University of Prince Mugrin (UPM)

College Bulletin
College of Engineering

Academic Year 2023-2024
Version 1.0

Document Control

Document Information

	Information
Document Name	CoE Bulletin 2024
Document Owner	College of Engineering, UPM
Issue Date	May 30, 2024
Last Saved Date	May 30, 2024
Document Code and Version	Vr. 1.0

Document History

Version	Issue Date	Changes
1.0	May 30, 2024	First release

Document Approvals

Council / Committee Name	Reference No.	Date
College Council	CoE Council MoM No. 62	13 May 2024

1. *Table of Content*

2. *List of Figures*

3. *List of Tables*

1. *General Information*

1.1 The University

The University of Prince Mugrin (UPM) is a pioneering project of AlBayan Charity Foundation for Education, which was established in 2014 in Al-Madinah Al-Munawwarah (Medina). Previously, it was called AlBayan Private Non-profit Colleges, then transformed to UPM by the minister's council decree No. 22 dated 09/01/1438H.

UPM is the first and only non-profit private university in Medina with two campuses to accommodate male and female students. UPM is an emerging and rapidly growing institution of higher education, the campus provides a multicultural environment with the presence of students from more than 30 countries who constitute to the university's diversity and global outlook.

The medium of instruction for all degree programs is in the English language, where students are taught by highly qualified Saudi and international faculty members to provide the highest standards of academic services. The university offers academic programs through its three colleges: Engineering, Business and Tourism, and Computer and Cyber Sciences, with 12 bachelors-level degree programs. The Preparatory Year Program (PYP) is available to develop students' essential capabilities in English, Mathematics and Computing essentials.

UPM aspires to be one of the leaders in higher education in KSA by leveraging its multiple, internationally benchmarked academic programs that are designed by following international benchmarking criteria with the curriculum of top universities in each field. The Engineering, Computer Sciences and Business Administration programs were developed by the University of Connecticut (UConn) as per the contracted project between the American International Education Services, Ltd., and Al Bayan Foundation for Education. The primary purpose of this project is to assist in applying the highest international standards and the best academic practices while addressing the local needs of Saudi Arabia. UPM policies and organizational structure were provided by UConn as well as the department handbook containing course specifications and syllabi for all classes.

Moreover, to ensure that the university's programs are globally competitive, Al Bayan was keen to establish distinct contacts and associations with international universities such as Connecticut University, Boston University, Texas University, Illinois University, Michigan University, Manchester University, Leeds University, Minnesota University, Cardiff University and Dublin University.

1.2 The Campuses

UPM has two campuses housed in Al-Madinah AlMunawwarah (Medina); the female campus is located Mudhainib district - King Abdullah Road and consisting of 26,133 square meters, while the male campus is located Alaqool district– King Khalid Road and consists of 39,998 square meters. Both campuses can accommodate up to 3,000 students. The campuses include preparatory year building, academic building, laboratories building, university administration building, and a mosque. All buildings are equipped to provide a state-of-the-art learning environment including offices, lecture halls, auditoriums, lounges and a student union, libraries, gym, and cafeterias.

1.3 University Mission

Empowering individuals and communities with excellent educational programs, research and innovation consistent with development priorities, and community services based on effective partnerships.

1.4 University Graduate Attributes

UPM has formed a set of attributes; a list of skills, and characteristics which all students should have had the opportunity to develop during their studying time at the university. UPM graduates will be:

1) Analytical Thinking and Problem Solving.
2) Effective Communication.
3) Leadership and Teamwork Skills.
4) Commitment to Values and Ethics.
5) Professionalism in Selected Field of Study.
6) Global Perspective.
7) Lifelong Learning.

1.5 Preparation Year Program

The preparatory year program serves the purpose of minimizing the gap between secondary and university education. This program enables our students to broaden the horizons of their learning and prospects to develop their creative and analytical approach. Our comprehensive program is designed to offer a perfect combination of English language and different scientific subjects.

Our Prep-Year program is the gateway through which new students enter in the university and is dedicated to students' need which promote both the necessary capacities for life-long learning and the knowledge base that is transferable across different academic disciplines and vocational contexts.

The program is committed to providing students with the opportunity to enhance their ability to think critically, develop their communication and mathematical skills, stimulate their capacities for creative, innovative thinking, and enrich their knowledge of the wider social, cultural, and natural worlds in which they will live and work.

If the student does not meet the criteria for direct admission to the academic program, he must join the preparatory program, and if he meets the requirements for passing the preparatory program, he can begin studying in his academic major.
Students are distributed among the academic programs after they pass the preparatory program at the university according to the specific capacity of each program and college and based on their wishes that they apply to the university.

Required scores to Pass Preparatory year courses:

1- **English Language:**
   C and Above, or 70% and above.
2- **Mathematics:**
   C and Above, or 70% and above.
3- **Computer:**
   D and Above, or 60% and above.

1.6 General Studies Department

The Department of General Studies is one of the first educational departments to be in contact with the newly enrolled students at the University of Prince Mugrin. Our mission is to provide students with knowledge and skills in mathematics and applied physical sciences that will enable them to cope with the challenges of their specialization courses. This target is achieved by bridging the gap between students' secondary school education and professional degree programs through a supportive learning environment.

