deformation method, influence lines for statically determinate structures, criteria for maximum effects due to moving loads and force envelopes.

0620-310 Fluid Mechanics (3-0-3)
(Pre-requisites: 0410-211, 0410-240, 0600-203)

Fluid statics, conservation laws, Bernoulli's equation, dimensional analysis, pipe flow, pipe networks, flow measurement.
0620-311 Water Resources (3-3-4)
(Pre-requisites: 0460-101, 0620-310; Co-requisites: 9988-221)

Basic principles of open channel hydraulics, energy and momentum concepts, uniform, gradually varied, and rapidly varied flows, surface hydrology, analysis of precipitation, infiltration, evapotranspiration, rainfall-runoff relations, hydrographs, hydrologic flood routing, basic principles of flow in porous media, groundwater occurrence and distribution, hydraulics of wells, estimates of recharge and surcharge, various laboratory experiments are performed to illustrate the basic principles of hydraulics and water resources.

0620-312 Environmental Engineering (2-3-3)
(Pre-requisites: 0420-101, 0620-310)

Characteristics of water, air and their contaminants, environmental equilibrium chemistry, environmental chemical kinetics, transport processes and reactor models, water quality issues in the natural environment, water supply and pollution control systems, treatment processes, physical process, chemical process, biological process, air quality, solid wastes and residues.

0620-350 Soil Mechanics (3-3-4)
(Pre-requisites: 0460-101, 0600-204)

Basic characteristics of soils, soil compaction, permeability and seepage, effective stress principle, stresses in a soil mass, consolidation theory and settlement, shear strength of soils, introduction to geosynthetics, various laboratory experiments are performed to illustrate the basic principles of soil mechanics.

0620-366 Transportation Engineering (3-3-4)
(Pre-requisites: 0600-304, 0620-236)

This course is designed to present to undergraduate students the principles and tools of the broad area of transportation engineering and systems. This includes traffic and highway engineering with laboratory work involved once a week. Seaports and airport operations are reasonably covered throughout the semester. Mathematical models and concepts for the study of transportation systems are presented. Some basic concepts of transport economics and optimization are introduced in this course.

0620-371 Structural Analysis (3-0-3)
(Pre-requisites: 0600-308, 0620-271)

Analysis of indeterminate structures by: identification of structural problems and their degrees of static indeterminacy, consistent deformations method by flexibility matrices, slope-deflection method, moment distribution method, stiffness matrix method derived from slope deflections, stiffness matrix method using direct approach (unit displacement), and coordinate transformation and assembling technique using element approach with applications.
0620-373 Reinforced Concrete I  
(Pre-requisites: 0620-252, 0620-271)  
(3-0-3)

This course introduces students to the fundamental principles of design of reinforced concrete structural elements. This course discusses properties of concrete as a structural material, behavior of reinforced concrete structural elements such as columns, beams, and one way slab, the course covers design specifications required for elements experiencing compression, shear and flexure behavior, and serviceability requirements, the course includes design of reinforcements in concrete for bonds and development lengths for various conditions, the design specifications are according to the building code of practice of American Concrete Institute (ACI).

0620-395 Engineering Training  
(0-10-3; 200 hours of training)  
(Pre-requisites: Completion of 90 Credit hours & Consent of Engineering Training Center)

Students will attend a training program at one of the approved institutions engaged in civil engineering practice, the objective is to gain practical experience in real engineering applications, the student should submit a formal report related to the program attended at the end of the training period, a minimum of 200 hours of supervised training is required for the course.

0620-401 Coastal Engineering Fundamentals  
(Co-requisites: 0620-310)  
(3-0-3)

Introduction to coastal engineering, linear wave theory, dispersion, kinematic & dynamic properties of waves, shoaling, refraction, diffraction, wave run-up, overtopping and reflection, wind waves and statistics, wave forecasting, astronomical tides, wave pressure, wave forces on circular piles and seawalls.

0620-403 Coastal Processes and Modeling  
(Pre-requisites: 0620-401)  
(3-0-3)

Applications of basic wave theory and numerical models to coastal problems, short- and long-term wave analyses, wave-induced processes: mass transport, sediment motion, longshore currents and sediment transport, wave setup and set-down, wave run-up and overtopping, and wave scour, response of sheltered bays, marinas, and harbors to wave agitation, coastal structures: types, functionality, limitations, design factors, breakwater design principles and groin systems, modeling and scaling laws in coastal engineering, applications/predictions based on computer software systems.

0620-404 Advanced Strength of Material  
(Pre-requisites: 0600-204 and Completion of 90 Credit hours)  
(3-0-3)

Theories of stress and strain, stress-strain-temperature relationships, plane theory of elasticity, failure theories, torsion, unsymmetric bending, shear center, elastic theory of thin plates, beams on elastic foundations, thick-walled cylinders and spinning disks.
0620-409 Mechanisms of Sand Movement and Desertification Management  (3-0-3)  
(Pre-requisites: 0600-200, 0620-311)  

0620-411 Water and Wastewater Treatment  (2-3-3)  
(Pre-requisites: 0420-101, 0620-311)  
Water quality and standards, water pollution control and water quality models, design of physical, chemical and biological processes for water and wastewater treatment, disposal methods and processing of biosolid, water reuse, experimental work to cover basic concepts in water and wastewater analysis.

0620-412 Open Channel Hydraulics  (3-0-3)  
(Pre-requisites: 0620-311)  
Principles of hydraulics of open channels including energy and momentum approaches, concepts of critical flow, surface roughness and velocity distribution, theory and application of uniform, gradually varied, and rapidly varied flows, Elements of unsteady open channel flow.

0620-413 Groundwater Hydraulics  (3-0-3)  
(Pre-requisites: 0620-311)  
Mechanics of flow through porous media, Darcy's law, Potential flow theory, Steady and Unsteady flow to wells, boundary effects and the method of images, leaky aquifer theory, partial penetration theory, practical aspects of well design, drilling and testing, numerical methods, analytical solutions, case studies.

0620-414 Hydraulic Engineering  (3-0-3)  
(Pre-requisites: 0620-311)  
Elements of hydraulic structures design such as spillways, transitions, culverts, irrigation, drainage and flood control works.

0620-419 Environmental Pollution Control  (3-0-3)  
(Pre-requisites: 0620-311)  
An environmental engineering course that emphasizes student’s ability to integrate knowledge gained in basic sciences, fluid mechanics, and water resources to control various types of environmental pollution and conserve resources, evaluation and analysis of environmental quality factors, population and resource use, air pollution, water pollution, solid waste management, thermal pollution, noise pollution, radiation, energy and the environment, and environmental impact of development projects.
0620-425 Computer Applications in Water Resources and Environmental Engineering (Pre-requisites: 0620-311) (3-0-3)

Use of computers in the analysis of water resources and environmental engineering problems, computation of uniform and non-uniform flows in open channels, culvert design and hydraulics, storm sewer systems modeling and design.

0620-429 Groundwater Contamination (Pre-requisites: 0620-311) (3-0-3)

An introduction to groundwater and well hydraulics with emphasis on flow equations and modeling, sources, types, transport, modeling, and remediation of groundwater contaminants.

0620-430 Legal, Professional, and Social Aspects of Engineering (Pre-requisites: Completion of 90 Credit hours) (3-0-3)

Building and construction contract procedures, general conditions of contract and contract documents, bond and insurance requirements, preparation of technical specifications. The development of the concepts of professionalism and ethics and the traditional practice of these concepts are considered in relation to changing situations in practice in a variety of employment conditions, case histories are discussed.

0620-434 Construction Estimation and Cost Control (Pre-requisites: 0600-104, 0600-209, Completion of 90 Credit hours) (3-0-3)

Fundamental definition and concepts of estimation, conceptual estimation, preliminary estimation, detailed estimation, building systems, measurements, pricing, computer tools and applications, bidding extensions of estimation to cash flow analysis.

0620-435 Construction Engineering and Management (Pre-requisites: 0620-373 ) (3-3-4)

Construction project initiation, budgeting, planning, scheduling, and control for construction operations using Critical Path Method (CPM). Concepts of networking techniques including activity-on-node (precedence) and activity-on-arrow, network computations, resource allocation and leveling, and time/cost tradeoffs, project control concepts and techniques are also taught. The course is supplemented with a 3-hour weekly session for various computer applications in construction engineering and management and for site visits to major projects.

0620-436 Construction Work Improvement (Pre-requisites: 0620-435) (3-0-3)

An overview of the construction industry characteristics, construction organizations, and productivity improvement methods, introduction of data gathering techniques including questionnaires, interviews, surveys, work sampling and five minutes rating, techniques for presenting and implementing productivity improvement findings such as crew balance.
charts, process charts, and flow diagrams. It also covers safety and environmental health aspects on the construction sites.

0620-437 Concrete Construction and Technology (3-0-3)
(Pre-requisites: 0620-435)

Employment of major construction equipment and estimation of their production, comprehensive introduction to concrete construction methods, and types of mixers, ready mix concrete, pumping equipment, shotcreting, precast and cast in place concrete and prestressed concrete construction, hot weather concreting, formwork design for walls, columns and slabs, types of cements and admixtures, method of curing, concrete strength, batching equipment, and gunite, employment of construction equipment and productivity of equipment including excavators, pile drivers, dumping trucks, and other types of heavy equipment.

0620-449 Civil Engineering Systems (3-0-3)
(Pre-requisites: 0600-209, 0600-304, 0600-308)

Functional design of civil engineering systems, optimization of resources, linear programming, applied probability theory, economic analysis, cost benefit studies and applications, systems engineering techniques, value management.

0620-451 Foundation Engineering (3-0-3)
(Pre-requisites: 0620-350)

Soil exploration, sampling and field measurements, types of foundations and criteria for selection, shallow foundations: ultimate bearing capacity, settlements, allowable soil pressure, mat foundations, deep foundations, earth pressure theories and retaining walls.

0620-452 Earth and Earth Retaining Structures (3-0-3)
(Pre-requisites: 0620-350)

An introduction to design and construction of earth and earth retaining structures, engineering applications include: retaining walls, flexible earth support, slope stability, dewatering techniques, soil improvement, and earth dams and embankments.

0620-455 Computer Applications in Geotechnical Engineering (3-0-3)
(Pre-requisites: 0620-451)

Use of computer in the analysis of geotechnical problems: stress distribution in soil masses, settlement analysis, seepage flow, earth pressure, shoring (retaining walls, sheet piles, strutted excavations), slope stability, foundation analysis, and embankment and excavation problems. Geotechnical engineering modeling is reviewed. For each application the necessary theoretical background is reviewed and discrete modeling is discussed.
0620-461 Traffic Engineering (3-0-3)
(Pre-requisites: 0620-366)

Introduction to traffic engineering. Traffic Flow theory and variables: volume, speed, density, headway and spacing, traffic studies: speed, travel time and delay, volume, parking, pedestrians, accidents, and environmental impacts, traffic simulation models: Poisson and queueing, intersection capacity analysis, traffic signal design, geometric design of intersections, traffic control devices and regulations, traffic system management.

0620-462 Traffic Control Systems (3-0-3)
(Pre-requisites: 0600-200, 0620-366)

Introduction to existing and new traffic control systems strategies including both off-line signal optimization techniques and real-time computer traffic-responsive control concepts, control concepts and methods for signal intersection, arterial systems and area traffic networks, traffic control system evaluation techniques using measures of effectiveness (MOE’s) for signal intersections, arterials and networks.

0620-463 Highway Materials and Construction (3-0-3)
(Pre-requisites: 0620-252, 0620-366)

Application of soil classification methods to evaluate subgrade materials, introduction to various tests used to characterize pavement materials, stabilization techniques of subgrade and subbase materials, introduction to material variability and quality control, pavement evaluation and rehabilitation, pavement construction.

0620-464 Urban Transportation Planning (3-0-3)
(Pre-requisites: 0600-304, 0620-366)

Principles and practices of urban transportation planning process, examination of the characteristics of urban travel, the application of systems approach to transport planning, survey design and data management, and calibrations of urban transport demand and supply models and alternative plan evaluation and the impact of transport systems on the environment.

0620-465 Pavement Design (3-0-3)
(Pre-requisites: 0620-252, 0620-366)

A comprehensive coverage of flexible and rigid pavement design, including mix and structural designs, analyses of the effects of traffic, environment, soil support, and stiffness of paving materials on the structural design of pavements, design of drainage systems, pavement performance and condition surveys.

0620-471 Steel Design I (3-0-3)
(Pre-requisites: 0620-271)

This course introduces students to the fundamental principles of design of structural elements fabricated with structural steels. This course covers design process and procedures of structural elements experiencing tension, compression, shear and flexure;
beam and column joints; and bolted and welded connections. The design specifications are based on LRFD method of AISC.

0620-473 Reinforced Concrete II  
(Pre-requisites: 0620-371, 0620-373)  
(3-0-3)

This is a senior level reinforced design course. The course covers design procedures and behaviors of various types of two-way slabs, columns, and footings. The design specifications are according to the building code of practice of American Concrete Institute (ACI).

0620-474 Steel Design II  
(Pre-requisites: 0620-471)  
(3-0-3)

Built-up sections, design of plate girders, composite (steel and concrete) design, building connections, design of multi-story buildings, design of simply supported bridges.

0620-475 Pre-stressed Concrete  
(Co-requisites: 0620-473)  
(3-0-3)

Introduction to pre-stressed concrete, pre-stressing systems, materials, analysis and design of sections for flexure, shear and torsion, partial losses of pre-stress force, composite beams, continuous beams, camber and downward deflections.

0620-476 Computer Applications in Structural Engineering  
(Co-requisites: 0620-473)  
(3-0-3)

This course aims at providing students in-depth knowledge of computer aided analysis (CAA) and design (CAD) of reinforced concrete and structural steel structures. The course reviews theoretical background of the analysis and design systems available in CAA and CAD. CAA and CAD include analysis and design of concrete beams, columns, and slabs; and steel beams, columns, and frames. The course requires a design project of simple structural system using CAA and CAD. The design specifications are based on LRFD method of AISC for steel structures, and ACI for reinforced concrete structures.

0620-478 Reinforced Masonry  
(Pre-requisites: 0620-373)  
(3-0-3)

Materials, mechanical behavior and specifications, flexural behavior and design, design for shear and normal forces, walls and columns, lateral load resisting elements, connections and joints, design of a typical structure.

0620-481 Advanced Topics in Reinforced Concrete Design  
(Pre-requisites: 0620-473)  
(3-0-3)

Design and analysis of advanced reinforced concrete elements: Analysis and design of slab using strip method and yield line theory, slenderness effects in long columns, design of combined footings, strap footing, pile foundations, retaining walls, water tank, mat foundation, and design of torsion effects in beams.
0620-490  Engineering Design (Capstone Design)  (1-6-3)
(Pre-requisites: Completion of 130 credits, )

A major civil engineering design experience that emphasizes development of student creativity, development and use of design methodologies, evaluation of alternative solutions, feasibility considerations and detailed system description. Each section will emphasize a specific area but will be exposed to other disciplines with the aim of achieving an integrated design of a real project.

0620-498  Building Systems for Environmental Control  (3-0-3)
(Pre-requisites: 0620-200 or 0630-421 and Completion of 75 Credit hours)

Relationship between climate, man, and architecture, occupant’s thermal and visual comfort assessment and building energy conservation analysis and strategies, techniques to evaluate the energy performance of buildings and ways to enhance their energy performance.
DEPARTMENT
OF
MECHANICAL ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

Mission

The mission of the Department is to provide a quality and broad engineering education, to conduct strong basic and applied research, and to serve the industry, the profession and the community at large through innovative solutions, dissemination of knowledge, and advancement of science and technology.

Vision

The vision of the Department is to gain regional and international recognition for providing a quality engineering education, outstanding research programs and exceptional community service. In addition, it is envisioned that the graduates of the Program will be successful in their professional careers and/or graduate studies, prepared for professional creativity and leadership, and lead productive lives that contribute to improvement of society.

The Mechanical Engineering Department is committed to providing a healthy academic environment by attracting high quality students, faculty and staff. The curriculum is thoroughly based on mathematics, science, engineering science and design to fully-prepare students for their careers.

Program Educational Objectives

Program educational objectives are broad statements that describe what graduates are expected to attain within a few years after graduation.

The graduates of the ME program will:

- engage in productive careers in a broad range of mechanical engineering areas in public and private sectors in Kuwait, or successfully pursue advanced studies and careers in academia or in other research environments
- advance in responsibility and leadership in their careers, and engage in continuous professional development to respond to rapidly evolving technological and social challenges
- contribute to the welfare of society and the development of the profession through responsible practice of engineering and involvement in professional organizations.

Mechanical Engineering is a broad discipline that embraces such diverse activities as the science and art of generation, conversion, transmission and utilization of thermal and mechanical energy. It also includes the design and production of tools and machines and their products, the consideration of the fundamental characteristics of materials as applied to design, and the synthesis and analysis of mechanical, thermal and fluidic systems, as well as their individual components, including feedback and control.
A mechanical engineer contributes to contemporary technology in every industry and in every phase of research, design, development and production. Because the training of a mechanical engineer (ME) is rather broad, mechanical engineers are in demand in practically every type of manufacturing, research and governmental organizations. An ME may be employed in the electrical, chemical, petroleum, metal processing, paper, plastics or any other of a host of industries which require his / her services in connection with specially engineered production equipment, for plant engineering, or for administrative responsibilities.

The curriculum of the Mechanical Engineering Program is designed to serve the needs of Kuwait and its surrounding area. It is a balanced combination of the theoretical and practical aspects of Mechanical Engineering with enough flexibility to allow for interaction between the ever-developing sciences and technologies and with the changing needs of the region. The program ensures a general background in Mechanical Engineering and the student may, through the choice of elective courses, follow a line of specialization in one of three areas: Thermo-Fluid Engineering, Mechanical Design, Engineering Materials and Manufacturing.

**Student Outcomes**

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. The Student Outcomes of the Mechanical Engineering Program are the following:

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

**CURRICULUM**

Each student majoring in Mechanical Engineering must satisfactorily complete a minimum of 144 credits distributed as follows.
## I. General Education Courses (21 Credits)

### C. Compulsory (12 Credits)

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<td>Modern and Contemporary History of Kuwait</td>
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<tr>
<td>0330-102</td>
<td>Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

### D. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

## II. Mathematics and Basic Science Courses (27 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>0410-102</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>0410-111</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>0410-211</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>0410-240</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>0420-101</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>0420-105</td>
<td>General Chemistry I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0430-101</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>0430-105</td>
<td>General Physics I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0430-102</td>
<td>General Physics II</td>
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</tr>
<tr>
<td>0430-107</td>
<td>General Physics II Laboratory</td>
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</tr>
</tbody>
</table>

## III. College of Engineering Requirements (21 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering Programs</td>
<td>0</td>
</tr>
<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>0600-200</td>
<td>Computer Programming for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals I</td>
<td>3</td>
</tr>
<tr>
<td>0600-207</td>
<td>Electrical Engineering Fundamentals I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>0600-208</td>
<td>Engineering Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>0600-209</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>0600-304</td>
<td>Probability and Statistics for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0600-308</td>
<td>Numerical Methods for Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

## IV. Major Requirements (75 Credits)

### A. Compulsory Courses (60 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-102</td>
<td>Workshop</td>
<td>1</td>
</tr>
<tr>
<td>0600-202</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>0600-203</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-204</td>
<td>Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>0630-241</td>
<td>Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>0630-259</td>
<td>Introduction to Design</td>
<td>3</td>
</tr>
<tr>
<td>0630-311</td>
<td>Theory of Machines</td>
<td>3</td>
</tr>
</tbody>
</table>
### B. Elective Courses (15 Credits)

Students choose 15 credits from the following list of current Departmental electives. However, a maximum of 3 credits may be substituted, with the approval of the Department, by a suitable selection from Science or Engineering offerings of the 200 level or higher.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0630-319</td>
<td>Mechatronics</td>
<td>3</td>
</tr>
<tr>
<td>0630-325</td>
<td>Environmental Challenges in Managing Ozone Depleting Substances</td>
<td>3</td>
</tr>
<tr>
<td>0630-361</td>
<td>Project Planning and Management</td>
<td>3</td>
</tr>
<tr>
<td>0630-341</td>
<td>Materials Science and Metallurgy II</td>
<td>3</td>
</tr>
<tr>
<td>0630-395</td>
<td>Industrial Training</td>
<td>3</td>
</tr>
<tr>
<td>0630-403</td>
<td>Intermediate Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>0630-416</td>
<td>Noise and Vibration Control</td>
<td>3</td>
</tr>
<tr>
<td>0630-419</td>
<td>Special Topics in Mechanical Design</td>
<td>3</td>
</tr>
<tr>
<td>0630-420</td>
<td>Energy Conversion and Utilization</td>
<td>3</td>
</tr>
<tr>
<td>0630-422</td>
<td>Internal Combustion Engines</td>
<td>3</td>
</tr>
<tr>
<td>0630-423</td>
<td>Computational Fluid Mechanics &amp; Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>0630-425</td>
<td>Industrial Refrigeration</td>
<td>3</td>
</tr>
<tr>
<td>0630-426</td>
<td>Energy Conservation in Buildings</td>
<td>3</td>
</tr>
<tr>
<td>0630-427</td>
<td>Solar Energy</td>
<td>3</td>
</tr>
<tr>
<td>0630-428</td>
<td>Power Plant Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0630-429</td>
<td>Mechanical Aspects of Desalination Processes</td>
<td>3</td>
</tr>
<tr>
<td>0630-431</td>
<td>Fluid Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>0630-432</td>
<td>Combustion Measurements</td>
<td>3</td>
</tr>
<tr>
<td>0630-433</td>
<td>Combustion</td>
<td>3</td>
</tr>
<tr>
<td>0630-434</td>
<td>Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>0630-437</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>0630-438</td>
<td>Jet and Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>0630-440</td>
<td>Modeling in Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>0630-445</td>
<td>Mechanical Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>0630-446</td>
<td>Introduction to Composites</td>
<td>3</td>
</tr>
<tr>
<td>0630-447</td>
<td>Corrosion Control of Engineering Materials</td>
<td>3</td>
</tr>
<tr>
<td>0630-448</td>
<td>Advanced Strength of Materials</td>
<td>3</td>
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<tr>
<td>0630-449</td>
<td>Non-Destructive Testing</td>
<td>3</td>
</tr>
<tr>
<td>0630-450</td>
<td>Introduction to Robotics</td>
<td>3</td>
</tr>
<tr>
<td>0630-456</td>
<td>Computer-Aided Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>0630-458</td>
<td>Control Design for Mechanical Systems</td>
<td>3</td>
</tr>
<tr>
<td>0630-460</td>
<td>Experimental Stress Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0630-461</td>
<td>Planned Maintenance</td>
<td>3</td>
</tr>
<tr>
<td>0630-463</td>
<td>Artificial Intelligence in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0630-464</td>
<td>Machinery Condition Monitoring</td>
<td>3</td>
</tr>
<tr>
<td>0630-465</td>
<td>Introduction to Simulation</td>
<td>3</td>
</tr>
<tr>
<td>0630-466</td>
<td>Failure Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0630-467</td>
<td>Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>0630-468</td>
<td>Printing Technology</td>
<td>3</td>
</tr>
<tr>
<td>0630-479</td>
<td>Special Topics in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0630-481</td>
<td>Tribology and Lubrication</td>
<td>3</td>
</tr>
<tr>
<td>0630-482</td>
<td>Thermal System Design</td>
<td>3</td>
</tr>
<tr>
<td>0630-483</td>
<td>Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>0630-484</td>
<td>Industrial Safety and Loss Prevention</td>
<td>3</td>
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<tr>
<td>0630-485</td>
<td>Nuclear Power Systems</td>
<td>3</td>
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<tr>
<td>0630-486</td>
<td>Heat Exchanger Design</td>
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<tr>
<td>0630-487</td>
<td>Industrial Ventilation</td>
<td>3</td>
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<tr>
<td>0630-488</td>
<td>Thermal Systems Design</td>
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<tr>
<td>0630-489</td>
<td>Special Topics in Thermo-Fluid Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0630-495</td>
<td>Senior Project</td>
<td>3</td>
</tr>
</tbody>
</table>
MECHANICAL ENGINEERING COURSES

0630-241  Materials Science and Metallurgy  (3-0-3)
(Pre-requisites: 0420-101, 0420-105)

Material applications throughout civilizations, materials science and engineering, classification of materials, modern material needs, relation between structure, properties and performance, atomic structure and interatomic bonding, the structure of crystalline solids, imperfections in solids, diffusion in solids, mechanical properties of engineering materials, deformation and strengthening mechanisms, mechanical failure of materials, phase diagrams, phase transformations, heat treatment processes, materials selection.

0630-259  Introduction to Design  (2-3-3)
(Pre-requisites: 0600-102, 0600-202; Co-requisites: 0600-204)

The design process in the broad context of engineering enterprise, conceptual design including visualization, problem definition, information search, and project planning, intermediate design including modeling and simple analysis, decision making concepts, design documentation, teamwork and communication, use of computer tools in engineering design, case studies and examples from industry, engineering ethics.

0630-311  Theory of Machines  (3-0-3)
(Pre-requisites: 0600-203)

Graphical, analytical and computer aided analysis and synthesis of basic mechanism, cam design, analysis and design of gears, gear trains.

0630-318  System Dynamics  (3-0-3)
(Pre-requisites: 0410-240, 0600-203, 0600-205)
[Formerly, 0630-317]

Mathematical modeling and analysis of dynamic systems with mechanical, electrical and fluid elements, linearization techniques, transient and steady-state response, introduction to design and synthesis, frequency response.

0630-319  Mechatronics  (2-3-3)
(Pre-requisites: 0630-318 or 0630-317)

Integrated use of mechanical, electrical and computer systems for information processing and control of machines and devices, system modeling, electromechanics, sensors and actuators, signal processing and conditioning.

0630-322  Engineering Thermodynamics II  (3-0-3)
(Pre-requisites: 0600-208)

Second Law analysis of engineering systems, gas power cycles, Vapor and Combined power cycles, Refrigeration cycles, thermodynamic property relations, gas mixtures, gas vapor mixtures and air conditioning, chemical reactions.
0630-325 Environmental Challenges in Managing Ozone Depleting Substances (Pre-requisites: 0600-208)

Introductions to environmental issues related to engineering, review of selected multilateral agreements and, in particular, review of the Montreal protocol with emphasis on compliance strategies and discussion of current status of Ozone depleting substance (ODS), available technologies that work best now and with a look to future technologies and alternatives, applications are related to firefighting, aerosols, solvents, foams and pesticides, management of ODS programs, good practices and safety issues, (This is a unified course developed in collaboration with United Nations Environmental Program).

0630-331 Fluid Mechanics I (Pre-requisites: 0410-240, 0600-203, 0600-208)

Fluid Statics, introduction to fluid dynamics, conservation laws, Bernoulli equations, dimensional analysis and similitude, internal viscous flows, introduction to external flows.

0630-341 Materials Science and Metallurgy II (Pre-requisites: 0630-241)

Review of the fundamentals of engineering materials including ferrous alloys, nonferrous alloys and super alloys, ceramic materials (structure, applications and processing), composites (divisions, processing, strengthening mechanisms and properties), corrosion and degradation of materials, electrical properties of materials, thermal properties of materials, magnetic properties of materials, optical properties of materials, materials selection and design considerations, economic, environmental, and societal issues in materials science and engineering.

0630-351 Mechanical Design I (Pre-requisites: 0600-203, 0600-204, 0630-241, 0630-259) [Formerly, 0630-352]

Meaning of design, design considerations, codes and standards, economics, safety, professional ethics, stresses due to Torsion, bending and shear forces (review), stress concentration, beams with asymmetrical sections, stresses in cylinders, press and shrink fits, curved members in flexure, contact stresses, deflection and stiffness (curved members, Castigliano’s theorem), buckling, statistical considerations in design, limits and fits, selection of materials in design, fracture and propagation of cracks, design with steady loading (failure criteria), design with variable loading (fatigue and endurance limit, cumulative fatigue damage).

0630-353 Manufacturing Processes (Pre-requisites: 0600-102, 0630-241)

Principles of manufacturing processes including casting, metal forming, material removal, and joining, engineering and economic analysis of manufacturing processes.
0630-361 Project Planning and Management (3-0-3)
(Pre-requisites: 9988-221; Co-requisites: 0600-304)

Planning, scheduling, and control of projects using project management techniques including PERT and Gantt representations; management of organizations, goal setting, performance review and appraisals, budgeting, leadership and engineering project team building, computer applications of project management software.

0630-373 Mechanical Engineering Fundamentals Laboratory (0-3-1)
(Pre-requisites: 0600-204, 0600-304, 9988-221)
[Formerly, 0630-372]

Training on the use of computer in preparation of reports and graphs, safety rules in laboratory, theory and practice of measurement and experimental data collection, laboratory evaluation and demonstration of components of the generalized measurement systems and their effects on the final results, applications of basic methods of data analysis as well as basic instrumentation for sensing, conditioning and displaying experimental measurements, basic measurements of physical and mechanical properties and basic experiments on motion and on material testing.

0630-395 Industrial Training (0-10-3; 200 hours of training)
(Pre-requisites: Completion of 90 Credit hours and Consent of the Engineering Training Center)

Student should attend a field training program at one of the approved institutions engaged in mechanical engineering practice. The objective is to gain practical experience in real engineering applications. The student should submit a formal report related to the program attended at the end of the training period. A minimum of 200 hours of supervised training is required for the course.

0630-403 Intermediate Dynamics (3-0-3)
(Pre-requisites: 0410-211, 0410-240, 0600-203)

Review of Newtonian Mechanics in plane motion, motion of rigid bodies in three dimensions, gyroscopic effects, principle of virtual work, D’Alembert’s principle, Lagrange’s equations of motion, case of impulsive forces, conservation laws, Lagrange’s multipliers, variational calculus, Hamilton’s principle, Hamilton’s equations, Canonical transformations, The Hamilton-Jacobi equation.

0630-415 Mechanical Vibrations (3-0-3)
(Pre-requisites: 0600-308, 0630-318 or 0630-317)

Fundamentals of vibratory linear and torsional systems, harmonically excited systems, balancing, whirling of shafts, vibration measuring instruments, transient response of dynamic systems, two degree-of-freedom systems, multi degree-of-freedom systems, continuous systems, approximate methods, vibration control.
0630-416 Noise and Vibration Control (Pre-requisites: 0630-415) (3-0-3)

Sound levels, effects of noise, noise control criteria, instrumentation, sources of noise, room acoustics, enclosures and barriers, acoustical materials, vibration control, malfunction diagnosis.

0630-417 Control of Mechanical Systems (Pre-requisites: 0630-331, 0630-415) (3-0-3)

Components of control circuits, feedback, operation, stability, and performance characteristics, cascade and feedback compensation, pole-zero assignment, sensitivity and state-variable feedback, applications in thermal, fluid, air conditioning, automotive and machine tool systems.

0630-419 Special Topics in Mechanical Design (Pre-requisites: Consent of the Department) (3-0-3)

Special topics to be selected by the department to reflect interests in special areas of mechanical engineering design.

0630-420 Energy Conversion and Utilization (Pre-requisites: 0630-322) (3-0-3)

Analysis and performance characteristics of energy conversion systems, based on thermodynamics and fluid flow, fossil fuels, thermodynamics limitations, electrical energy from fossil fuels, thermodynamics limitations, electrical energy from fossil fuels, nuclear energy: fission, solar energy (collectors, photo voltaic solar cells, applications), water, wind and geothermal power (electrodynamic generators), magnetohydrodynamics.

0630-421 Heat Transfer (Pre-requisites: 0600-308, 0630-331) (3-0-3)

Basic concepts of conduction, convection, and radiation, steady state, one and two dimensional heat conduction, heat transfer from extended surfaces, transient conduction, natural and forced convection with applications for external and internal flows, heat exchangers, black and gray body radiation, shape factors and radiation exchange between surfaces.

0630-422 Internal Combustion Engines (Pre-requisites: 0630-322, 0630-421) (3-0-3)

Engine overview, two and four strokes engines cycles, fuels and combustion thermochemistry, knocking, spark and compression ignition engines, turbocharging and supercharging, performance and testing, alternative fuels and fuel cells, after-treatment systems, emissions and safety, lubrication, assessments (optimization of fuel economy, energy, friction, etc.), maintenance and reliability, design of thermal systems.
0630-423 Computational Fluid Mechanics and Heat Transfer (Pre-requisites: 0630-331, 0630-421) (3-0-3)

Classification of partial differential equations, numerical techniques for solving fluid dynamics and heat transfer problems, finite difference, finite element, boundary element, and finite control volume methods, numerical solutions of parabolic, elliptic, and hyperbolic equations in fluid dynamics and heat transfer.

0630-424 Air conditioning and Refrigeration (Pre-requisites: 0630-322, 0630-421) (3-0-3)

Analysis of vapor compression refrigeration systems, air conditioning systems, moist air properties and psychrometric processes, solar radiation, cooling load, space air distribution, fans selection and air duct design.

0630-425 Industrial Refrigeration (Pre-requisites: 0630-424) (3-0-3)

Mechanical vapor compression refrigeration cycle (single-stage and multi-stage), equipments: compressors, condensers, evaporators and metering devices, selection and balancing equipment, absorption refrigeration systems, refrigeration of foods, cold store construction and refrigeration load, refrigeration systems.

0630-426 Energy Conservation in Buildings (Pre-requisites: 0630-424) (3-0-3)

Energy conservation measures and energy auditing, energy analysis tools, indoor air quality, building envelope, efficient lighting, fenestration and shading devices, efficient HVAC systems, heat recovery systems, thermal energy storage systems, cogeneration systems, compressed air systems, water management, building energy code.

0630-427 Solar Energy (Pre-requisites: 0630-421) (3-0-3)

Nature and availability of solar energy, spectral distribution of solar radiation, solar angles and solar radiation on horizontal and tilted surfaces, transmission through transparent media and absorption by opaque surfaces, flat plate collectors, solar concentrates, solar water heating systems (design using f-chart method), solar cooling systems, energy storage systems, other applications.