1.7 English Language Department

The English Language Department at the University of Prince Mugrin endeavors to provide students with a supportive and dynamic learning environment which aims to foster a passion and enthusiasm for learning through outstanding educational practices. The ELD is committed to providing high quality intensive English language instruction to students for them to develop as independent critical thinkers and enhance their English language skills, so that they can successfully study and thrive at the undergraduate level and beyond.

1.8 Computer Labs

COE has 3 main Computer labs (Figure 1): One in the male campus, and two computer labs in the female campus. These computer laboratories are used for the CAD and BIM courses. It is used also for other courses that need using computer simulation software. The laboratory has 25 dedicated desktop computers, and laptop-friendly tables with power ports. All of the desktop computers are loaded with Autocad, Autodesk Revit 2017, Autodesk 3ds Max 2017, Adobe Creative Cloud, SAP2000 15.1.0 WS, etc., in addition to traditional office software. This laboratory also helps expose students to industry standard and to the principles of engineering design, including teamwork, project management, design drawings and engineering practice.

Figure 1: Computer Labs

1.9 College Mission

To produce quality academic programs in engineering and related design disciplines, provide a sustainable and productive environment that supports research, innovation, and teaching excellence, meet the requirements of national development and play a leading role in the needs of society.

1.10 Policies & Procedures

You can refer to the link below for Policies and Procedures: 21 - UPM Policies Approved
Or you can visit the website: Student Affairs Policies and Procedures - upm

1.11 Career Centre

In light of the Kingdom of Saudi Arabia's ambitious vision towards 2030, a firm commitment to developing human capabilities is evident as a pivotal pillar for achieving sustainable development and economic success. Investing in empowering young people and providing them with the skills and knowledge they need to excel in the labor market is not only strategic, but also pivotal to building a diverse and prosperous economic future.

Universities are considered a fertile environment for planting the seeds of excellence and innovation in the hearts of young people, where their professional and personal futures can be shaped through targeted guidance and programmes. The Center offers programs such as "FutureReady," "UPMConnect," and "CareerCraft," which are considered pivotal steps towards achieving this goal, as they provide the necessary tools, skills, and knowledge to enable students and graduates to be ready to face the challenges of the labor market and successfully achieve their professional goals.

1.11.1 Career Centre Mission

Facilitating the transition of university graduates into the competitive labor market by employing effective partnerships and providing them with the elements of success that make them the preferred choice in competitive job sectors. To ensure this, the Center supports students from an early career and life stage through career guidance services, job counselling, future career planning, experiential learning, career connections and direct access to opportunities that support career readiness.

1.11.2 Career Centre Vision

Building a pivotal bridge between academic excellence and career readiness.

1.11.3 Career Centre Units

- Career Readiness.
- Experiential Learning
- Alumni Association

To find more information about the Career and Professional Development Center, please visit their page on the UPM website. You can access it through the following link: Career Center - upm

1.12 Tuition, Fees and Financial Aid

The tuition fee for the College of Engineering is 33,000 SR\Semester (before VAT).

1.13 Health Services

The Medical Services Unit provides its services for both emergency and non-emergency cases within the university. The unit recommends directing cases that require follow-up to a specialized clinic and a specialist doctor, depending on the condition of the case. Additionally, the unit is available to respond to any health inquiries.

The Medical Services Unit locations & Contact Info:

- Male Campus:
  - Room BC115
  - Phone number: 0148318484 Ext. 1046.
  - Email: clinic@upm.edu.sa

- Female Campus:
  - Building B
  - Room GC109
  - Phone number: 0148490707 Ext. 3024.
  - Email: clinic@upm.edu.sa

1.14 Academic Advising

Academic advising plays a crucial role in the College of Engineering as it serves as a vital support system for students throughout their academic journey. The primary responsibility of academic advisors is to communicate with advisees, providing them with guidance and advice regarding their study plans for their years in college. By understanding the unique needs and goals of each individual student, advisors can assist in creating personalized academic plans that align with their aspirations.

The procedure for Academic Advising in the college is as follows: Before the semester starts, the Head of the Department (HoD) will distribute the faculty members (advisors) among the program students. Each advisor will then ensure that they communicate the best options for the academic path to their assigned students (advisees) in order to make sure the students are on the right track. At least one week before the semester begins, the advisor will send the academic plan and all recommendations to their advisees. In the email, the advisor will introduce themselves by providing their name, specialty, and all contact information needed to facilitate communication between them and the advisee.

One of the key benefits of academic advising is that it helps students explore and understand the various options available to them when enrolling in courses. This guidance ensures that students have a comprehensive understanding of the potential outcomes and implications of their course selections. It is important to note that the academic plans were designed in the best interest of the students. The plans should be well explained to the students and they should follow the plan to avoid any delay in their graduation.

Furthermore, academic advisors offer advice and support related to all aspects of the academic side of a student's college experience. They can provide guidance on course sequencing, prerequisite requirements, and alternative pathways to degree completion. In addition, advisors

can offer recommendations on study skills, time management strategies, and campus resources that can enhance academic success.

Overall, the Academic Advising process in the college ensures that students receive personalized guidance and support to make informed decisions about their academic journey, leading to a successful and fulfilling college experience.

1.15 Contact Information

University Of Prince Mugrin - Male campus
FPH5+XV6,
Al Aqool, Medina 42241,
Saudi Arabia

University Of Prince Mugrin - Female campus
FPH5+XV6,
Al Aqool, Medina 42241,
Saudi Arabia

Tel: 920000238

Dr. Mohammed AlMansouri
Dean of the College of Engineering
College of Engineering,
University of Prince Mugrin

Phone: 920000238 Ext.1167
Email: m.almansouri@upm.edu.sa

2. *Admission & Registration*

2.1 General Admission criteria

To admit students at University of Prince Mugrin, student should:

- Have high school diploma or its equivalent form the kingdom or abroad.
- Be physically fit.
- Not be dismissed from any other university for disciplinary reasons, otherwise, his/her admission will be revoked.

Table1 : University Admission Criteria based on the educational system

Educational System	High School score
Saudi System	Scientific stream: 80% and Above * Literature stream: 80% and Above
British Diploma IGCSE	Must satisfy one of the below conditions: 1. Eight courses O level grade C and above or 2. 5 courses O level grade C and above in addition to two courses AS with score not less than D or 3. Five courses O level grade C and Above and one course A level with grade D
American Diploma	Student must have the American Diploma and set for SAT exam and score at least 1000 out of 1600

* Engineering programs admit students exclusively from the Scientific Stream

The university can accept high school graduates from other educational systems that follow the non-attendance education pattern if the student fulfills the university's admission requirements, such as: home schooling, or any other programs.

Admission Conditions for Non-Saudi high school certificate:

- American Diploma's should be recognized by the Ministry of Education.
- Saudi high school certificates form outside the kingdom, must be certified from the Saudi embassy at the country of issuing.
- Students who wish to apply to the university who have a general secondary certificate granted by educational systems other than the Saudi educational system must obtain an equivalency for this certificate if it is from outside the Kingdom of Saudi Arabia and provide the required attestations and accreditations if this certificate is issued by a non-Saudi educational system within the Kingdom of Saudi Arabia.
- If the secondary certificates are of a different type - other than what was mentioned above - the applicant must contact the admission and registration department at the university to find out the admission criteria required according to the secondary certificate he or she obtained.

Special Admission criteria

A. Direct Admission to the academic programs:

Admission to the university originally direct students to the academic programs, and the applicant - in addition to the above - must fulfill the conditions below:

Table2 : Conditions for Special Admission to CE Program

Certificate & Test Type	Required score
IELTS or equivalent	Score 5.0 in IELTS for all academic programs.
TOEFL	IBT 35-45 for all programs Paper based 500 for all programs.
UPM placement test	*(Oxford Online Placement Test) 71
UPM math and Computer placement tests	70% and Above

*Students are distributed among the academic programs upon their admission to the university and after fulfilling the admission requirements, according to the determined capacity of each program and college and based on their desire when they apply to the university.

B. Admission to preparatory year program:

If the student does not meet the criteria for direct admission to the academic program, he must join the preparatory program, and if he meets the requirements for passing the preparatory program, he can begin studying in his academic major.
Students are distributed among the academic programs after they pass the preparatory program at the university according to the specific capacity of each program and college and based on their wishes that they apply to the university.

Required scores to Pass Preparatory year courses:

Course	Passing Grade	Equal to out of 100%
English Language	C and Above	70% and above
Mathematics	C and Above	70% and above
Computer	D and above	60% and above

All students enrolled in the preparatory year for the College of Computer and Cyber Sciences programs must achieve a cumulative GPA of no less than 2.5 out of 4.0 in the preparatory year to be admitted into the college's programs.

Documents needed to Apply:

1. Copy of High school certificate or its equivalent.
2. Copy of Saudi ID for Saudi students, Iqama or visit visa for none-Saudis.
3. Copy of Aptitude exam result, if set for the exam
4. Copy of Achievement exam result, if set for the exam.

5. Medical report issued and stamped from a certified hospital or health care center.
6. Copy of English language certificate (IELTS or its equivalent), if available.

2.2 Transfer Students & Courses

Transfer Students

The Admission Department in UPM receives the applications of the students who are willing to transfer from other universities and other educational institutions with the following terms and conditions:

- The applicant was enrolled in a university, or college, recognized by the Ministry of Education.
- The applicant should not have been dismissed for disciplinary reasons from the university he/she is transforming from.
- The applicant must have completed at least one semester in their university.
- The applicant should provide a full course description and the degrees should be officially attested.

Internal transfer between UPM Colleges:

To initiate the transfer process internally, the student must first approach the admission office and obtain a transfer form. The form needs to be signed by both the student's former college/department and the new college/department they wish to transfer to. Upon successful completion of this step, the student will be allowed to select courses from the new program.

Transfer Credits

To transfer their credit hours to UPM, accepted transferred students should fulfil the following requirements:

- The two courses are ascertained to be essentially of the same content by the concerned UPM department or program.
- The student must get grade C or better in these courses.
- The number of credit hours to be transferred must be at least the same as the number of credit hours of the equivalent subjects at UPM.
- Total credit hours to be transferred should not exceed 40% from the approved total credit hours in the needed program.
- The approved courses appear in the student’s academic record as a transferred course (T), but not in the calculation of the GPA.

Any student requesting approval of transferred credit hours for fulfilling University of Prince Mugrin requirements must complete a Transfer Credit Request Form in order to start the evaluation process.