0630-428 Power Plant Engineering (Pre-requisites: 0630-322, 0630-421) (3-0-3)

The application of the principles of thermodynamics and transport phenomena to the analysis of power plants systems and its component: Special emphasis on the conventional steam power plants, gas turbines power plants, and co-generation power desalting plants used in Kuwait.
0630-429 Mechanical Aspects of Desalination Processes (3-0-3)
(Pre-requisites: 0630-322, 0630-421)

The application of the principles of thermodynamics and transport phenomena to the analysis of Desalination systems by distillation (evaporation and condensations) and by membrane processes with special emphasis on the Multi Stage Flash (MSF), and Reserve Osmosis Desalting methods to desalt seawater in combination, conventional steam power plants, gas turbines power plants, and co-generation Power desalting plants used in Kuwait.

0630-431 Fluid Mechanics II (3-0-3)
(Pre-requisites: 0630-331)

Compressible flow, unsteady - flow problems, kinematics of fluids, flow of viscous fluid, turbo-machines, fluid power control.

0630-432 Combustion Measurements (3-0-3)
(Pre-requisites: 0630-331)

Experimental studies of spark ignition & diesel, including power, energy balance fuel system, economy, thermal efficiency & mechanical efficiency, introduction to computerized data acquisition and cycle analysis system, gas chromatograph and emission, safety and control. A semester team-based design project is required.

0630-433 Combustion (3-0-3)
(Pre-requisites: 0630-322, 0630-421)

An introduction to chemical thermodynamics, chemical kinetics, reacting systems, detonation and deflagration, laminar and diffusion flames, droplet evaporation and burning, combustor applications and design considerations, pollutant emissions and control.

0630-434 Fluid Dynamics (3-0-3)
(Pre-requisites: 0630-331)

Flow of ideal fluids. Compressible flows, laminar boundary layer flows, turbulent flows.

0630-437 Aerodynamics (3-0-3)
(Pre-requisites: 0630-331)

Potential flow theory, characteristics of airfoils and wing sections, 2-D incompressible flows, subsonic flow, supersonic flows. Elements of airplane performance and design.

0630-438 Jet and Propulsion (3-0-3)
(Pre-requisites: 0630-322, 0630-331)

Propulsion Engines, fluid dynamics of compressible flow at subsonic and supersonic speeds, isentropic flow shock wave, principles of turbojet, turbofan, ramjet and rocket engines, solid and liquid rocket fuels, rocket components and controls.
0630-440 Modeling in Materials Processing
(Pre-requisites: 0630-241, 0630-421) (3-0-3)

Analytical study of manufacturing processes for metals and polymers, processing by casting, solidification, forming, polymer molding and extrusion, and welding applications, recent advancements in materials processing.

0630-445 Mechanical Properties of Materials
(Pre-requisites: 0600-204, 0630-241) (3-0-3)

Review of stress, strain and elasticity, plasticity and viscoelasticity, elements of dislocation theory, fracture and fracture mechanics, fatigue, composites.

0630-446 Introduction to Composites
(Pre-requisites: 0600-204, 0630-241) (3-0-3)

Principles of reinforcement and matrix materials, mechanics and mechanical properties. failure analysis and strength, design with composites.

0630-447 Corrosion Control of Engineering Materials
(Pre-requisites: ME 241, 100 credits or above) (3-0-3)

Corrosion and society, aqueous corrosion, dissimilar metal corrosion, selective attack, crevice and pitting corrosion, concentration cells, erosion corrosion, enabling theory for environmental sensitive cracking, corrosion control by environmental change, corrosion control by barrier coatings, the corrosion properties of some metallic materials, cathodic and anodic protection, corrosion at elevated temperatures.

0630-448 Advanced Strength of Materials
(Pre-requisites: 0600-204) (3-0-3)

Introduction to applied elasticity, thermoelasticity, energy methods, torsion, unsymmetrical bending, failure criteria, shear center, curved beams, beams on elastic foundation, bending of plates and shells, elastic stability.

0630-449 Non-Destructive Testing
(Pre-requisites: 0630-415, 100 credits or above) (3-0-3)

Material discontinuities, management and evaluation of non-destructive evaluation (NDE), visual inspection and basic test methods, vision and optical sensors, fundamental methods of NDE, liquid penetrant methods, magnetic particle tests, ultrasonic methods (immersion and contact), radiography inspection and other advanced methods of NDE.

0630-450 Introduction to Robotics
(Pre-requisites: 0600-204, 0600-205; Completion of 90 Credit hours) (3-0-3)

A system engineering approach to robotic science and technology, fundamentals of manipulators, actuators, and end effectors, kinematics, control, and programming of manipulators, along with introduction to sensing, perception, pattern recognition and computer vision.
0630-451 Mechanical Design II (3-0-3)
(Pre-requisites: 0600-304, 0630-311, 0630-351 or 0630-352, 0630-353)

Design of Screws (Power Screws, Fasteners and Connectors), design of permanent joints (Welded, Brazed and Bonded Joints, Riveted Joints), design of mechanical springs, design of rolling-contact bearings, lubrication and journal bearing (Hydrodynamic Theory of lubrication, bearing type, temperature effects and design considerations), design of gears (force analysis, stress and strength consideration, various factors affecting strength and resistance), design of clutches, brakes, couplings and flywheels.

0630-455 Computer-Aided Design (3-0-3)
(Pre-requisites: 0630-415, 0630-421; Co-requisites: 0630-451)

Use of computers in modeling, simulation and design, introduction to finite element method, optimization techniques, applications in thermal, fluid and mechanical system design.

0630-456 Computer Aided Manufacturing (3-0-3)
(Pre-requisites: 0630-353)

Fundamentals of industrial automation; numerical control (NC) systems, part programming, robotics in manufacturing; materials handling and automated storage systems; group technology, automated identification and inspection systems, flexible manufacturing systems.

0630-458 Control Design for Mechanical Systems (3-0-3)
(Pre-requisites: 0630-417)

State variable feedback for SISO and MIMO systems eigenstructure assignment, controllability and observability, observer design, introduction to digital control, robust control, design and implementation issues through case studies.

0630-459 Engineering Design (3-0-3)
(Pre-requisites: 0600-209, 0630-455)

Application of design process through a team project, teams of students experience mechanical engineering design through: problem definition, developing a project plan, gathering available information, generating and evaluating alternative solutions through design analysis and synthesis, prototype construction, testing, and refinement.

0630-460 Experimental Stress Analysis (2-3-3)
(Pre-requisites: 0600-204, and Completion of 100 Credit hours)

Stress and strain, Elasticity, theoretical and applied photo-elasticity, Moire method, stress coating, electrical resistance strain gauges.
0630-461 Planned Maintenance (3-0-3)
(Pre-requisites: 0600-304)

Types of maintenance management, planned and scheduled maintenance, maintenance by use of computer, maintenance cost measurement techniques, sensing devices for maintenance diagnoses.

0630-463 Artificial Intelligence in Mechanical Engineering (3-0-3)
(Pre-requisites: 0600-308)

Introduction to AI, types of knowledge-based systems, knowledge acquisition and representation, search strategies and inference process, expert systems, neural networks, and other implementation tools of AI, case studies of AI applications such as robotics, manufacturing, and thermal sciences.

0630-464 Machinery Condition Monitoring (3-0-3)
(Pre-requisites: 0630-415)

A broad study of condition monitoring of rotating and reciprocating machinery, presenting condition monitoring techniques (vibration, oil, electrical current, thermal, corrosion, manual inspection), emphasis on vibration and signal analysis, data acquisition, recording, sensing, balancing, fault diagnosis and conditioning, case studies, and applications.

0630-465 Introduction to Simulation (3-0-3)
(Pre-requisites: 0600-304, and Consent of Department)

Use of simulation to build, analyze, improve, implement and test systems in the service and manufacturing industries, methods for using a simulation language, introduction to statistical aspects to simulation.

0630-466 Failure Analysis (3-0-3)
(Pre-requisites: 0630-451)

Introduction to the field of failure analysis including real-world practical investigations and solutions to actual failure problems with technical products, equipment and systems, product liability issues, failure prevention techniques, remedial design, engineering ethics, the engineer as an expert witness.

0630-467 Quality Control (3-0-3)
(Pre-requisites: 0600-304)

The quality function in computer integrated manufacturing, in-depth analysis of control charts and other statistical process control techniques, organization and managerial aspects of quality assurance, attributes and variable acceptance sampling plans.
0630-468 Printing Technology  
(Pre-requisites: 0600-200)  
(3-0-3)  
Fundamentals of imaging sciences, printing process in manufacturing, color separation, platemaking, overview of printing processes, including offset lithography, gravure, flexography, screen printing and metal decorating, electronic publishing, finishing operations, estimation, production planning, quality control.

0630-473 Thermal Science Lab. I  
(Pre-requisites: 0630-322, 0630-331, 0630-373 or 630-372)  
(0-3-1)  
Experiments, analysis, and writing reports, includes experiments covering the fields of thermodynamics, fluid mechanics and fluid machinery.

0630-474 Dynamics of Machines and Mechanical Vibrations Lab.  
(Pre-requisites: 0630-373 or 0630-372, 0630-415)  
(0-3-1)  
Experimental techniques in the study of mechanical vibrations and dynamics of machines, analysis and discussion of experimental results in formal reports.

0630-475 Thermal Science Lab. II  
(Pre-requisites: 0630-421, 0630-424; Co-requisites: 0630-473)  
(0-3-1)  
Experiments, analysis, and writing reports, includes experiments covering the field of heat transfer and air conditioning.

0630-476 Control of Mechanical Systems Lab.  
(Co-requisites: 0630-417, 0630-474)  
(0-3-1)  
Experimental methods for system identification, control design, and analysis of controlled systems, electrical, hydraulic and pneumatic systems are considered, calibration of sensors, analysis and discussion of experimental results in formal reports.

0630-479 Special Topics in Mechanical Engineering  
(Pre-requisites: Consent of Department)  
(3-0-3)  
Special topics to be selected by the department to reflect interests in special areas in mechanical engineering.

0630-481 Tribology and Lubrication  
(Pre-requisites: 0630-331, 0630-451)  
(3-0-3)  
Mechanisms of friction, wear, and lubrication that govern interfacial behavior, applications of basic theories to solutions of friction and wear problems
0630-482 Thermal System Design  
(Pre-requisites: 0630-421)  
(3-0-3)

Introduction to thermal systems design, performance and analysis of thermal components, systems simulations, systems control, uncertainty analysis, design and optimization of thermal systems.

0630-483 Biomechanics  
(Pre-requisites: 0630-455)  
(3-0-3)

Description of the relevant anatomy and kinematics and kinetics of synovial joints and the spine, methods of engineering analysis will include motion analysis and different types of modeling, applications from industrial ergonomics and biomechanical engineering in artificial joint replacement is to be introduced.

0630-484 Industrial Safety and Loss Prevention  
(Pre-requisites: Completion of 100 Credit hours)  
(3-0-3)

Workplace model of occupational safety, safety laws and regulations, definition of occupational injuries and diseases, measurement of hazard potential and safety performance, statistical analysis of safety, safety programs.

0630-485 Nuclear Power Systems  
(Pre-requisites: 0630-322, 0630-421)  
(3-0-3)

Nuclear fission, reactor criticality, reactor power and rating, fuel consumption and burn up, fuel cycles, reactor operation and radiation shielding, conversion, and breeding, fast reactors, nuclear power plants, power generation, heat transfer in nuclear reactors, thermodynamic power cycles, economics of nuclear power plants.

0630-486 Heat Exchanger Design  
(Pre-requisites: 0630-421)  
(3-0-3)

Modes of heat transfer, basic design methods of heat exchangers, classification of heat exchangers, heat transfer and flow friction characteristics, compact, shell-and-tube and plate-type heat exchangers performance analysis, fouling and its effect on the life cycle analysis, maintenance methodology, flow-induced vibration and noise in heat changers.

0630-487 Industrial Ventilation  
(Pre-requisites: 0630-421)  
(3-0-3)

Principles of airflow and airflow measurement techniques, industrial process exhaust systems, selection and design of exhaust hoods (general and specific applications), make-up and supply air ventilation systems, dilution ventilation systems, selection and design of ducts, fans, stacks, and air cleaners, monitoring and testing of ventilation systems.
0630-488 Thermal Systems Design (3-0-3)
(Pre-requisites: 0630-421)

Thermodynamics and principles of thermal systems, performance and analysis of thermal components, systems simulations, systems control, uncertainty analysis, design and optimization of thermal systems.

0630-489 Special Topics in Thermo-Fluid Engineering (3-0-3)
(Pre-requisites: Consent of Department)

Special topics to be selected by the department to reflect interests in special areas in Thermo-Fluid Engineering.

0630-495 Senior Project (0-9-3)
(Pre-requisites: Completion of 100 Credit hours)

The student undertakes an independent project (theoretical and/or experimental) under the supervision of a faculty adviser. The objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout his/her course of study in an actual problem. The student must document his/her study in a technical report and give an oral presentation of the results.
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering or alternatively specifically Chemical Process Engineering, is an engineering discipline that focuses on the design, operation, control, construction, development and marketing of processes and products that involves chemicals which most engineering applications do. Basically, chemical engineering is so broad that fits anywhere, in the literature, it is known as the Universal Engineer. The chemical engineering curriculum provides knowledge in the fundamental of engineering calculations, synthesis and design of processes, reaction engineering and unit operations as well as process control. In Kuwait University, emphasis is made on Water Desalination and Petroleum Refinery, as they are the major applications in the state of Kuwait.

The department of Chemical Engineering builds its undergraduate and graduate curricula to accommodate the ongoing progress in the field of chemical engineering. The undergraduate curriculum aligns with the global standard of chemical engineering education. To fulfil its mission, the chemical engineering department is actively involved in Kuwait chemical industries through technical consultations and professionals training. Furthermore, the department has established several chemicals tests centres and laboratories: Materials, Analytical, Molecular Design, Catalyst Evaluation and Testing, Desalination and Energy, Separation and Membrane Processes, Water Technology, Phase Equilibrium, Heat Transfer, Process Control, Fluid Mechanics, and Mass Transfer and Unit Operations laboratories. For further information about the department, visit http://www.eng.kuniv.edu/chemical/.

Mission

The Mission Statement of the Chemical Engineering Department is to produce chemical engineers capable of meeting the technological and societal needs of Kuwait and the Gulf region.

This mission is fulfilled by providing a broad curriculum in the basic sciences, process systems and design, unit operations, and in modern experimental and computing techniques. The program strives for academic excellence through continual assessment of the outcomes. The focus is on petroleum and petrochemical technology, environmental engineering, and water technology.

Vision

The Chemical Engineering Department strives for regional and international recognition in teaching, research and community service. It enriches the standard of engineering education, continually enhances the quality and competence of graduated students, and stimulates outstanding research activities that contribute to the advancement of the chemical engineering profession and the development of local and regional industry.

Program Educational Objectives

The Educational Objectives serve the mission of the Chemical Engineering Department, and are consistent with the mission statements of the University and the College. Moreover, they satisfy the constituents’ needs. They focus on the long term accomplishment of the alumni of the Chemical Engineering Department at Kuwait
University. The Educational Objectives are continually assessed and updated to ensure the quality of the outcomes and the effectiveness of the curriculum. The statement of the Educational Objectives is:

Graduates of the Undergraduate Program in Chemical Engineering will:

- be productive in their chosen careers in the public and private sectors; especially in the fields of oil refining, petrochemicals, and water;
- advance in responsibility and leadership in their careers and engage in ongoing professional development by successfully pursuing graduate studies and/or other learning activities; and
- contribute to the welfare of society by directing their skills and technical expertise toward addressing the needs of the community and the environment.

**Student Outcomes**

The Chemical Engineering Program provides an integrated curriculum enabling students to develop skills and attitudes that are essential to their future successful career. The Program will ensure that its engineers can demonstrate the following capabilities:

- Apply basic mathematics and science to solve engineering problems.
- Design and conduct laboratory experiments, and interpret results.
- Design and analyze chemical processes.
- Participate effectively in teamwork.
- Identify, formulate and solve engineering problems.
- Recognize and conform to highest professional and ethical standards.
- Communicate effectively in oral and written form.
- Recognize the impact of engineering solutions on the society and the environment.
- Recognize the need for life-long learning.
- Awareness of contemporary social, economic and political issues.
- Proficiency in utilizing modern engineering tools.
- Competence in tackling Chemical/process engineering problems that are important to local and regional industries.

**CURRICULUM**

Each student majoring in Chemical Engineering must satisfactorily complete a minimum of 144 credits. In addition to the 21-credits general education component, Chemical Engineering students must satisfactorily complete 38 credits of Mathematics and basic sciences, 21 credits of core engineering course, 52 credits of core Chemical engineering courses, and 12 credits of elective courses.