To transfer credits, the procedure of course transfer will be as the following:

i. University must announce times allowed to accept the transfer credit application(s), which is usually before the beginning of first and second semester and should be included into the academic calendar.

ii. When applications are allowed, student must fill, sign, and submit, the course transfer credit request form to the admission department attached with:
   - An official transcript(s) from the previous institution(s).
   - Syllabus(s) and course(s) description(s) from previous institution(s).

iii. Admission office will direct the form and document to the concerned Colleges (head of concerned department) within 24 hours.

iv. Head of Department (HoD) will assign the evaluation process to one or group of instructors to evaluate the potential transfer course(s), and this may take up to 72 hours.

v. An evaluation credit transfer form to be filled with the approved and transferred course(s) by the concerned department and signed by the course(s) evaluator(s) and the Head of Department.

vi. Filled and signed evaluation credit transfer form with the documents submitted by the student to be returned to the Admission Department.

vii. Transferred courses to be entered to the Student's Information Systems (SIS) within 48 hours.

viii. All the original documents related to the transfer credit process are to be filed and kept in the student file.

Internal transfer credit:

Any courses that are not included in the curriculum study plan will be categorized either as free/Professional elective option, or additional credit hours, depending on the guidance provided by the assigned academic advisor.

It is the responsibility of the advisor to determine the appropriate classification for these courses, ensuring a seamless transition into the student's chosen program.

2.3 Visiting Students

1. Registration of visiting students depends on the capacity and requirements of the programs.
2. Visiting students must pay the tuition fees and any other fees in advance as announced by the university.
3. The academic record is issued to these students to show the courses in which they registered and the grades they obtained.

3. *Grading System*

At the end of each semester, the student's performance in each course is evaluated and given a grade using numerical values to indicate the student's overall performance in that course. The numeric value of the course grade is converted to and recorded as a letter value. Below are the final grades for the courses, along with the standard points that are used in calculating the semester and cumulative average.

UPM follows a four-point grading system for calculating grade point averages (GPA). Letter grades and their numeric equivalent values are summarized in Table 1. In addition, one of the grades in Table 2 might be issued and/or appear on student transcripts under certain conditions and approvals.

Grade	Letter Grade	Points	Numerical
Exceptional	A+	4.00	95 -100
Excellent	A	3.75	90 -less than 95
Superior	B+	3.50	85 -less than 90
Very Good	B	3.00	80 -less than 85
Above Average	C+	2.50	75 -less than 80
Good	C	2.00	70 -less than 75
High Pass	D+	1.50	65 -less than 70
Pass	D	1.00	60 -less than 65
Fail	F	0	Less than 60

Table 3: Letter Grades at UPM

Grade	Letter Grade	Description
In-complete	IC	A temporary grade that may be given at the instructor's discretion when a student is unable to complete planned class requirements due to extraordinary circumstances. Incomplete work must be submitted and cleared within the next semester, or the Incomplete will become a letter grade as assigned by the instructor.
In-Progress	IP	"IP" grade is given when the requirements of a research course necessitate more than one semester for completion.
Denied Grade due to Absence	DN	A grade of "DN" indicates that the student was administratively dropped from the course due to excessive absences. No credit is received for the course, and this grade is calculated into the student's grade point average as an F grade.
Withdrawal	W	A grade of "W" indicates that the student withdrew from the course within the specified period, without penalty, and it is not calculated into the CGPA. No credit is received for the course.

Table 4: IC, IP, DN and W Grades at UPM

4. Degree Completion & Graduation

A Bachelor of Science (B.Sc.) degree is awarded to students who have achieved the minimum requirements of credit hours, cumulative grade point average, and other requirements for the program in accordance with the university's applicable regulations and policies.:

1. The credit hours required to obtain a bachelor's degree depend on the student's academic program.
2. The cumulative GPA must not be less than two points (2.00) to obtain a bachelor's degree out of 4.
3. A bachelor's degree will not be awarded to a student if the academic record contains an "incomplete" grade.
4. The student is allowed to register in some additional courses at the university in case the student needs to raise the cumulative average to achieve the minimum required for graduation, based on the recommendation of the academic advisor and the approval of the dean.
5. Students should have studied 60% of the total academic units as a minimum, of undergraduate courses at the university in order to obtain an academic degree from University of Prince Muqrin. These units should include courses in the major of no less than (25) credits.

5. Summer Semester

The university may organize one or more summer semesters during the academic year.

- The maximum duration of the summer semester is eight weeks, not including the final exam period. The courses offered in the summer semester must be equal to those offered in regular semesters in terms of the number of credit hours and the number of teaching hours.
- The summer semester course schedule is considered intensive, and the student is not entitled to register for more than (9) credit hours, with the exception of students expected to graduate, who may register for a maximum of (12) credit hours.
- Courses which may be offered during the summer semester are subject to tuition fees and other fees as determined by the University Council.
- University students may register for courses with credit hours in other educational institutions recognized by the Ministry of Education during the summer semester. Acceptance and calculation of these hours at the University is subject to the following:
  i. The student must obtain prior approval from the college to study the summer semester at recognized educational institutions.
  ii. Courses completed from other educational institutions during the summer semester are counted if their grades are (C) or more.

The grades completed in other educational institutions in the summer semester are not included in the calculation of the average (cumulative and semester) at UPM.

6. *Summer Training & Internship*

- The maximum duration of the summer semester is eight weeks, not including the final exam period. The courses offered in the summer semester must be equal to those offered in regular semesters in terms of the number of credit hours and the number of teaching hours.

- The summer semester course schedule is considered intensive, and the student is not entitled to register for more than (9) credit hours.

- Courses which may be offered during the summer semester are subject to tuition fees and other fees as determined by the University Council.