**I. GENERAL EDUCATION COURSES**

**A. Compulsory**

(21 Credits)

(12 Credits)
0330-100 Modern and Contemporary History of Kuwait 3
0330-102 Arab and Islamic Civilization (or equivalent) 3
9988-123 Intermediate Writing Skills 3
9988-221 Technical Writing 3

B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

II. MATHEMATICS AND BASIC SCIENCE COURSES (27 Credits)

0410-101 Calculus I 3
0410-102 Calculus II 3
0410-111 Linear Algebra 3
0410-211 Calculus III 3
0410-240 Ordinary Differential Equations 3
0420-101 General Chemistry I 3
0420-105 General Chemistry I Laboratory 1
0430-101 Physics I 3
0430-105 Physics I Laboratory 1
0430-102 Physics II 3
0430-107 Physics II Laboratory 1

III. COLLEGE OF ENGINEERING REQUIREMENTS (21 Credits)

0600-099 Introduction to Engineering Programs 0
0600-104 Engineering Graphics 2
0600-200 Computer Programming for Engineers 3
0600-205 Electrical Engineering Fundamentals 3
0600-207 Electrical Engineering Fundamentals Lab 1
0600-208 Engineering Thermodynamics 3
0600-209 Engineering Economy 3
0600-304 Engineering Probability and Statistics 3
0600-308 Numerical Methods in Engineering 3

IV. MAJOR REQUIREMENTS (75 Credits)

A. Compulsory Courses (63 Credits)

0420-102 General Chemistry II 3
0420-106 General Chemistry II Laboratory 1
0420-234 Analytical Chemistry 3
0420-269 Organic Chemistry 4
0630-241 Material Science and Metallurgy 3
0640-211 Chemical Engineering Principles 3
0640-215 Physical Chemistry 4
0640-241 Fluid Mechanics 3
0640-242 Fluid Mechanics Laboratory 1
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<tr>
<th>Course Code</th>
<th>Course Name</th>
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<td>0640-291</td>
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<td>0640-321</td>
<td>Chemical Engineering Thermodynamics</td>
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<td>0640-324</td>
<td>Kinetics and Reactor Design (A)</td>
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<td>0640-345</td>
<td>Mass Transfer</td>
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<td>0640-351</td>
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<tr>
<td>0640-352</td>
<td>Process Dynamics and Control Laboratory</td>
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<td>0640-391</td>
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<td>0640-428</td>
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<td>0640-440</td>
<td>Mass Transfer Operations</td>
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<td>0640-443</td>
<td>Mass Transfer Operations Laboratory</td>
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<td>0640-461</td>
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<td>0640-472</td>
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<tr>
<td>0640-491</td>
<td>Plant Design</td>
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</tbody>
</table>

**IV. ELECTIVE COURSES**

(12 Credits)

Students choose 12 credits from the following list of current Departmental electives. However, a maximum of 3 credits may be substituted, with the approval of the Department, by a suitable selection from Science or Engineering offerings.

<table>
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<tr>
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<td>0640-302</td>
<td>Introduction to Chemical Processes</td>
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<td>0640-304</td>
<td>Introduction to Environmental Engineering</td>
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<td>0640-314</td>
<td>Properties of Materials</td>
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<td>Corrosion Engineering</td>
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<td>Transport Phenomena</td>
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<td>0640-353</td>
<td>Mathematical Methods in Chemical Engineering</td>
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<td>0640-463</td>
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<td>0640-471</td>
<td>Gas Engineering</td>
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<td>Polymer Engineering</td>
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<td>0640-475</td>
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<td>0640-479</td>
<td>Rheology and Polymer Processing</td>
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<td>Operations Research</td>
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<td>0640-493</td>
<td>Equipment Design</td>
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<td>0640-495</td>
<td>Senior Project</td>
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</table>
CHEMICAL ENGINEERING COURSES

0640-211 Chemical Engineering Principles (3-0-3)
(Co-requisites: 0420-102)

Basic concepts of material and energy balances, combined material and energy balances, balances on non-reactive and reactive processes, application of material and energy balances on unit operations.

0640-215 Physical Chemistry (3-3-4)
(Pre-requisites: 0420-102, 0420-106)

Rates of reaction, effects of temperature and pressure on the reaction rate, adsorption in gases and liquids, surface reactions, Kinetic theory of gases, transport properties of gases from molecular theory, PVT relations and equations of state, Dalton and Amagat laws, zeroth, first, second and third laws of thermodynamics, Raoult's law and vapor-liquid equilibrium, chemical equilibrium and effects of temperature and pressure on the equilibrium constant.

0640-241 Fluid Mechanics (3-0-3)
(Pre-requisites: 0410-211, 0430-102)

Fluid properties, fluid statics, kinematics, fluid dynamics including mass, energy and momentum equations, dimensional analysis, laminar flow, turbulent flow and its applications, forces on immersed bodies, Turbo-machines.

0640-242 Fluid Mechanics Laboratory (0-3-1)
(Pre-requisites: 0640-241)

Laboratory experiments on fluid flow in pipes (flow measurement, friction and pressure drop), Fluid properties, Valve and pump characteristics.

0640-291 Fundamentals of Chemical Engineering Design (2-3-3)
(Pre-requisites: 0600-104, 0600-200, 0640-211)

Structure of different kinds of chemical processes flow diagrams, basics of generating chemical process alternatives, chemical process descriptions, simultaneous material and energy balances using spreadsheet, symbolic programs and process simulators, manufacturing costs, impact of chemical engineering on society.

0640-302 Introduction to Chemical Processes (3-0-3)
(Pre-requisites: Completion of 45 Credit hours and Non-Chemical Engineering Students)

Structure of the chemical industry, oil refinery, crude distillation, synthesis gas, bulk chemicals, catalytic reactors, polymers, biotechnology, process development.
0640-304  Introduction to Environmental Engineering  
(Pre-requisites: Completion of 45 Credit hours)  
(3-0-3)

Environment and ecosystem, health issues, measure of water and air quality, water treatment, meteorology, air emission and treatment, solid waste, hazardous waste, engineering decision.

0640-314  Properties of Materials  
(Pre-requisites: 0640-291)  
(3-0-3)

Fundamentals of Engineering materials, material-oriented problems, relationships between the microscopic and macroscopic properties of matter, use of Atomistic models to explain and predict the behavior of solids and liquids.

0640-321  Chemical Engineering Thermodynamics  
(Pre-requisites: 0600-208, 0640-215)  
(3-0-3)

Thermodynamic properties of homogeneous mixtures, partial molal properties, fugacity, ideal and non-ideal solutions, heat effects of mixing, excess properties, phase equilibrium, miscible systems, activity coefficient, Gibbs-Duhem Equations, chemical reactions equilibrium.

0640-324  Kinetics and Reactor Design (A)  
(Pre-requisites: 0600-308, 0640-321)  
(3-0-3)

Fundamentals of thermodynamics and kinetics of chemical reactions, analysis of batch, plug-flow and continuous stirred tank reactors for different types of reactions, non-ideal reactor analysis, including residence time distribution, back mixing and dispersion models, kinetics of isothermal and non-isothermal ideal reactors.

0640-327  Corrosion Engineering  
(Pre-requisites: Completion of 90 Credit hours)  
(3-0-3)

Theories and principles of corrosion and prevention, localized corrosion, pitting, crevice corrosion, cavitation, metallurgical factors, welding problems, material selection, stress corrosion cracking corrosion fatigue, inspection, nondestructive testing, water treatment for boilers and condensers, chemical cleaning flue gas attack, corrosion testing evaluation and simulation, corrosion monitoring and cathode protection.

0640-343  Heat Transfer  
(Pre-requisites: 0410-240, 0600-208, 0640-241)  
(3-0-3)

The Heat Transfer course requires that students apply their knowledge of mathematics and science to real thermal engineering systems. In this course an expansion of students engineering skills, developed in thermodynamics and fluid mechanics, is undertaken. Students are required to identify, formulate and solve thermal problems using a combination of mass and energy balances and energy rate equations. The course combines analytical techniques and design principles as applied to thermal systems. The students will have a full understanding of conduction, convection, radiation, condensation and boiling heat transfer and will be able to design a heat exchanger system.
0640-344 Heat Transfer Laboratory
(Pre-requisites: 0640-242, 0640-343, 9988-221) (0-3-1)

Laboratory experiments on conduction, convection, radiation, dropwise and film condensation, nucleate and film boiling and heat exchangers.

0640-345 Mass Transfer
(Pre-requisites: 0600-308, 0640-291, 0640-242, 0640-343) (3-0-3)

Molecular mass transport in fluids, transport phenomena and the basic equation of change, molecular mass transport in liquids, mass transport phenomena in solids, mass transfer coefficient in laminar and turbulent flow, interphase mass transport, continuous two-phase mass transport.

0640-346 Transport Phenomena
(Pre-requisites: 0640-291, 0640-343) (3-0-3)

Derivation of general transport equations for momentum, heat and mass transfer, application and simplification of general equations to analysis of simple transfer operations, volume and time averaging of general equations, gas absorption, design of a gas absorption column.

0640-351 Process Dynamics and Control
(Pre-requisites: 0640-324, 0640-343) (3-0-3)

Mathematical tools (Linearization, Laplace Transforms and Block diagram algebra), process dynamics (first, second and higher order), open loop and closed loop responses, classification of control action (feedback and feed-forward), control loop instrumentation and control valves, PID controller design, tuning and stability.

0640-352 Process Dynamics and Control Laboratory
(Pre-requisites: 0600-207, 0640-351) (0-3-1)

Laboratory experiments demonstrating the principles covered in 0640-351, these include temperature, pressure, flow and concentration measuring devices, and process control simulation for typical chemical plants.

0640-353 Mathematical Methods in Chemical Engineering
(Pre-requisites: 0600-308; Co-requisites: 0640-343) (3-0-3)

Development and solution of mathematical models of chemical engineering systems with emphasis on physical and chemical processes, topics covered: Model development including different transport mechanisms, type of process models, application of numerical techniques.

0640-391 Chemical Process Synthesis
(Pre-requisites: 0600-209, 640-324, 640-345) (2-0-2)

This course provides students with essential knowledge that they will subsequently apply in their capstone design course, description of the chemical process industries, product
design, process creation, process assessment (health and safety, environmental protection, economic aspects), management of engineering projects, preparation of the design report.

**0640-395 Engineering Training** (0-10-3; 200 hours of training)  
(Pre-requisites: Completion of 90 Credit hours and Consent of Training Center)

The students should attend a training program at one of the approved institutions engaged in chemical engineering practice. The objective is to gain practical experience in real engineering applications. The student should submit a formal report related to the program attended at the end of the training period. A minimum of 200 hours of supervised training is required for the course.

**0640-428 Kinetics and Reactor Design (B)** (3-0-3)  
(Pre-requisites: 0640-324)

Kinetics of heterogeneous or catalytic reactions, design of different types of catalytic and non-catalytic reactors, mass and energy transfer limitations in heterogeneous reaction systems, catalyst effectiveness, reactor stability and sensitivity to operating parameters, optimization of reactor design, factors affecting choice of reactors.

**0640-437 Gas Chromatography for Chemical Engineers** (3-0-3)  
(Pre-requisites: 0640-345)

An introduction to liquid and gas chromatography, partition chromatography, gas chromatography apparatus, plate and rate theories of chromatography, resolution and efficiency, capillary column, temperature programming, high performance liquid chromatography.

**0640-440 Mass Transfer Operations** (3-0-3)  
(Pre-requisites: 0640-345)

The course begins with a general analysis of the concepts of binary and multicomponent separation processes in chemical engineering, it then covers analysis of equilibrium conditions, and thermodynamic equilibrium in ideal and non-ideal systems, the separation processes discussed are Distillation (Flash, Batch, Steam and Multi-component), solid-Liquid and Liquid-Liquid Extractions, Absorption, Adsorption, and Cooling Towers.

**0640-443 Mass Transfer Operations Laboratory** (0-3-1)  
(Co-requisites: 0640-440)

A laboratory course in mass transfer operations covering experiments on: Distillation, Leaching, Vapor-Liquid Equilibrium, Double-effect evaporator, Cooling tower, Absorption, and Spray drying.

**0640-444 Two Phase Flow** (3-0-3)  
(Pre-requisites: 0640-241)

Characterization of solid particles and their classification, solid-liquid systems consisting of flow past a cylinder and sphere and flow of fluids through porous media, detailed study of sedimentation and fluidization phenomenon and their applications in the industry.
filtration theory and practice and filtration equipment, gas cleaning equipment and centrifugal separations.

**0640-449 Multi component Phase Separation** (3-0-3)
(Pre-requisites: 0640-440)

Equilibrium and flash calculations for multi component systems, selection of separation processes, approximate methods for multi component multistage separations, exact methods for computation of multistage separations, energy requirements evolutionary and heuristic techniques for distillation columns synthesis, heat integrated columns, extractive distillation.

**0640-452 System Analysis and Simulation** (3-0-3)
(Pre-requisites: 0600-308, 0640-343)

Introduction to simulation techniques in chemical engineering, development and solution of mathematical models for a variety of processes through the application of chemical engineering fundamentals, analytical and numerical solutions, computer simulation, principles of simulator structure, data banks, use of industrial simulator.

**0640-457 Optimization Techniques** (3-0-3)
(Pre-requisites: 0600-308)

Introduction to problem structure and decomposition, functions and regions, single variable functions, multivariable functions, linear programming, geometric programming, dynamic programming.

**0640-461 Water Desalination** (3-0-3)
(Pre-requisites: 0640-343)

The course covers the basic concept of water desalination and combines water chemistry, scaling, corrosion, heat transfer principles, material behavior, and design principles as applied to desalination processes. Attention is given to the thermal (flash, vapor compression) and non-thermal (reverse-osmosis, electro-dialysis) desalination techniques, water properties and quality criteria and standards as well as corrosion behavior and its control in desalination plants will be discussed.

**0640-462 Introduction to Biochemical Engineering** (3-0-3)
(Pre-requisites: 0640-324)

Basics of enzyme kinetics and immobilization, basics of cell kinetics and cultivation, design of a simple enzyme reactor and a fermenter, methods of sterilization, downstream processes including purification and recovery.

**0640-463 Wastewater Treatment** (3-0-3)
(Pre-requisites: Completion of 90 Credit hours)

Characterization of industrial wastes, petroleum refinery wastes, treatment processes, solid-liquid separation, ion exchange, adsorption, biological treatments, reverse osmosis, economics, regulations, moral, legal and social implications.
0640-465 Air Pollution (3-0-3)
(Pre-requisites: Completion of 90 Credit hours)

Sources, measurements and equipment design for removal of air pollutants, effects of air pollutants, dispersion of pollutants in the atmosphere, particulate matter and its control equipment, atmospheric photochemical reactions, instrumentation and emission testing equipment.

0640-471 Gas Engineering (3-0-3)
(Pre-requisites: 0640-321, 0640-345)


0640-472 Petroleum Refining Engineering (3-0-3)
(Pre-requisites: 0420-269, 0640-440)

Refinery organization, refinery feed stocks and products, crude distillation, cracking and reforming, hydrotreating, alkylation, lubricating oils production, petroleum gases, Hydroprocessing, product blending, environmental constraints on refinery products, term project using actual refinery data to be utilized for typical design calculation on the above operations.

0640-473 Polymer Engineering (3-0-3)
(Pre-requisites: 0420-269)

Structure and physical properties of polymers, polymer solutions, analysis and testing of polymers, measurement of molecular weight, types of polymerization reactions, manufacture of polymers, process type of reactors, polymer processing, plastics, elastomers, properties of commercial polymers, thermoplastics and thermosetting resins.

0640-474 Petrochemical Engineering (3-0-3)
(Pre-requisites: 0420-269, 0640-211)

Petroleum chemistry: occurrence, composition of crude oil, distillation, catalytic and thermal cracking, alkylation, hydrogenation, isomerization, polymerization, techniques and economics of the production of basic and intermediate petrochemicals as well as some end products.

0640-475 Gas Sweetening (3-0-3)
(Pre-requisites: 0640-321, 0640-345)

Basic process principles, amine processes, carbonate processes, physical absorption methods, new amine-type processes, solid bed sweetening, liquid sweetening, sulfur production, tail gas conditioning.
0640-478 Liquefied Natural Gas  
(Pre-requisites: 0640-321)  
(3-0-3)

Refrigeration systems, natural gas preparation and liquefaction, thermodynamic aspects of liquefaction, liquefaction plants, properties of LNG, vaporization losses and custody transfer.

0640-479 Rheology and Polymer Processing  
(Pre-requisites: 0600-308, 0640-242)  
(3-0-3)

Fundamentals of Rheology, polymer processing unit operations, basic principles of continuum mechanics, descriptive and analytical presentation of non-Newtonian fluid behavior, derive fundamental equations of viscometry, using extrusion as a prototype unit operation for showing how to synthesize design equations, models for other operations.

0640-481 Operations Research  
(Pre-requisites: 0600-308)  
(3-0-3)

Introduction, mathematical modeling, classification of models, model construction, decision making, linear programming (LP), formulations of LP, graphical solution for two-variable problems, algebraic solutions, the simplex method, sensitivity analysis, advanced topics in linear programming, Applications and case studies.

0640-482 Industrial Safety  
(Pre-requisites: Completion of 80 Credit hours)  
(3-0-3)

Introduction, preventing emergencies in the process industry, human error, identification and assessment of hazards, fires and explosions, hazard of plant modification, case studies in Kuwait, miscellaneous topics to be covered by invited lecturers.

0640-484 Topics in Chemical Engineering  
(Pre-requisites: Completion of 100 Credit hours and Consent of Department)  
(3-0-3)

Special topics to be selected by the department to address special areas of chemical engineering applications.