- University students may register for courses with credit hours in other educational institutions recognized by the Ministry of Education during the summer semester. Acceptance and calculation of these hours at the University is subject to the following:

  a. The student must obtain prior approval from his college to study the summer semester at recognized educational institutions.

  b. Courses completed from other educational institutions during the summer semester are counted if their grades are (C) or more.

- The grades completed in other educational institutions in the summer semester are not included in the calculation of the average (cumulative and semester) at the university.

7. Electrical Engineering

7.1 Program Mission

To graduate professionals in the field of electrical engineering by providing knowledge and skills that enable them to contribute to the profession and the community.

7.2 Program Educational Objectives (PEOs)

PEO1: Graduates of the Electrical Engineering program will have successful careers in Electrical Engineering and related fields.
PEO2: Graduates will engage in continuous learning and professional development to adapt to evolving technologies and evolving Electrical Engineering practices.
PEO3: Graduates will exhibit a sense of ethical responsibility and awareness of the societal impact of their work.

7.3 Student Outcomes (SOs)

SO1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
SO2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
SO3: an ability to communicate effectively with a range of audiences.
SO4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
SO5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
SO6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
SO7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

7.4 Potential Careers For Electrical Engineering Graduates[1]

Career Name	Code	Career Name	Code
Project engineer	2212011	Engineer, electronics	2214011
Electrical engineers	2213001	Engineer, radio and television	2214021
Engineer, electrical	2213011	Engineer, transmission	2214031
Engineer, electric power	2213021	Engineer, telecommunications	2214041
Engineer, transmission and distribution	2213031	Engineer, medical equipment	2214051
Engineer, transmission	2213041	Engineer, computer	2214061
Engineer, distribution	2213051	Engineer, electronic maintenance	2214071
Engineer, installations	2213061	Engineer, radio and radar	2214081
Engineer, maintenance	2213071	Microwave Engineer	2214091
Engineer, precision instruments	2213081	Satellite Cables Engineer	2214101
Engineer, monitoring and control	2213091	Engineer Aux. Power Units	2215211
Engineer, prevention	2213111	Engineer, safety and occupational health	2218051
Electronic Engineers	2214001		

Table 5: Potential Careers for EE Graduates

7.5 Electrical Engineering Laboratories

The College of Engineering resides on main Building (C) of the UPM campus. The CoE was founded in the academic year 2014-2015. The CoE shares 2-story building with other colleges which hosts facilities for different engineering programs. The EE department laboratory facilities are located in the ground and first floors while the first floor contains the offices of the head of department and other faculty members, and the classrooms.

7.5.1 Physics Laboratories

These labs (shown in Figure 2) are prepared for the courses PHYS 101, and PHYS 102. There are the basic science labs which are common for all branches of freshman year with facilities for the group of 20 students/lab to carry out experiments independently. COE has 4 full equipped physics laboratories; two labs in each campus. Each lab is well-equipped and enables students to understand the fundamentals of Engineering Physics.

[1] دليل التصنيف السعودي الموحد للمهن (masar.sa)

Major Equipment: Newton's Ring Apparatus, Diffraction Grating Polarimeter, E/M Thomsons's Apparatus, Resolving Power Apparatus, Carey Foster's Bridge, Sonometer, P-N Junction Diode, Plancks Constant Apparatus, Cauchy Constant Apparatus, Cathode Ray Oscillator, De-Sauty Bridge, Ionisation Potential Apparatus, Solar Cell Apparatus, B-H Curve Apparatus etc.

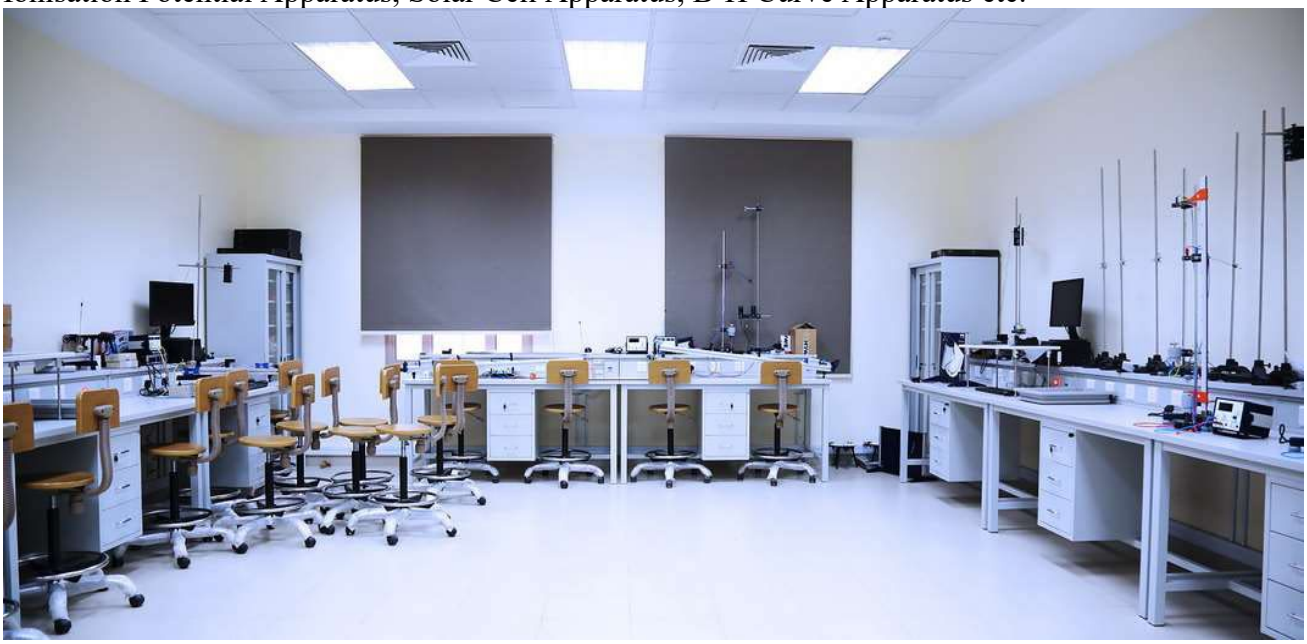


Figure 2: Physics Laboratory

7.5.2 Chemistry Laboratories

These labs are prepared for the course CHEM101 (Figure 3). The COE has two engineering chemistry laboratories, one in each campus. Each lab is aptly prepared to impart education in chemistry in a neatly designed, spacious and well-ventilated laboratory with a capacity to accommodate 20 students.

It provides students with a practical approach towards the various techniques used in modern engineering application. Practical awareness is inculcated, and students are trained both quantitatively and qualitatively during the lab sessions so that their understanding and problem-solving abilities can be enhanced.

Major Equipment: UV-Spectrophotometer, Digital Conductivity Meters, Flame Photometer, Redwood Viscometers, Pensky Marten's Flash & Fire Point Apparatus, Electrical Balance, Distillation Unit, Digital pH Meters etc.

Figure 3: General Chemistry Laboratory

The department has 8 laboratories used for instructional activities. Instructional laboratories feature modern equipment and computer-aided design tools that are more than adequate for most undergraduates. Nevertheless, many students take advantage of state-of-the-art research facilities to support their project work.

On the temporary basis, the Electrical Engineering Laboratory facilities are located on the ground floor: C122, C123, C124, C132, C133 C134, C222, C232 and Senior Design Project Lab. These labs cover the topics of Electrical Circuits, Digital Logic Design, Electronics I and II, Electrical Machines, Power Electronics, Microprocessor and Microcontroller, Power systems, Control Engineering, Communications, Renewable Energy, Smart Grid and SCADA Systems, Computers and Senior Design Project. These laboratories are fully equipped with the required measurement instruments, signal generators, DC power supplies, and computers for simulation purposes. Each laboratory is dedicated to one or more courses according to the Electrical Engineering Department's teaching program. A brief description of the labs is provided below:

7.5.3 Electric Circuit Lab

This lab (Figure 4) involves Measurements of basic electrical circuit voltage, current and components such as resistors, capacitors and inductors. Experimental verification of basic electrical laws and theories such as Ohm, KV, KCL, NVM, MCM, superposition, Norton, Thevenin and maximum power transfer. The lab equipment's include PCs, work benches, digital and analog millimeters, function generators and oscilloscopes etc. simulation tools Multisim are also used.

Figure 4: Electric Circuits Laboratory

7.5.4 Digital Logic Circuit Design Lab

It familiarizes the student with logic gates, combinational logic circuits, synchronous sequential logic circuits, registers, counters, memories, and programmable logic devices. The laboratory is prepared for carrying out the students' research projects and medium scale integration (MSI) circuits. Within this lab, the student tests the validity of the logic concepts. Furthermore, they can analyze, design, build and test basic combinational and sequential logic circuits.