0640-491 Plant Design  
(Pre-requisites: 0640-351, 0640-391, 0640-440)  
(1-6-3)

The capstone Chemical Engineering design course is run as a workshop in which small groups of students apply previously learned knowledge to design and cost a typical chemical plant, the exercise, which simulates real-life experience, involves the following elements: process selection, synthesis, screening of alternatives, safety and environmental issues, construction of a detailed flow sheet using a chemical process simulator, material and energy balances, conservation of material and energy flows, detailed design of equipment: size, construction details, materials of construction, instrumentation and control, process economics: capital cost estimation, manufacturing cost estimation, profit forecast, return on investment.
0640-493 Equipment Design (3-0-3)
(Pre-requisites: 0640-345)

High pressure vessels; cylindrical vessels, spherical vessels, methods of fabrication, materials of construction, reasons for vessel failure, thin tanks, design of closures, tall vertical vessels, self supported and guyed vessels, flanges, gaskets, pump and compressor selection, heat exchangers.

0640-495 Senior Project (0-9-3)
(Pre-requisites: Completion of 100 Credit hours and Consent of Department, GPA 3.0)

The student undertakes an independent project (theoretical and/or experimental) under the supervision of a faculty advisor, the objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout his courses in an actual problem, the student must document his study in a technical report and give an oral presentation.
DEPARTMENT
OF
PETROLEUM ENGINEERING
DEPARTMENT OF PETROLEUM ENGINEERING

Petroleum engineering department was founded in 1989. The petroleum industry is the backbone of the economy of the state of Kuwait. Kuwait has about 10 percent of known world oil reserves. Maintaining large hydrocarbon reserves to propel Kuwait's economy requires developing additional petroleum reserves. This additional development will be either in the form of exploration and drilling, or in the form of developing new technologies to increase extraction from known domestic reserves. The program will provide and define these technologies.

Vision

To be a world-class provider of education and research for the oil and gas industry, to play a leadership role in providing new technologies in order to increase the petroleum reserves of Kuwait.

Mission

To provide a modern petroleum engineering education with proper balance between theory and practice and to graduate petroleum engineers prepared for life-long learning and capable of being productive contributors for the oil and gas industry.

Program Education Objectives

The Petroleum Engineering Department at Kuwait University is dedicated to graduating Petroleum Engineers who will

- engage in productive careers in petroleum engineering in public or private sectors, or successfully pursue graduate studies and careers in academia or research centres.
- advance in responsibility and leadership in their careers, and participate in continuous professional development to meet the challenges of rapidly emerging technology.
- contribute to the welfare of the society and the environment and the development of the profession through responsible practice of petroleum engineering and participation in professional activities and organizations.

Student Outcomes

Petroleum Engineering Graduates must have the knowledge and skills described below:

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

CURRICULUM

The curriculum is designed to graduate engineers with proper balance between theory and practice. A total of 144 credits are required for graduations distributed as follows: 21 credits as general education courses, 27 credits as basic science requirements, 28 credits as college of engineering requirements, and 68 credits as departmental requirements. While the 27 credits in basic science requirements assure a solid background in Math, Physics and Chemistry, the 28 credits of engineering requirements guarantee breadth and assure some engineering fundamental prerequisites needed for the pursuit of a petroleum engineering degree. The 68 credits required by the department are distributed to cover the three principal disciplines of Petroleum Engineering, namely Reservoir Engineering, Drilling Engineering, and Production Engineering. An in-depth coverage of the area of Reservoir engineering is assured by offering eight courses equivalent to 24 credit hours related to this particular area. The design element in this curriculum is supported by a cornerstone design course taken by students in their fifth semester on campus, and a capstone design course taken in the last semester. The program is supported by six laboratories, namely: PVT, Subsurface mapping, Reservoir Rocks, Drilling Mud and Cement, Well Logging, and Research Laboratories.

The Petroleum Engineering Department is unique among other engineering departments at Kuwait University having a compulsory summer training program. This practical experience is meant to reinforce the student academic background, to broaden his/her industrial perspective, and to provide the student with a healthy environment for efficient team work.

I. GENERAL EDUCATION COURSES (21 Credits)

A. Compulsory (12 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0330-100</td>
<td>Modern and Contemporary History of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>
B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

II. MATHEMATICS AND BASIC SCIENCE COURSES (27 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>0410-102</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>0410-111</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>0410-211</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>0410-240</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>0420-101</td>
<td>General Chemistry</td>
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<td>0420-105</td>
<td>General Chemistry Lab</td>
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</tr>
<tr>
<td>0430-101</td>
<td>Physics I</td>
<td>3</td>
</tr>
<tr>
<td>0430-105</td>
<td>Physics Laboratory I</td>
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<tr>
<td>0430-102</td>
<td>Physics II</td>
<td>3</td>
</tr>
<tr>
<td>0430-107</td>
<td>Physics Laboratory II</td>
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</table>

III. COLLEGE OF ENGINEERING REQUIREMENTS (21 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering</td>
<td>-</td>
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<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>0600-200</td>
<td>Computer Programming for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>0600-207</td>
<td>Electrical Engineering Fundamentals Lab</td>
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</tr>
<tr>
<td>0600-208</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>0600-209</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>0600-304</td>
<td>Engineering Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>0600-308</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

IV. MAJOR REQUIREMENTS (75 credits)

A. Compulsory Courses (66 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-102</td>
<td>Workshop</td>
<td>1</td>
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<tr>
<td>0600-202</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>0600-204</td>
<td>Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>0650-210</td>
<td>Introduction to Petroleum Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0650-221</td>
<td>Reservoir Rock Properties</td>
<td>3</td>
</tr>
<tr>
<td>0650-241</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>0650-251</td>
<td>Introduction to Petroleum Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>0650-322</td>
<td>Reservoir Rock Lab</td>
<td>1</td>
</tr>
<tr>
<td>0650-323</td>
<td>Phase Behavior of Reservoir Fluids</td>
<td>3</td>
</tr>
<tr>
<td>0650-324</td>
<td>Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0650-333</td>
<td>PVT Lab</td>
<td>1</td>
</tr>
<tr>
<td>0650-341</td>
<td>Drilling Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0650-342</td>
<td>Mud and Cement Lab</td>
<td>1</td>
</tr>
<tr>
<td>0650-351</td>
<td>Petroleum Geology</td>
<td>3</td>
</tr>
<tr>
<td>0650-352</td>
<td>Subsurface Mapping</td>
<td>1</td>
</tr>
</tbody>
</table>
0650-354  Well Logging            3
0650-355  Well Logging Lab       1
0650-411  Petroleum Production Engineering  3
0650-425  Natural Gas Reservoir Engineering  3
0650-427  Secondary Recovery      3
0650-432  Well Testing           3
0650-435  Production Equipment Design  3
0650-437  Numerical Methods in Petroleum Engineering  3
0650-449  Petroleum Economics    3
0650-450  Industrial Training    3
0650-496  Petroleum Engineering Design  3

B. Required Courses Outside the Department  (3 credits)

0460-101  Geology                  3

C. Elective Courses   (6 credits)

Students must choose two elective courses (equivalent to 6 credits) from the Petroleum Engineering department:

0650-325  Fluid Flow in Porous Media        3
0650-424  Reservoir Engineering II           3
0650-431  Formation Evaluation               3
0650-438  Advanced Well Completion           3
0650-442  Industrial Safety for Oil Field Operations  3
0650-443  Offshore Technology                3
0650-445  Storage and Transportation of Crude Oil and Gas  3
0650-447  Oil Field Corrosion and Corrosion Control  3
0650-451  Reservoir Modeling                 3
0650-452  Thermodynamics and Phase Behavior of Petroleum fluids         3
0650-453  Fractured Reservoir Characterization  3
0650-454  Transport Phenomena in Geo-Systems  3
0650-461  Rock Mechanics in the Oil Industry  3
0650-463  Directional Drilling              3
0650-464  Horizontal Well Technology        3
0650-465  Drilling in Abnormal Pressure Zones  3
0650-467  Advanced Well Control Operations  3
0650-469  Practical Advances in Drilling Engineering  3
0650-471  Natural Gas Sweetening and Dehydration  3
0650-475  Well Stimulation                   3
0650-485  Introduction to Geostatistics      3
0650-495  Senior Project                   3
PETROLEUM ENGINEERING COURSES

0650-101 Petroleum Basics (3-0-3)
(Pre-requisites: Completion of 25 Credit hours)
(The course is offered in Arabic)

Introduction to Petroleum Engineering: origin and migration of petroleum, petroleum traps, petroleum reservoirs, petroleum exploration methods, properties of petroleum fluids, properties of reservoir rocks, drilling operations, production operations (primary and enhanced recovery), estimation of petroleum reserves, importance of petroleum industry in Kuwait economy, effects of petroleum operations on the environment, comparison of petroleum with other forms of energy, Kuwait oil fields, petroleum production in the Arab countries and the world.

0650-210 Introduction to Petroleum Engineering (3-0-3)
(Pre-requisites: Completion of 30 Credit hours)

Origin and accumulation of hydrocarbon fluids, exploration for oil and gas, basic concepts of hydrocarbon traps, introduction to various Petroleum Engineering disciplines, formulation of physical concepts into mathematical equations, application of engineering methods to problem solving, graphic, analytic, and numeric solution methods.

0650-221 Reservoir Rock Properties (3-0-3)
(Pre-requisites: 0460-101, 0650-210)

Measurement of rock properties and interpretation of petrophysical parameters, interaction of residents fluids with rocks, application of petrophysics to reservoir engineering problems.

0650-241 Fluid Mechanics (3-0-3)
(Pre-requisites: 0430-101, 0410-240, 600-200)

This is an introduction to the basic phenomena and principles of fluid mechanics with petroleum engineering applications. The course covers fluid statics, conservation of mass, momentum and energy. Emphasis is on the quantitative analysis of velocities, pressures, shear stresses, and flow forces. The application of basic fluid mechanics concepts to the analysis of mud flow, and two-phase flow in pipes and annuli is stressed.

0650-251 Introduction to Petroleum Engineering Design (2-3-3)
(Pre-requisites: 0650-221)

This course introduces students to the principles of engineering design in a broad context. The course then provides students with the opportunity to apply these principles for designing simple petroleum engineering systems. Some emphasis will be on communication skills and on computer tools that can support the design process.
0650-301 Fundamentals of Petroleum Engineering (3-0-3)
(Pre-requisites: Completion of 45 Credit hours for Science and non-Petroleum Engineering Students)

Origin of petroleum fluids, identify the different types of reservoir fluids and reservoir traps, petroleum exploration methods, familiarize the student with the properties of petroleum reservoir fluids, properties of reservoir rocks, types of oil and gas accumulations, familiarize the student with different methods of drilling a well, components of drilling rig, methods of oil production, calculation of oil in place, famous oil fields in Kuwait.

0650-312 Petroleum Industry (3-0-3)
(Pre-requisites: 60 credit hours and non-PE student)

Discussion of various petroleum industry processes, identify types of reservoir exploration methods, recognize the properties of reservoir rocks and petroleum fluids, describe oil and gas production facilities downstream and upstream of the well choke, identify petroleum products, describe the handling, transportation, and marketing of petroleum products.

0650-322 Reservoir Rock Laboratory (0-3-1)
(Co-requisites: 0650-221)

Measurement of rock petrophysical properties such as porosity, permeability, saturation, capillary pressure and electrical resistivity of fluid saturated rocks.

0650-323 Phase Behavior of Reservoir Fluids (3-0-3)
(Pre-requisites: 0420-101, Completion of 45 Credit hours)

Phase behavior of pure substances, two-component and multi-component mixtures, phase behavior classification of oil and gas reservoirs, gas condensates, retrograde phenomena.

0650-324 Reservoir Engineering (3-0-3)
(Pre-requisites: 0650-322, 0650-323)

Classification of reservoirs by type and recovery mechanism, reserve and production rate estimate based on material balance, aquifer modeling and water influx calculation methods.

0650-325 Fluid Flow in Porous Media (3-0-3)
(Pre-requisites: 0650-324)

Properties of fluid-saturated rocks. Steady state and transient fluid flow in porous reservoir rocks as applied to petroleum engineering.

0650-333 PVT Laboratory (0-3-1)
(Co-requisites: 0650-323)

Measurements of reservoir fluid properties: flash liberation test, constant volume depletion test, constant composition expansion and separator test, preparation of PVT reports.
0650-341 Drilling Engineering (Pre-requisites: 0600-204, 0650-241, 0650-251, 0650-322) (3-0-3)

Rotary drilling equipment, operational procedures and drilling cost evaluation, primary functions and the composition of the drilling fluids, well control, well completion principles and methods.

0650-342 Mud and Cement Laboratory (Co-requisites: 0650-341) (0-3-1)

Functions of drilling fluids, rheology and filtration of fluids with various concentrations of reactive and non-reactive solids, effects on plastic viscosity, yield point, gel strength, use of thinners.

0650-351 Petroleum Geology (Pre-requisites: 0650-221, 9988-221) (3-0-3)

Aspects of seismo-stratigraphy, morphology and development of oil and gas traps, application to the Middle East oil fields.

0650-352 Subsurface Mapping (Co-requisites: 0650-351) (0-3-1)

Overview of stratigraphy and structural geology, correlation of stratigraphic sections, log correlation, interpretation of seismic sections, structural contour maps.

0650-354 Well Logging (Pre-requisites: 0600-304, 0600-207, 0650-333) (3-0-3)

Principles, applications, and interpretation of wireline well logs as applied to petroleum exploration and reservoir evaluation.

0650-355 Well Logging Laboratory (Co-requisites: 0650-354) (0-3-1)

Problem-oriented applications of well-log combinations for petroleum exploration and evaluation, application of resistivity, sonic and dipmeter logs to determining lithological boundaries, faulting, and abnormal pressure zones, well Log correlations, programming well log interpretation, Shaly sand analysis.

0650-411 Petroleum Production Engineering (Pre-requisites: 0600-209, 0650-324, 0650-342) (3-0-3)

Interpretation of gas and oil well performance using nodal system analysis, two-phase flow in pipes, design of continuous gas lift projects, rate decline analysis and production forecasting.
0650-424 Reservoir Engineering II (Pre-requisites: 0650-324) (3-0-3)

Review methods of calculations of IOIP, models of water influx, estimation of IOIP or IGIP and aquifer properties, understanding abnormal pressure gas reservoirs, production mechanisms of abnormal pressure gas reservoir, method of estimating IGIP for abnormal pressure gas reservoirs.

0650-425 Natural Gas Reservoir Engineering (Pre-requisites: 0600-208, 0650-324) (3-0-3)

Properties of natural gas, flash calculations and types of gas reservoirs, gas reservoir performance: well deliverability tests, pressure transient tests, and reserve estimates, gas well performance, calculation of pressure losses and unloading gas wells, gas compression and gas metering, total system analysis of gas wells, gas processing.

0650-427 Secondary Recovery (Pre-requisites: 0650-324, 0650-352) (3-0-3)

This course is designed for students to learn the basic skills of monitoring, analyzing and projecting the performance of various secondary recovery methods. Emphasis is given to gas cycling and water flooding. Students are also introduced to tertiary recovery methods.

0650-431 Formation Evaluation (Co-requisites: 0650-354) (3-0-3)

Exploring mechanisms that cause low productivity either because of formation damage far in the reservoir, or near the wellbore, or because of wellbore problems, modeling formation damage, use of capillary pressure analysis for rock characterization.

0650-432 Well Testing (Pre-requisites: 0650-324, 0650-355) (3-0-3)

Derivation and solutions of the diffusivity equation, principle of superposition, and different types of transient pressure analysis tests as applied to oil and gas wells, type-curve analysis, well test analysis of fractured formations.

0650-435 Production Equipment Design (Pre-requisites: 0650-411) (3-0-3)

Principles of design and operation of the surface production facilities including gas-oil separators, heater treaters and desalters, oil skimmers, flotation cells and subsurface equipment such as packers, tubings, safety and control valves, types of wellheads and Christmas trees of natural flow wells, design and operation of various artificial lift equipment including sucker-rod pumps, ESP, hydraulic pumps.
0650-437 Numerical Methods in Petroleum Engineering (3-0-3)
(Pre-requisites: 0600-308, 0650-324, 0650-333)

Solution of partial differential equations commonly encountered in petroleum engineering applications, introduction to the principles of model formulation for both linear and nonlinear systems.

0650-438 Advanced Well Completion (3-0-3)
(Pre-requisites: 0650-341)

Fundamental principles underlying casing, tubing, and cementing design, packers, well completion and planning of vertical, horizontal and multilateral wells.

0650-442 Industrial Safety for Oil Field Operations (3-0-3)
(Pre-requisites: Completion of 90 Credit hours)

The course enables the audience to gain expertise in diagnosing all types of hazardous faults of a variety of engineering related operations including: storage and transportation of oil and gas, gas flaring, drilling and completion of oil wells, and safe production of hydrocarbon reservoirs. The course emphasizes the various techniques for controlling various hazardous situations and teaches the audience skills for designing inherently safe plants, and proposing changes to existing ones.

0650-443 Offshore Technology (3-0-3)
(Pre-requisites: 0650-411)

Introduction to offshore operations, procedure for the design and construction of the equipment and facilities of offshore operations, selection of offshore equipment.

0650-445 Storage and Transportation of Crude Oil and Gas (3-0-3)
(Pre-requisites: 0600-208, 0650-411)

Methods of crude oil and gas transportation, types of storage tanks and pressure vessels, design and selection of storage tanks according to API standards, maintenance of storage tanks.

0650-447 Oil Field Corrosion and Corrosion Control (3-0-3)
(Pre-requisites: 0630-341 or 0640-327 or 0650-341)

Theories of corrosion, causes of corrosion in drill strings, casing, tubing and production equipment, evaluation of corrosion, methods of detecting corrosion, preventive measures.

0650-449 Petroleum Economics (3-0-3)
(Pre-requisites: 0600-209, 0650-324)

Economics of the upstream sector in all its aspects: reserves, players (international oil companies, national oil companies, service companies), investments, costs and benchmarking, certainty economics applied to petroleum projects cash flow including taxation, decline curve analysis and oil and gas reserve estimate, application of uncertainty
analysis and the use of statistical and probabilistic properties of reservoir description, standard methods of investment analysis when risk has to be coped with.

0650-450 Industrial Training (0-10-3; 200 hours of training)  
(Pre-requisites: 0650-411, Completion of 90 credit hours and the consent of PE department)

The purpose of this field training is to acquaint the student with the various petroleum industry disciplines structured for characterization and exploitation of oil and gas fields. Such disciplines may include core analysis and interpretation of well tests and well logs, geology and subsurface mapping, design of drilling and production facilities, the use of reservoir simulators for the design and prediction of reservoir performance. Students spend a period of six weeks (minimum of 200 hours) on work training with an oil company operating in Kuwait, or in the Gulf area. Each student presents a comprehensive report of his/her training activities and assignments upon completion of the training period.

0650-451 Reservoir Modeling (3-0-3)  
(Pre-requisites: 0650-437)

Development of the general material balance equation, solution of PDE using numerical methods, prediction of reservoir performance.

0650-452 Thermodynamics and Phase Behavior of Petroleum Fluids (3-0-3)  
(Pre-requisites: 0600-208 or 0650-323)

Application of chemical thermodynamics to the behavior of reservoir fluids, with emphasis on phase behavior of multi-component mixtures.

0650-453 Fractured Reservoir Characterization (3-0-3)  
(Pre-requisites: 0650-324)

Geological aspects, well testing and well log analysis of naturally fractured reservoirs, reservoir performance.

0650-454 Transport Phenomena in Geo-systems (3-0-3)  
(Pre-requisites: 0600-208, 0410-240)

Momentum, energy and mass balances as applied to the field of transport phenomena and their implications on the fluid flow in porous media.

0650-461 Rock Mechanics in the Oil Industry (3-0-3)  
(Pre-requisites: 0650-341)

Mechanical behavior of rocks with application to petroleum exploration, drilling, production, and stimulation.
0650-463 Directional Drilling  
(Pre-requisites: 0650-341)  (3-0-3)

Planning and calculating directional well trajectory, survey calculation techniques, equipment and bottomhole assembly used in directional drilling operations, torque and drag problems in directional wells.

0650-464 Horizontal Well Technology  
(Pre-requisites: 0650-341)  (3-0-3)

Drilling and completion of horizontal wells, different types of horizontal wells based on build-radius, logging systems, performance and analysis of horizontal wells.

0650-465 Drilling in Abnormal Pressure Zones  
(Pre-requisites: 0650-341)  (3-0-3)

Estimating the naturally occurring pressure of subsurface formation fluids and the maximum wellbore pressure that a given formation can withstand without fracture, well control in abnormal pressure zones.

0650-467 Advanced Well Control Operations  
(Pre-requisites: 0650-341)  (3-0-3)

The course focuses on practical experience that a rig crew should have to control an oil well during drilling operations. This includes various methods for handling gas and liquid kicks, handling lost circulation and performing leak-off tests, the course trains students extensively on an interactive drilling simulator in order to sharpen their drilling skills and develop reliable safety records.

0650-469 Practical Advances in Drilling Engineering  
(Pre-requisites: 0650-341)  (3-0-3)

Well design and planning using general drilling software packages and the ADS 9800 drilling simulator system.

0650-471 Natural Gas Sweetening and Dehydration  
(Pre-requisites: 0640-321 or 0650-323)  (3-0-3)

An overall view of natural gas engineering with particular emphasis on occurrence of gas hydrates and their prevention, treatment of recovered natural gas for marketing.

0650-475 Well Stimulation  
(Co-requisites: 0650-432)  (3-0-3)

The course emphasizes the basic fundamentals and design aspects of sandstone and carbonate reservoir stimulation by acid treatment, and by hydraulic fracturing.
0650-485 Introduction to Geostatistics (3-0-3)
(Pre-requisites: 0600-304, 0650-324)

Spatial correlations, use of optimal interpolation schemes (Kriging), use of synthetic field generation, use of geostatistics for the characterization of hydrocarbon reservoirs, statistical methods and their accuracies are presented.

0650-495 Senior Project (3-0-3)
(Pre-requisites: 0650-411)

This course is oriented toward designing and finding solutions to open-ended problems. This task integrates several areas of petroleum engineering and involves design, research and analysis skills.

0650-496 Petroleum Engineering Design (3-0-3)
(Pre-requisites: 124 credits & department consent)

Team-oriented design projects involving the application of geologic and engineering methods to the planning of drilling hydrocarbon wells. This is a capstone design course.
DEPARTMENT
OF
INDUSTRIAL & MANAGEMENT SYSTEMS
ENGINEERING
Mission

The mission of the Industrial And Management Systems Engineering Program is to graduate competent students with capability to work in leading local and international organizations and potential for lifelong learning; and to provide faculty with the required resources and environment to excel in teaching, research, and community service.

Vision

The vision of the program is to be recognized as a leading educational institution in Industrial and Management Systems Engineering in the region; attracting high-caliber students and faculty members.

To satisfy the Mission and Vision of the Department and meet the needs of its constituents, three Educational Objectives have been adopted after consulting with faculty, employer representatives, and studying ABET models of leading educational institutions. In addition, a set of Student Outcomes are developed.

Program Educational Objectives

Graduates of the IMSE program are expected within a few years of graduation to:

- have engaged in careers in a broad range of Industrial and Management Systems Engineering areas, or successfully pursued advanced studies.
- have assumed leadership roles, and engaged in continuous professional development in response to technological and social challenges.
- have contributed to the welfare of society and the development of the profession through active participation in societal and/or professional activities.

Student Outcomes

Achievement of the following Student Outcomes would indicate that the graduates are equipped with the necessary knowledge and skills to achieve the Educational Objectives. The first eleven Student Outcomes are similar to those listed under Criterion 3 of ABET EC2000.

- Ability to apply knowledge of mathematics, science and engineering to model and solve Industrial and Management Systems Engineering problems.
- Ability to design and conduct experiments related to deterministic or stochastic systems, as well as to analyze and interpret data.
- Ability to design processes and integrated systems that achieve system design objectives which typically include considerations of productivity, quality, profitability, and ergonomics and safety.
- Ability to work in multidisciplinary teams providing Industrial Engineering input, as well as leading and/or coordinating the team's project.
• Ability to identify, formulate and solve Industrial and Management Systems Engineering problems.
• Ability to understand and appreciate professional conduct and ethical responsibility.
• Ability to communicate effectively.
• Ability to understand the impact of engineering solutions in a global and social context.
• Ability to engage in life-long learning and appreciate the need for continual self-development.
• Knowledge of contemporary issues.
• Ability to use the techniques, skills, and the modern engineering tools necessary for Industrial and Management Systems Engineering.
• A competency to apply Industrial and Management Systems Engineering techniques and tools in diverse types of organizations with focus on quality engineering and management, productivity and logistics, ergonomics and safety, and engineering economical decisions.

CURRICULUM

I. GENERAL EDUCATION COURSES (21 Credits)

A. Compulsory (12 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0330-100</td>
<td>Modern and Contemporary History of Kuwait</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
</tr>
<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Elective (9 Credits)

Students choose 9 credits from the list of General Education Courses approved by the College.

II. MATHEMATICS AND BASIC SCIENCE COURSES (27 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
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<tr>
<td>0410-102</td>
<td>Calculus II</td>
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<tr>
<td>0410-111</td>
<td>Linear Algebra</td>
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<td>0410-211</td>
<td>Calculus III</td>
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<tr>
<td>0410-240</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
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<tr>
<td>0420-101</td>
<td>General Chemistry I</td>
<td>3</td>
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<tr>
<td>0420-105</td>
<td>General Chemistry I Lab</td>
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<td>0430-101</td>
<td>Physics I</td>
<td>3</td>
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<tr>
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<td>Physics I Lab</td>
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<td>0430-102</td>
<td>Physics II</td>
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<td>0430-107</td>
<td>Physics II Lab</td>
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## III. College of Engineering Requirements (21 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>0600-099</td>
<td>Introduction to Engineering Programs</td>
<td>0</td>
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<tr>
<td>0600-104</td>
<td>Engineering Graphics</td>
<td>2</td>
</tr>
<tr>
<td>0600-200</td>
<td>Computer Programming for Engineers</td>
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<tr>
<td>0600-205</td>
<td>Electrical Engineering Fundamentals</td>
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<tr>
<td>0600-207</td>
<td>Electrical Engineering Fundamentals Lab</td>
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<tr>
<td>0600-208</td>
<td>Engineering Thermodynamics</td>
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<td>0600-209</td>
<td>Engineering Economy</td>
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<tr>
<td>0600-304</td>
<td>Engineering Probability and Statistics</td>
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<tr>
<td>0600-308</td>
<td>Numerical Methods for Engineers</td>
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## IV. Required from IMSE Dept. (51 Credits)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>0600-102</td>
<td>Workshop</td>
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<td>0600-202</td>
<td>Statics</td>
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<td>0600-204</td>
<td>Strength of Materials</td>
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<tr>
<td>0660-221</td>
<td>Introduction to Industrial Engineering</td>
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</tr>
<tr>
<td>0660-312</td>
<td>Industrial Engineering Labs</td>
<td>2</td>
</tr>
<tr>
<td>0660-321</td>
<td>Work Design and Measurement</td>
<td>3</td>
</tr>
<tr>
<td>0660-325</td>
<td>Safety and Health for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>0660-351</td>
<td>Engineering Statistical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0660-352</td>
<td>Production Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0600-361</td>
<td>Operations Research I</td>
<td>3</td>
</tr>
<tr>
<td>0600-372</td>
<td>Project Management and Control</td>
<td>3</td>
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<tr>
<td>0660-434</td>
<td>Facilities Planning and Design</td>
<td>3</td>
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<tr>
<td>0660-454</td>
<td>Production Planning and Inventory Control</td>
<td>3</td>
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<tr>
<td>0660-457</td>
<td>Quality Control</td>
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<tr>
<td>0660-461</td>
<td>Operations Research II</td>
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<tr>
<td>0660-471</td>
<td>Engineering Management</td>
<td>3</td>
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<tr>
<td>0660-481</td>
<td>Systems Simulation</td>
<td>3</td>
</tr>
<tr>
<td>0660-496</td>
<td>Design in Industrial Engineering</td>
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## V. Required from NON – IMSE Dept. (9 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>0630-241</td>
<td>Material Science and Metallurgy</td>
<td>3</td>
</tr>
<tr>
<td>0650-312</td>
<td>Petroleum Industry</td>
<td>3</td>
</tr>
<tr>
<td>0630-353</td>
<td>Manufacturing Processes</td>
<td>3</td>
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</table>

## VI. IMSE Electives (15 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>0660-381</td>
<td>Data and Decision Analysis</td>
<td>3</td>
</tr>
<tr>
<td>0660-395</td>
<td>Industrial Engineering Internship</td>
<td>3</td>
</tr>
<tr>
<td>0660-419</td>
<td>Special Topics in Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0660-425</td>
<td>Human Factors Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0660-429</td>
<td>Ergonomics and Safety in Process Industries</td>
<td>3</td>
</tr>
<tr>
<td>0660-445</td>
<td>Manufacturing Systems</td>
<td>3</td>
</tr>
<tr>
<td>0660-446</td>
<td>Computer Aided Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>0660-451</td>
<td>Reliability and Maintainability Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0660-456</td>
<td>Productivity Improvement Methods</td>
<td>3</td>
</tr>
<tr>
<td>0660-458</td>
<td>Design of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>0660-459</td>
<td>Quality in Health Care</td>
<td>3</td>
</tr>
<tr>
<td>0660-464</td>
<td>Optimization Methods</td>
<td>3</td>
</tr>
<tr>
<td>0660-470</td>
<td>Supply Chain and Logistics</td>
<td>3</td>
</tr>
<tr>
<td>0660-487</td>
<td>Expert Systems in Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0660-489</td>
<td>Special Topics in Management Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>0660-494</td>
<td>Industrial Engineering in Process and Service Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
Department of Industrial and Management Systems Engineering

DEPARTMENT OF INDUSTRIAL AND MANAGEMENT SYSTEMS ENGINEERING COURSES

0660-221 Introduction to Industrial Engineering (3-0-3)  
(Pre-requisite: 0600-102)

Definition and concepts of industrial and management systems engineering (IMSE), the roles and jobs of industrial engineers, professional conduct and ethics of engineers, activities of IMSE, applications of IMSE tools and techniques to real-world organizations.

0660-312 Industrial Engineering Labs (0-6-2)  
(Pre-requisite: 0600-304, 0660-221)

Lab experiments, analysis, and writing reports. Includes basic experiments covering quality, work design and measurement, facilities, simulation, ergonomics and safety.

0660-321 Work Design and Measurement (3-0-3)  
(Pre-requisite: 0600-304, 0660-221)

Work study, productivity, and quality of life; the work study approach, method study procedure, techniques and tools for process analysis and redesign and simplification, work measurement sampling and time study, setting time standards.

0660-325 Safety and Health for Engineers (3-0-3)  
(Pre-requisite: 0600-304)

Safety and health engineering fundamentals, engineering approach to the control of hazards in industry and business, risks to employees, facilities, production, and the environment, local and international safety and health laws, regulations and standards, incident data recordkeeping and reporting; hazard assessment techniques and controls, safety and health management systems.

0660-351 Engineering Statistical Analysis (3-0-3)  
(Pre-requisite: 0600-304)

Random samples and sampling distributions, point and interval estimation, confidence intervals and tests of hypotheses for a single and two populations for different parameters (mean, variance, proportion), simple linear regression and correlation, multiple linear regression, analysis of variance, nonparametric statistics.

0660-352 Production Cost Analysis (3-0-3)  
(Pre-requisite: 0600-209)

Analysis of cost elements, cost centers, modeling of cost functions, depreciation methods, financial reports and performance analysis, break-even analysis, probabilistic and stochastic cost systems.
0660-361 Operations Research I  (Pre-requisite: 0410-111)  (3-0-3)
Models and Methods of operations research in solving engineering and management problems, linear programming, simplex method, duality, sensitivity analysis, transportation, assignment and transshipment methods, network flows methods, integer programming.

0660-372 Project Management and Control  (Pre-requisite: 0600-304, 0600-209)  (3-0-3)
An overview of project management including; proposal and contracts, project scope definition, work breakdown structure, developing a network plan, project scheduling, managing risk, time-cost trade-off, resource allocation and leveling, managing project teams, progress and performance measurement and evaluation (project control), using a project management software, case studies.

0660-381 Data and Decision Analysis  (Pre-requisite: 0600-304)  (3-0-3)
Exploring data by using different tools including data analysis and Pivot Tables using a spreadsheet software, regression analysis for categorical data, introduction to a database software, decision analysis involving multiple objectives, measuring attributes, determining weights of attributes, aggregating benefits, trading benefits against costs, sensitivity analysis, decision analysis under uncertainty, single and multi-attribute utility functions, expected utility criterion, decision trees and utilities, multi-stage decision trees

0660-395 Industrial Engineering Internship  (Pre-requisite: Junior standing and Consent of Department)  (0-9-3)
Practical work for at least 200 hours on a specific practical engineering problem in one of the industrial, service, or consulting organization under the supervision of a faculty member and a focal person from the selected organization.

0660-419 Special Topics in Industrial Engineering  (Pre-requisite: Consent of Department)  (3-0-3)
A topic to be selected by the department to address new subjects in Industrial Engineering.

0660-425 Human Factors Engineering  (Pre-requisite: 0660-325)  (3-0-3)
Basic definitions and concepts of human factors/ergonomics; man-machine systems, human capabilities, design of displays and controls, introduction to engineering anthropometrics and bio-mechanics, design of hand tools and tasks/jobs, introductory manual material handling, design of workstations, environmental conditions.
0660-429 Ergonomics and Safety in Process Industry (3-0-3)
(Pre-requisite: 0660-425)

Review of ergonomic, safety and environmental assessment methodologies, ergonomics applications in process industry, impact of environment on workplace design, control of hazards and risks to employees, facilities, production, and the environment, safety and health regulations and standards.

0660-434 Facilities Planning & Design (3-0-3)
(Pre-requisites: 0660-321; 0660-361)

Facilities planning and its relation to product, process, and schedule design, methods to generate effective layout designs based on flow, space, and activity relationships using analytical, simulation, and computer-aided layout design tools, integration of material handling systems, warehouse operations, automated storage and retrieval systems, modeling and analysis of single and multi-facility location problems.