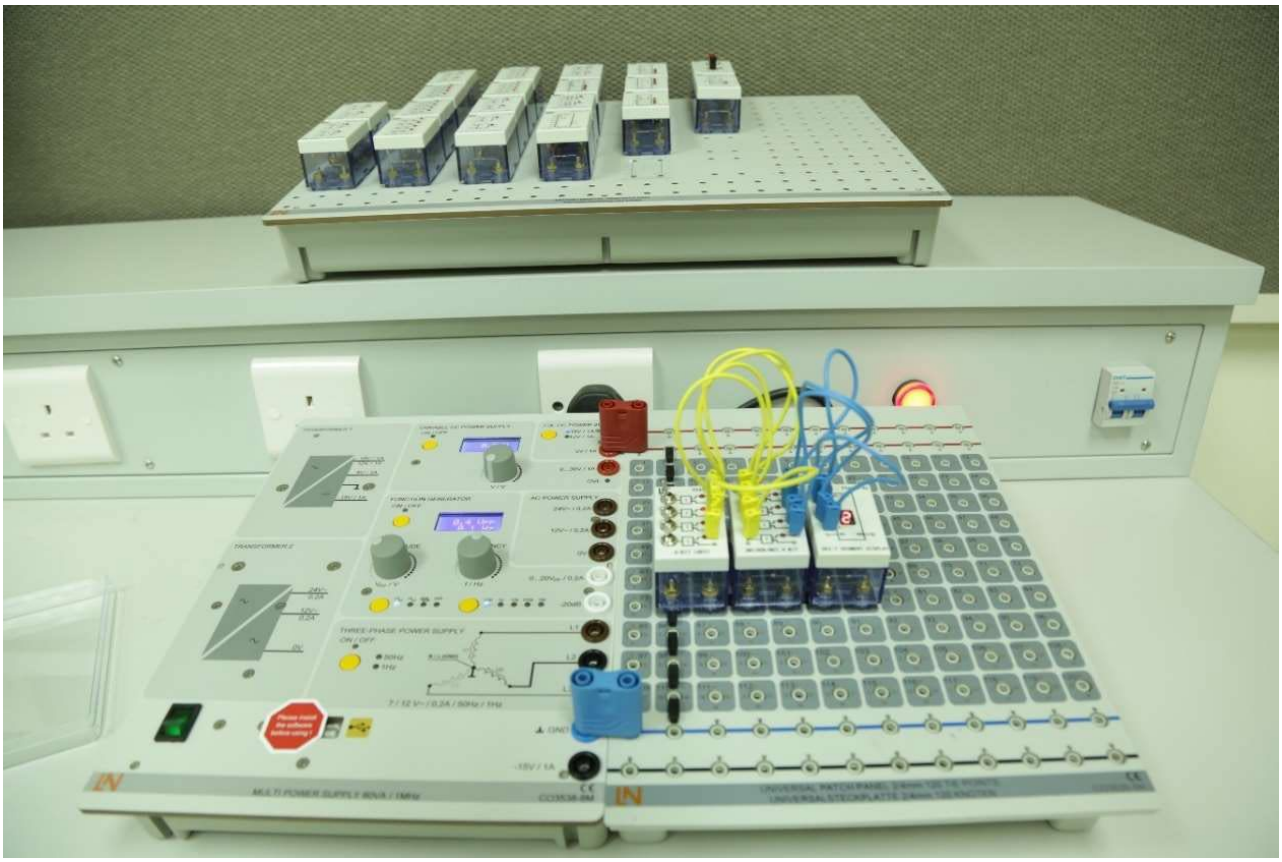


Figure 5: Logic Circuits Design Laboratory

7.5.5 Electronics I and II Lab

In this lab (Figure 6) the students learn the basic operations of electronic components such as diodes, BJT and MOSFET. In addition, the operation and applications of single, multistage, feedback and operational amplifier circuits are demonstrated. Furthermore, the student is exposed to the operation and application of active filters and oscillators. The characteristics and advantages of electronic elements, industrial electronics, and operational amplifiers were explored experimentally.

Figure 6: Electronic Circuits Laboratory

7.5.6 Electric Machines Lab

This lab (Figure 7) focuses on Balanced Three Phase Circuits ،Magnetic Circuit, Single Phase Transformers, DC Generators, DC Motors, Three-Phase Synchronous Generators, Three-Phase Synchronous Motors, Three-Phase Induction Motor with Slip-Ring Rotor, Three-Phase Squirrel Cage Induction Motor and related work benches.

Figure 7: Electric Machines Laboratory

7.5.7 Microprocessor and Microcontroller Lab

In this lab (Figure 8) students perform software and hardware experiments in (Digital Systems Engineering). The laboratory has ten PCs with TASM installed, ten board 8086 embedded training kits and ten training kits for microcontroller 8051. Experiments include: Introduction to Debug and Turbo Debugger, Addressing modes and data transfer instructions, Arithmetic instructions, Shift and rotate instructions. Introduction to 8086 Microprocessor Trainer and Application Board, 8086 Application I – Traffic Lights, – Motor Control and many 8051 Microcontroller applications.

Figure 8: Microprocessor and Microcontroller Laboratory

7.5.8 Power Electronics Lab

Power electronics and its applications lab (Figure 9) cover experiments related to uncontrolled and controlled rectifiers (single phase and three phases), step-up and step-down chopper, ac voltage controller, single phase and three-phase inverter. Simulations of speed control methods for DC motors. Experimental analysis of diode rectifiers. Permanent magnet DC machine simulation. Characteristics of DC machines. Experimental analysis of controlled rectifiers.

Figure 9: Power Electronics Lab

7.5.9 Power Systems Lab

In this lab (Figure 10) the student learns electrical energy generation, transmission and distribution experimentally. In this lab students perform experiments of parallel operation of three phase synchronous generators. Determination of the direct and quadrature axis reactance of synchronous machines. V-curves characteristics of synchronous motor.