0660-445 Manufacturing Systems (3-0-3)
(Pre-requisites: 0660-321, 0660-361)

Manufacturing systems and models, high volume production and analysis of production flow lines, assembly systems and line balancing methods, material flow and multi-stage systems, process scheduling with different products, modern manufacturing management systems including just in time and flexible systems, applications of analytical and simulation models in manufacturing systems.

0660-446 Computer Aided Manufacturing (3-0-3)
(Pre-requisites: 0630-353)

High Volume Discrete Parts Production Systems, CAD/CAM fundamentals, Numerical Control (NC) Manufacturing Systems, part programming, NC justification advances in NC (CNC, DNC, Adaptive Control), tooling for NC and CNC, overview of group technology, Flexible Manufacturing Systems (FMS), and robotics in manufacturing, related laboratory experiments.

0660-451 Reliability and Maintainability Engineering (3-0-3)
(Pre-requisites: 0600-304)

Reliability theory and modeling approaches, topics include: failure data analysis, maintainability, reliability models, reliability and maintainability systems, applications and implementation issues and case studies.

0660-454 Production Planning and Inventory Control (3-0-3)
(Pre-requisite: 0600-304, 0660-361)

Methods of production planning, deterministic and stochastic inventory control models, short to intermediate production planning decisions using quantitative techniques, forecasting techniques, aggregate production planning, material requirements planning, production scheduling models.
Identification of bottleneck impact of human performance on productivity, effect of the interaction between technological advances and human capabilities on performance and productivity, cost reduction and productivity improvement programs.

Understanding the concepts of quality in products and services, specifications and tolerances, design of quality control systems, quality control techniques, statistical process control charts for variables and attributes, acceptance sampling techniques, operating characteristics curves, process capability analysis, international quality standards, total quality management (TQM), quality control software.

Introduction to experimentation, review of simple comparative experiments, analysis of variance models and applications, randomized blocks and Latin square designs, factorial designs, regression models and process optimization.

Philosophy and concepts of quality management, tools and techniques for quality improvement, applications of statistical process control in healthcare, quality and measurement in healthcare, the process of patient satisfaction, TQM/CQI strategies in healthcare.

Probabilistic models in operations research, Queuing Theory, Markov Decision Processes and Markov Chains, decision analysis, and utility functions.

Multi objective optimization and goal programming, discrete optimization models and discrete optimization methods, unconstrained and constrained nonlinear programming.

Supply chain and logistic problems, multi-facility networks and location analysis, supply chain restructuring, applications of linear programming and transportation algorithms to supply chain management problems, managing risk and uncertainty in supply chain analysis, software applications.
0660-471 Engineering Management
(Pre-requisite: 0660-221, 0660-352)  (3-0-3)

Engineering management and leadership, the functions of engineering management, business Fundamentals for engineering managers, marketing management, engineers as managers and leaders, quality management systems, ethics in engineering management, globalization, engineering management in the New Millennium.

0660-481 Systems Simulation
(Pre-requisite: 0600-304, 0660-351 or Consent of Department)  (3-0-3)

System definition, manufacturing and service systems, model formulation, discrete events simulation, random number generation, data gathering, simulation input and output analysis, system entities and its attributes, application of simulation languages and software to manufacturing and service systems.

0660-487 Expert Systems in Industrial Engineering
(Pre-requisite: 0600-304, 0660-221)  (3-0-3)

Artificial intelligence and expert systems, applications of expert systems, expert systems components, expert systems development, rule-based knowledge acquisitions and representation.

0660-489 Special Topics in Management Systems Engineering
(Pre-requisite: Consent of Department)  (3-0-3)

A topic to be selected by the department to address new subjects in Management Systems Engineering.

0660-494 Industrial Engineering in Process and Service Systems
(Pre-requisite: 0660- 351, 0660- 461)  (3-0-3)

Application of Industrial Engineering in oil and chemical industries, and power generation and distribution, application in banking and investments firms, application in healthcare and emergency service systems, application in government and public services.

0660-496 Design in Industrial Engineering
(Pre-requisite: Consent of Department)  (0-9-3)

A capstone design course, students are exposed to creative design and synthesis in the various areas of industrial and management systems engineering. All knowledge acquired in mathematical modeling and economic techniques are utilized in conducting the design analysis.
DEPARTMENT OF ARCHITECTURE

Architecture is one of the most important fields and it is one of the measurement criteria for the development of nations and civilizations. This field of specialization is concerned with the planning and design of cities and all building types such as housing, hospitals, educational institutions, hotels, airports, industrial buildings, etc. Architecture is not only the art of the building but also the science of building, including the spaces organization and building systems and services and connections and detailing. It is also concerned with the interior and exterior elevations of buildings and the design of the exterior spaces between buildings. Architecture is also concerned with the planning and designs of cities within the satisfaction of the peoples needs.

The department was initiated because of the need of the country and the region to graduate students to work as creative architects and serve the country and society by designing the cities and buildings which satisfy the social needs and cultural understanding of the society and adapt the environmental conciliations of the region.

The program in the department was quoted from one of the top American schools of architecture and has been developed and modified based on the needs of the Kuwaiti market and the experience of the department. The student has to finish 166 credit units to obtain the degree of Bachelor of Architecture.

Mission

The mission of the program is to disseminate and improve the knowledge of architecture. To provide a balanced and integrated curricula which enable the graduate to combine the theoretical and practical skills in finding unique solutions to challenging architectural tasks. Teaching, research, and community service will always be an integral part of the department's main activities and should always complement and reinforce each other in order for such a mission to be achieved successfully. To supply students with the knowledge and the means to become active participants in the intellectual discourse of the discipline of architecture is also necessary.

Vision

The vision of the department is to be a leading department in the region where it provides the highest quality of education and develops responsible, educated, and professional architects who are able to create a better world through unique and effective architectural ideas and solutions.

Program Educational Objectives

The Educational objectives of the Architectural Department are as follows:

- To educate individuals in the art and science of architecture to assume leading and creative roles as architects and building professionals and to respond to the specific needs of the Kuwaiti society.
**Student Outcomes**

The Architectural program provides essential bases to graduate professional architects that can prove their understanding and capabilities in interacting with the development and the society in a positive and successful manner. The program is designed to ensure that the graduated architects can demonstrate the following capabilities:

- Participate effectively in teamwork
- Recognize the impact of the planning and design solutions on the society reactions.
- Reaching the architectural design solutions based on the methodological analyses and design process.
- Understanding the development process and decision making process.
- Professionalism in dealing with the clients and market demands.
- Respecting the planning and design regulations within the creative way of thinking.
- Understanding the needs and demands beyond the design solutions.
- Understanding the importance of the sustainable architecture and designing in relation to the environmental conditions of the region.
- Respecting the regional identity of the architecture and coop with the new technology and techniques.
- 10 Serving the community through research and training courses.
CURRICULUM

Each student majoring in Architecture must satisfactorily complete a minimum of 166 semester credits. These credits are divided into four categories as follows:

- 19 credits of compulsory general courses (11.45%);
- 15 credits of elective liberal studies courses (9.03%);
- 99 credits of compulsory architectural courses (59.64%);
- 33 credits of elective architectural courses (19.88%).

I. COMPULSORY GENERAL COURSES (19 Credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>9988-123</td>
<td>Intermediate Writing Skills</td>
<td>3</td>
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<tr>
<td>9988-221</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>0330-102</td>
<td>History of Arab and Islamic Civilization (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>0410-101</td>
<td>Calculus I</td>
<td>3</td>
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<tr>
<td>0430-101</td>
<td>Physics I</td>
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<tr>
<td>0430-105</td>
<td>Physics I Laboratory</td>
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<tr>
<td>0330-100</td>
<td>Modern &amp; Contemporary History of Kuwait</td>
<td>3</td>
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Students requiring remedial English and/or mathematics must take:

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>9988-098</td>
<td>Remedial English (10 contact hours)</td>
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<tr>
<td>0410-091</td>
<td>Pre-Calculus (3 contact hours)</td>
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II. COMPULSORY ARCHITECTURE COURSES (99 Credits)

<table>
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<tbody>
<tr>
<td>1610-105</td>
<td>Design Basics in Architecture</td>
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</tr>
<tr>
<td>1610-111</td>
<td>Architecture Communication (1)</td>
<td>3</td>
</tr>
<tr>
<td>1610-112</td>
<td>Architecture Communication (2)</td>
<td>3</td>
</tr>
<tr>
<td>1610-121</td>
<td>History of Architecture (1)</td>
<td>3</td>
</tr>
<tr>
<td>1610-131</td>
<td>Introduction to Architecture</td>
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<td>1610-205</td>
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<td>History of Architecture (2)</td>
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<td>Materials and Methods of Building Construction (1)</td>
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<td>Architectural Design (3)</td>
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<td>1610-321</td>
<td>History of Architecture (3)</td>
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<td>Design of The Luminous and Sonic Environment</td>
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<td>Structural Analysis (2)</td>
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<td>1610-342</td>
<td>Materials and Methods of Building Construction (2)</td>
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<td>Theory and Philosophy of Architecture (2)</td>
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<td>1610-406</td>
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<tr>
<td>1610-433</td>
<td>Urban and City Planning</td>
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III. ELECTIVE ARCHITECTURAL COURSES (33 Credits)

Students choose 11 courses from the following list of Architectural courses. However, the program requires that at least two courses be selected from each of the following four categories.

A. Category I - Visual Category

1610-181 Art Appreciation 3
1610-182 Art and Artists: Introduction to Theory and Practice in Visual Arts 3
1610-281 Painting 3
1610-282 Photography (1) 3
1610-283 Photography (2) 3
1610-284 Ceramics (1) 3
1610-285 Ceramics (2) 3
1610-286 Introduction to Graphic Design 3

B. Category II - Cultural Category

1610-222 Indigenous Architecture 3
1610-224 Architectural Criticism 3
1610-322 History of Western Art 3
1610-421 Architecture in the Middle East 3
1610-480 Special Topics in Architecture 3
1610-485 Architecture Research 3

C. Category III - Professional Category

1610-232 Architects and Architecture 3
1610-331 Introduction to Interior Design 3
1610-332 Introduction to Landscape Architecture 3
1610-333 Introduction to Urban Design 3
1610-334 Introduction to Product Design 3
1610-358 Architectural Professional Training 3
1610-454 Facilities Management and Planning 3

D. Category IV - Technical Category

1610-345 Solar Energy in Buildings 3
1610-441 Design of the Luminous Environment 3
1610-442 Design of the Sonic Environment 3
IV. ELECTIVE LIBERAL ARTS COURSES (15 Credits)

Students choose 5 courses (15 credits) from the following list of Liberal Arts courses and at least 2 courses from one department:

A. Department of Philosophy

- 0360-101 Philosophy of Science 3
- 0360-102 An Introductory to Logic 3
- 0360-103 Principles of Philosophy 3
- 0360-214 History of Science 3
- 0360-227 Moral Philosophy 3
- 0360-302 Symbolic Logic 3
- 0360-312 Aesthetics and Philosophy of Art 3
- 0360-429 Philosophy of Language 3

B. Department of Psychology

- 1350-101 Introductory Psychology 3
- 1350-201 Experimental Psychology (1) 3
- 1350-203 Psychology of Learning 3
- 1350-205 Social Psychology 3
- 1350-206 Physiological Psychology 3
- 1350-208 Psychology of Development I 3
- 1350-415 Environmental Psychology 3

C. Department of Sociology and Social Work

- 1370-101 Introduction to Sociology 3
- 1370-171 Introduction to Anthropology 3
- 1370-201 Social Problems 3
- 1370-202 History of Social Thought 3
- 1370-203 Social Organization 3
- 1370-204 Social Psychology 3
- 1370-205 Social and Cultural Change 3
- 1370-206 Social and Cultural Anthropology 3
- 1370-328 Urban Sociology 3
- 1370-401 Arab Gulf Society 3

D. Department of History

- 0330-101 Modern Arab History 3
- 0330-109 History of the Ancient Arabian Gulf 3
- 0330-215 History of Europe in Middle ages 3
- 0330-219 History of Al–Magreb Al- Islami 3
- 0330-220 History of the Beginning of Islam 3
- 0330-274 History of the Gulf and the Arabian Peninsula in the Islamic Age 3
- 0330-363 History of Modern Europe 3
0330-389  Modern & Contemporary History of Arabian Gulf  3

E. Department of Geography

1340-101  Man and Environment  3
1340-208  Geography of the Arab World  3
1340-242  Population Geography  3
1340-256  Urban Geography  3
1340-315  Arid Zones  3
1340-425  Regional & Urban Planning  3

F. Department of Political Science

1360-101  Introduction to Political Science and Public Administration  3
1360-103  Government and Politics of Kuwait  3
1360-155  Introduction to International Politics  3
1360-201  Western Political Thought  3
1360-202  Islamic Political Thought  3
1360-207  Political Development in the Third World  3
1360-227  Public Opinion & Political Propaganda  3
1360-355  International Organizations  3
1360-415  Governments & Politics of the Arab States  3

G. Department Of Economics

1030-110  Principles of Economics (Micro)  3
1030-111  Principles of Economics (Macro)  3
1030-205  Mathematics for Economists  3
1030-212  Money and Banking  3
1030-304  Economics of Industry  3

H. Department of English Language

0320-106  English Conversation  3
0320-108  Freshman Reading  3
0320-180  Principles of Translation  3
0320-205  Advanced Conversation  3
0320-280  Translation I  3
0320-281  Translation II  3

I. Language Center

9989-201  French Language (1)  3
9989-202  French Language (2)  3
9989-301  French Language (3)  3
9989-302  French Language (4)  3

J. College of Law

0200-105  Human Rights  3
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<td>0200-106</td>
<td>Constitutional law in Kuwait</td>
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</tbody>
</table>

**K. Department of Mass Communication**

<table>
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<tr>
<th>Code</th>
<th>Course</th>
<th>Credits</th>
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<tr>
<td>0380-101</td>
<td>Introduction to Mass Media</td>
<td>3</td>
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</table>
ARCHITECTURAL COURSES

1610-105 Design Basics in Architecture (3-6-5)
(Pre-requisites: None)

The objective of this course is to familiarize students with architectural graphics and to introduce them to the principles and processes of sequencing of exercises emphasizing development of basic skills, ideas, and techniques used in the design of simplified architectural projects. Lecture, studio and field trips.

1610-111 Architecture Communication (1) (1-6-3)
(Pre-requisites: None)

Drawing basics and drafting skills, orthographic drawings: object views (2 & 3 dimensional), architectural drafting: floor plans, elevations & sections, perspective drawings: one-point & two-point.

1610-112 Arch Communication (2) (1-6-3)
(Pre-requisites: 1610-111)

Freehand sketching, architectural black and white rendering using pencil and ink, rendering in colors (pencil, water, magic marker and airbrush), developing perspective views, architectural presentation, modeling, shade and shadows.

1610-121 History of Architecture (1) (3-0-3)
(Pre-requisites: None)

The course focuses on architecture of ancient world civilizations from Prehistoric to Baroque and Rococo architecture. Lecture, discussion.

1610-131 Introduction to Architecture (1-0-1)
(Pre-requisites: None)

The definition of architecture and its professional practice as well as a survey of issues affecting current local and international architectural theory and practice. Lecture, discussion.

1610-181 Art Appreciation (3-0-3)
(Pre-requisites: None)

Art history, criticism, and aesthetics, visual analysis of works of arts as well as historical and critical writings.

1610-182 Art and Artists (1-6-3)
(Pre-requisites: None)

This is a theoretical and workshop course aimed at developing knowledge and aesthetic judgment in the context of direct studio experience. Students are team-taught in painting/drawing, photo-reproduced media and sculpture.
1610-205 Architectural Design (1) (3-6-5)
(Pre-requisites: 1610-105)

Issues and methods in designing environments for human habitation and well-being, reinforcement of graphic and verbal skills necessary to communicate architectural design concepts, projects addressing concepts such as site, functional planning, spatial ordering, form generation, theory and practice of architecture as art and science, interrelationship of function, structure, and form in building design through analytical approach to problem identification and problem solution, exercises in identifying conflicts of various forces normally associated with a variety of building types and the generation of a range of design solutions.

1610-206 Architectural Design (2) (3-6-5)
(Pre-requisites: 1610-205)

Continuing issues and methods taught in ARCH205 in designing environments for human habitation and well-being, reinforcement of graphic and verbal skills necessary to communicate architectural design concepts, projects addressing concepts such as site, functional planning, spatial ordering, form generation, theory and practice of architecture as art and science, interrelationship of function, structure, and form in building design through analytical approach to problem identification and problem solution, exercises in identifying conflicts of various forces normally associated with a variety of building types and the generation of a range of design solutions.

1610-211 Computer Applications in Architecture (2-3-3)
(Pre-requisites: 1610-111)

Visual communication techniques applicable to the design of the built environment using the computer, computer applications include drawing, modeling, rendering, animation, and multimedia presentation, lecture, studio.

1610-220 Theory and Philosophy of Architecture (1) (3-0-3)
(Pre-requisites: 1610-206)

The course is concerned with the architectural philosophy and intentions, meanings and identity, perceptions, components, articulations, trends, and esthetical satisfaction. An attention is also given to approach and solve design problems following theories and conceptual issues through a discipline of design principles, processes and analyses.

1610-221 History of Architecture (2) (3-0-3)
(Pre-requisites: 1610-121)

The course focuses on architecture of the Islamic civilization. It reviews and discusses issues related to history of architecture of the regional civilization and Arabian Gulf region with major emphasis on Kuwait. Lecture, discussion.
1610-222 Indigenous Architecture (Pre-requisites: None) (3-0-3)

Descriptive analysis of the factors contributing to the distinctive aspects of indigenous architecture of the region, research, field survey and documentation of the traditional and transitional architecture of the region.

1610-224 Architectural Criticism (Pre-requisites: 1610-205) (3-0-3)

The aim of this course is to introduce architectural criticism as the methodological bases for evaluation of the premises, the process, the final product, the impact (social, formal, and other) of architectural projects on the surrounding environment, the course illustrates methods of analyzing buildings, and evaluates their impact on people and the environment, students are required to select an architectural landmark from Kuwait for continuous study throughout the course and apply the discussed theoretical knowledge on it.

1610-232 Architects and Architecture (Pre-requisites: None) (3-0-3)

Architectural thoughts of the various ages and civilizations, different materials, tools, and ideas that have determined the contemporary styles of buildings.

1610-241 Structural Analysis (1) (Pre-requisites: 0410-101, 0430-101, 0430-105) (3-0-3)

Basic theories of structural analysis and behavior of typical systems.

1610-242 Materials and Methods of Building Construction (1) (Pre-requisites: 1610-206) (3-0-3)

Physical and behavioral properties of building materials, construction methods and processes for buildings including safety requirements and selection of equipment and materials. Lectures are supplemented with field trips to illustrate the subject matter.

1610-281 Painting (Pre-requisites: None) (1-6-3)

Practical introduction to oil and Acrylic pigments, painting equipment, processes, and media, color, composition, and perception through representational and abstract painting.

1610-282 Photography (1) (Pre-requisites: None) (1-6-3)

The practice of black and white photographic image-making within fine arts context, emphasis on the development of technical skills in relation to personal vision.

1610-283 Photography (2) (Pre-requisites: 1610-282) (1-6-3)

Advanced course of colored photographic image-making within fine arts context.
1610-284 Ceramics (1) (Pre-requisites: None) (1-6-3)
Practical and theoretical exploration of the nature of surface and form as fundamental elements of ceramic sculpture, plaster, and clay sculpture.

1610-285 Ceramics (2) (Pre-requisites: 1610-284) (1-6-3)
Advanced practical and theoretical exploration of the nature of surface and form as fundamental elements of ceramic sculpture, plaster, and clay sculpture.

1610-286 Introduction to Graphic Design (Pre-requisites: None) (2-3-3)
This course aims to develop students architectural presentation and graphic capabilities, which are essential to the success of any design project, through introducing students to various presentation techniques, graphic design illustration, logo design and the like, topics covered include pen &ink drawing and sketching, delineation with various media, college and the like.

1610-305 Architectural Design (3) (Pre-requisites: 1610-206; Co-requisite: 1610-241) (3-6-5)
These design studios deal with site and building design problems, and place emphasis on programmatic and environmental determinants and building in the natural and urban context. Lecture, studio and field trips.

1610-306 Architectural Design (4) (Pre-requisites: 1610-305) (3-6-5)
Continuing the site and building design problems that were investigated in ARCH 305, and place emphasis on programmatic and environmental determinants and building in the natural and urban context. Lecture, studio and field trips.

1610-321 History of Architecture (3) (Pre-requisites: 1610-221) (3-0-3)
This class covers the history of architecture during the 19th and 20th century, especially of the western civilization, and the history of contemporary architecture throughout the world. Lecture, discussion.

1610-322 History of Western Art (Pre-requisites: Completion of 45 credits) (3-0-3)
The history of western art reviewed chronologically from the Renaissance period to the present day, with special emphasis on the relationship of history and visual thought.
1610-331 Introduction to Interior Design
(Pre-requisites: Completion of 45 credits) (2-3-3)

Basic principles of interior design approach and methodology, including derivation of standards, planning and spatial conception, materials and technical considerations. Lecture, studio and field trips.

1610-332 Introduction to Landscape Architecture
(Pre-requisites: Completion of 45 credits) (3-0-3)

Principles, theories, methods, and technologies of landscape architecture, design and practice processes in small and moderate scale urban projects, lecture, discussion.

1610-333 Introduction to Urban Design
(Pre-requisites: Completion of 45 credits) (3-0-3)

Basic spatial and infrastructure elements of the city and how urban places are formed, topics covered include: 1. A topological analysis of buildings, open space, and urban pattern, 2. Incremental development, public-private collaboration, community incentives and control, project implementation strategies, lecture, discussion.

1610-334 Introduction to Product Design
(Pre-requisites: None) (2-3-3)

Product design is a lecture and a project interdisciplinary course with an emphasis on designing competitive quality products related to architecture and urban environments, such as furniture, kitchen-wares, home accessories, curtain design, lighting design, elevator design, door design, windows design, etc. Lecture, discussion.

1610-340 Design of the Luminous and Sonic Environment
(Pre-requisites: 1610-206, 1610-305) (3-0-3)

Architects deal with a broad spectrum of constraints and opportunities when designing or thinking about design, much of the way that a building is experienced relates to the environment created by the building, both within and without. This is especially true in terms of light and sound, the interaction between occupant and building is almost entirely filtered through those two sensory media. This course deals with those channels, their perception, their effect, and how the designer controls or manipulates those experiences. It is necessary to understand the processes, the perceptions, and the materials and tools with which we work.

1610-341 Structural Analysis (2)
(Pre-requisites: 1610-241) (3-0-3)

Problems and processes of design of building structures, structural investigation for design, codes and standards, design of elements and systems of wood, steel, masonry, and concrete for gravity and lateral forces.
1610-342 Materials and Methods of Building Construction (2)  
(Pre-requisites: 1610-242)  
(3-0-3)
Principles, conventions, standards, applications, and restrictions associated with the manufacture and use of existing and emerging construction materials and assemblies. Lectures are supplemented with field trips to illustrate the subject.

1610-345 Solar Energy in Buildings  
(Pre-requisites: Completion of 45 credits)  
(3-0-3)
Policy, design, and development implications of using solar energy in new and existing constructions.

1610-358 Architectural Professional Training  
(Co-requisites: 1610-306, Consent of the Department)  
(0-10-3; 200 hours of training)
Students gain practical experience by attending a training program at one of the approved institutions engaged in the practice of architecture. Training includes architectural design and construction supervision. Each student should submit a formal report related to the program attended at the end of the training period. A minimum of 200 hours of design and supervision training is required for the course.

1610-361 Theory and Philosophy of Architecture (2)  
(Pre-requisites: 1610-220)  
(3-0-3)
A survey course of contemporary architectural theories, comprehensive introduction to a wide converge of intellectual frameworks and theoretical thoughts representative to the current discipline of architecture, including the issues and viewpoints on postmodernism, deconstruction, phenomenology, typology, contextualism, tectonic, and etc, text and original writing by leading architects and theoreticians will be examined.

1610-405 Architectural Design (5)  
(Pre-requisites: 1610-306)  
(3-6-5)
This Architectural Design Studio deals with general comprehensive urban design problems while focusing on architecture as a basic element of the urban fabric. The class will include seminars and discussions about theories and philosophies of urban design and planning. Lecture, studio and field trips.

1610-406 Architectural Design (6)  
(Pre-requisites: 1610-242, 1610-405, 1610-443)  
(3-6-5)
The Design studio deals with comprehensive projects requiring accountability and integration for the full range of previously acquired architectural design knowledge, such as, structure systems, materials and methods of building constructions, and building systems. Lecture, studio and field trips.
1610-421 Architecture in the Middle East  
(Pre-requisites: Completion of 45 credits)  
(3-0-3)

Lecture and seminar course focusing on the development of architecture in the Middle East in the twentieth century, research and visual illustrations of the works of prominent architects.

1610-433 Urban and City Planning  
(Pre-requisites: 1610-305)  
(2-3-3)

The purpose of this course is to introduce students to various levels of planning especially urban and city planning, a design field somewhat related to architecture, but one that operates at larger scale. While architecture is practiced largely in the private sector, city planning is applied mainly to work in the public sector. To this end the course will apprise students of some of the theories and techniques of planning as well as the activities those planners are frequently engaged in. This course will be taught in a lecture/discussion format; however, there will be some studio work centering on a small scale urban development exercise. Major topics to be presented in the course include cartography (or the use of GIS software), land use data collection, models of urban development, community facility planning, transportation modeling, population studies and analyses, neighborhood planning, housing, and urban design concepts.

1610-441 Design of the Luminous Environment  
(Pre-requisites: 1610-340)  
(2-3-3)

Basic theories of lighting, ideas, problems, and computations related to the design of buildings in response to the luminous environment. Lectures are supplemented with laboratory sessions to illustrate the subject matter.

1610-442 Design of the Sonic Environment  
(Pre-requisites: 1610-340)  
(2-3-3)

Basic theories of acoustics, ideas, problems, and computations related to the design of buildings in response to the sonic environment. Lectures are supplemented with laboratory sessions to illustrate the subject matter.

1610-443 Building Systems (1)  
(Pre-requisites: 0430-101, 1610-305)  
(3-0-3)

Basic theories of environmental control and building systems and energy management, as well as the relevant codes and regulatory standers and their applications to physical and environmental systems. Lecture, discussion.

1610-444 Advanced Environmental Systems  
(Pre-requisites: 1610-443)  
(2-3-3)

This course is a compressed course in design criteria and calculation methods for (1) mechanical and passive solar systems including loads, plant system, duct, and storage sizing and (2) lighting and acoustics (CIE and IES methods, DBA and NC systems). Lecture, laboratory.
1610-451 Professional Practice (1)  (Pre-requisites: 1610-406)  (3-0-3)
Design methodology, typology programming, site analyses, budget formulation and pro-form procedures, development of comprehensive project documentation, detailing, specifications, drawing formats and organizations, the architect’s role in project design and construction, the administration of the construction contract, and in the relationship with others involved with the project, types of documentation required to render competent and responsible professional service. Lecture, discussion.

1610-452 Professional Practice (2)  (Pre-requisites: 1610-451)  (3-0-3)
Implications of economic systems, finance, and building costs on specific building projects as well as the roles of value engineering, life-cycle cost analysis, and construction cost estimation in the framework of a design project, project and office management, emphasizing professional services and professional ethics and project responsibilities during design and construction, laws and regulations affecting the architecture practice as well as building economics and financing. Lecture, discussion.

1610-454 Facilities Management and planning  (Pre-requisites: 1610-306)  (3-0-3)
This lecture course provides a broad overview and introduction to the field of facility management to develop an understanding of the knowledge and skills needed, the decision-making process and the function of a facility manager within the total organization. The course will cover aspects of planning, analysis and design, implementation and management and technology that concern facility management.

1610-455 Architectural Working Drawings  (Pre-requisites: 1610-306)  (3-0-3)
The development of a design project into architectural working drawings, which illustrates an integration of structure, building systems and other technical knowledge.

1610-461 Building Systems (2)  (Pre-requisites: 1610-443)  (3-0-3)
The basic elements, organization, and design of the building services such as heating, ventilation, and air-conditioning systems, mechanical and electrical, plumbing, communication, security, and vertical transportations systems plumbing, air safety, etc., architectural design implications of heating, ventilation and air-conditioning systems, and its application. Lecture, discussion.

1610-480 Selected topics in Architecture  (Pre-requisites: Completion of 60 credits)  (3-0-3)
Selected topics in Architecture, in depth study of a subject of special interest as a response to important technological, cultural, environmental, aesthetic, and theoretical challenges, topics to be selected by the faculty member teaching the course.
1610-485 Architectural Research (3-0-3)
(Pre-requisites: 1610-306)

This course is an introduction to various domains of architectural research and inquiry, their foundations and framework, relations to design, importance of methods, overview and understanding of research methods currently available in the fields related to architectural studies, including e.g. interpretive-qualitative, argumentative, quantitative and experimental, simulation and modeling and strategies of case studies, etc. Lecture, discussion.

1610-491 Architectural Graduation Project (1) (1-3-2)
(Pre-requisites: 1610-406)

Data collection on selected topic under the guidance of a faculty advisor, formulation and preparation of space program and design brief and requirements in the form of design report study and analysis of selected site constraints and environmental factors.

1610-492 Architectural Graduation Project (2) (2-6-4)
(Pre-requisites: 1610-491)

Formulation of schematic design as translation of the previously prepared design brief under the guidance of a faculty advisor, development of schematic design into preliminary design drawings, modification of the design report toward the final design drawings. A thesis is required to be submitted.
FACULTY

OF

COLLEGE OF ENGINEERING

& PETROLEUM
DEPARTMENT OF ELECTRICAL ENGINEERING

PROFESSORS

1- AL-FUHAID, ABDULLAH SULAIMAN; Ph.D. (1982); North Carolina State University, U.S.A; Kuwait; Professor; Electrical Engineering (1982).

2- AL-MUTHAIRI, NASER FAHAD; Ph.D. (1988); Virginia Polytechnic Institute and State University, U.S.A.; Kuwait; Professor; Electrical Engineering (1988).

3- CHERRI, ABDALLAH KHALIL; Ph.D. (1989); University of Dayton, Dayton, Ohio, USA; Professor; Electrical Engineering (1993).

4- EL-SAYED, MOHAMED AHMED HASSAN; Ph.D. (1978); RWTH University, Aachen, Germany; Egyptian; Professor; Electrical Engineering (2010).

5- GHANNAM, MOUSTAFA YEHIA; Ph.D. (1985); Katholieke Universities' Leuven, Belgium; Belgium; Professor; Electrical Engineering (2006).

6- HABIB, MAHMOUD KASEM RAMADAN; Ph.D. (1978); University of Delaware, USA; Kuwaiti; Professor; Electrical Engineering (1978).

7- HASSAN, MOHAMED FAHIM; D.SC. (doctor d Etat), (1978); Paul Sabatier University, Toulouse, France; Egyptian; Professor; Electrical Engineering (2002).

8- HUSSAIN, MALEK GHULOUM MALEK; Ph.D. (1983); Catholic University of America, Washington DC; Kuwaiti; Professor; Electrical Engineering (1983).

9- MAHMOUD, SAMIR FAHMI; Ph.D. (1973); Queens University, Canada; Egyptian; Professor; Electrical Engineering (1988).

10- ZRIBI, MOHAMED; Ph.D. (1992); Purdue University, West Lafayette, Indiana, U.S.A; Tunisian; Professor; Electrical Engineering (1998).

ASSOCIATE PROFESSORS

1- AL-BARRAK, MOHAMED HADI F.; Ph.D. (1996); University of Colorado at Boulder, U.S.A; Kuwait; Associate Professor; Electrical Engineering (1996).

2- AL-MAZEEDI, MOOSA M.; Ph.D. (1981); The Pennsylavnia State University, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (1981).

3- AL-MUTAIRI, ALI F.; Ph.D. (2000); University of Florida, Gainesville, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (2000).

4- AL-MUTAIRI, NAIF BEJAD; Ph.D. (2002); North Carolina State University, NC, USA; Kuwaiti; Associate Professor; Electrical Engineering (2002).
5- **AL-OMAR, ABDUL-AZEEZ SULAIMAN**: Ph.D. (1988); Cornell University, Ithaca NY, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (1988).

6- **AL-RIFAI, MUTHANA TALEB**: Ph.D. (1999); Rensselaer Polytechnic Institute, Troy, New York, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (1999).

7- **AL-SHABER, MEHSHAL**: Ph.D. (1998); Rensselaer Polytechnic Institute, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (1998).

8- **AL-ZAYED, AYMAN SULAIMAN**: Ph.D. (2004); North Carolina State University, U.S.A; Kuwaiti; Associate Professor; Electrical Engineering (2004).

9- **KHACHAB, NABIL IBRAHIM**: Ph.D. (1990); The Ohio State University, Columbus, Ohio, U.S.A; Lebanese; Associate Professor; Electrical Engineering (1992).

**ASSISTANT PROFESSORS**

1- **ABDULRAHEEM, YASER MOHAMMED**: Ph.D. (2004); University of California, Los Angeles; U.S.A; Kuwaiti; Assistant Professor; Electrical Engineering (2004).

2- **AL-AJMI, FAHAD SHAMMAKH**: Ph.D. (2007); North Carolina State University, Raleigh, U.S.A; Kuwaiti; Assistant Professor; Electrical Engineering (2007).

3- **AL-GHARABALLY, MISHAL HISHAM**: Ph.D. (2007); University of California - San Diego, U.S.A; Kuwaiti; Assistant Professor; Electrical Engineering (2007).

4- **AL-KANDARY, ALI AHMED ALI ABDULAH**: Ph.D. (2005); University of Southern California, U.S.A.; Kuwaiti; Assistant Professor; Electrical Engineering (2005).

5- **AL-NASEEM, OSAMA ABDULRAHMAN**: Ph.D. (2001); University of Colorado at Boulder, U.S.A; Kuwaiti; Assistant Professor; Electrical Engineering (2001).

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7- **ALQALLAF, ABDULLAH K.**: Ph.D. (2009); University of Minnesota - Twin Cities; U.S.A; Kuwaiti; Assistant Professor; Electrical Engineering (2009).
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