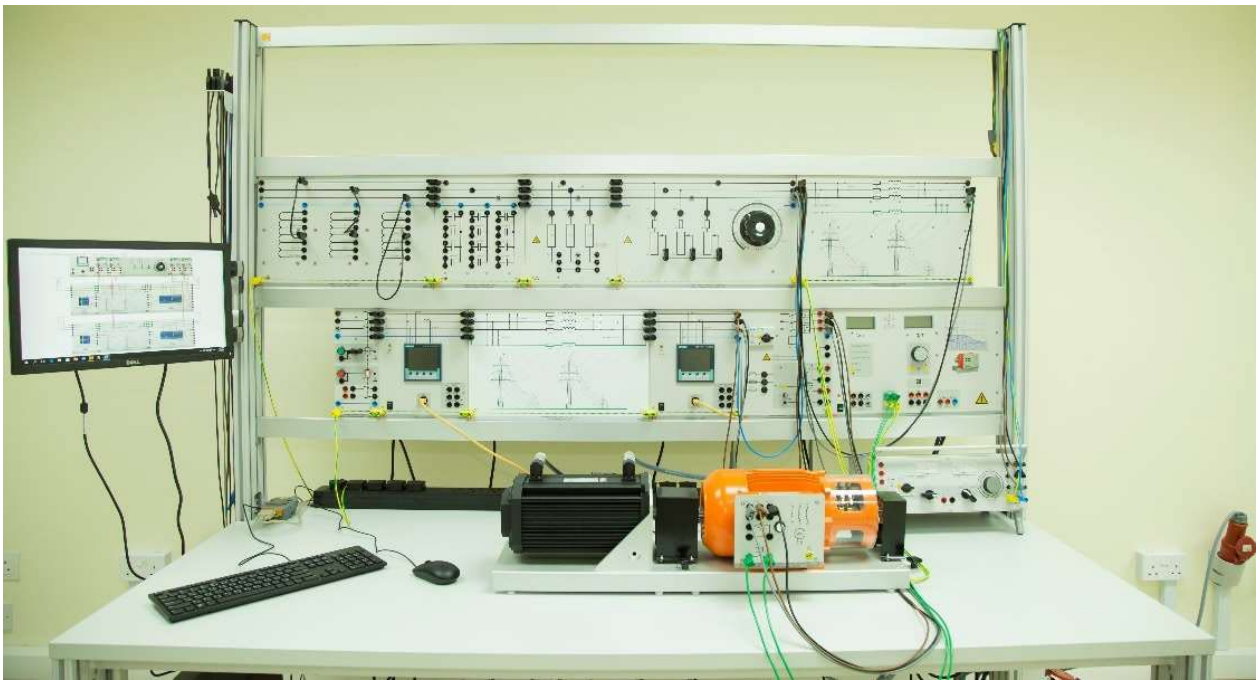


Figure 10: Power Systems Laboratory

7.5.10 Renewable Energy systems Lab

Renewable energy laboratory (Figure 11) includes fuel cell mobile system, PV integrated with battery mobile system, PV integrated with wind system and battery, and finally geothermal mobile system. This lab is devoted to serve mainly the renewable energy systems course and power system courses.

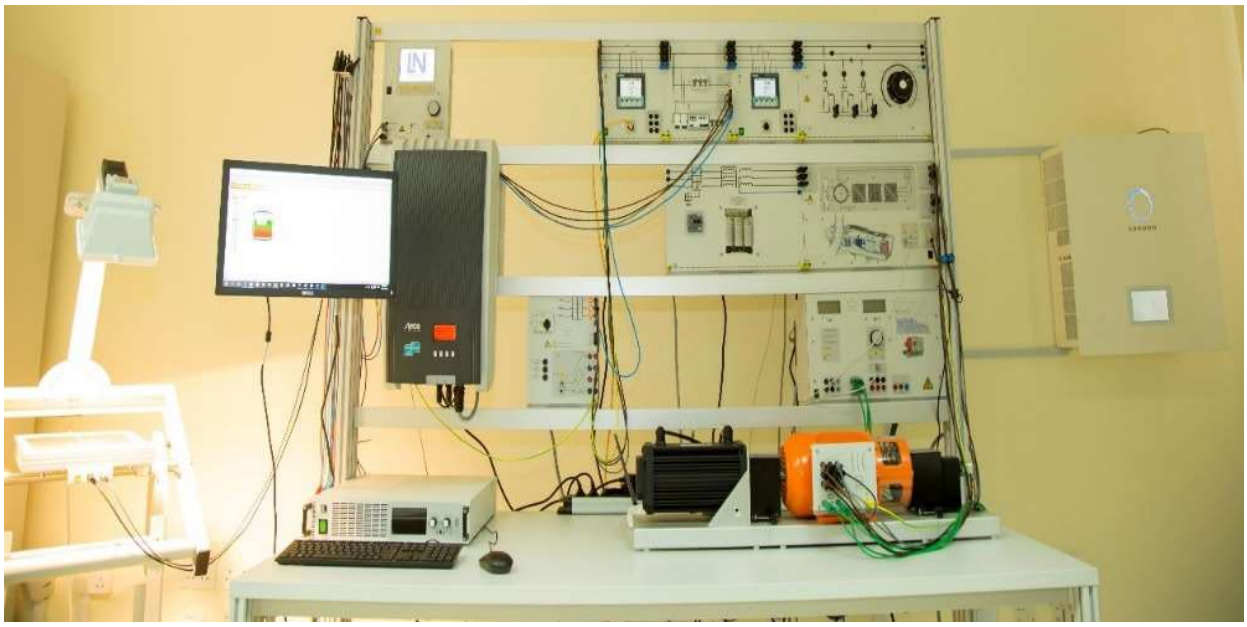


Figure 11: Renewable Energy Systems Laboratory

7.5.11 Smart Grid Systems Lab

In this lab (Figure 12) students perform experiments of operation of smart power grid system and one a number of microgrids operate as part of an interconnected power grid. For example, a photovoltaic (PV) based residential system with its local storage system and load would be one of the smallest microgrids in the smart power grid system. the basic system concepts of sensing, measurement, integrated communications, smart meters, and high green energy penetration of intermittent generation sources.

Figure 12: Smart Grid Systems Laboratory

7.5.12 Communications Systems Lab

The laboratory (Figure 13) has two workstations equipped with PCs, oscilloscopes, and function generators. Hardware experiments are performed using analog and digital communications trainers. Experiments include Amplitude and Angle modulation/demodulation, sampling and quantization, pulse code modulation/demodulation ،and channel effects. Software simulations are carried out. Two spectrum analyzers with bandwidths up to 1.2GHz are also available for observing the spectra of baseband/band pass signals.

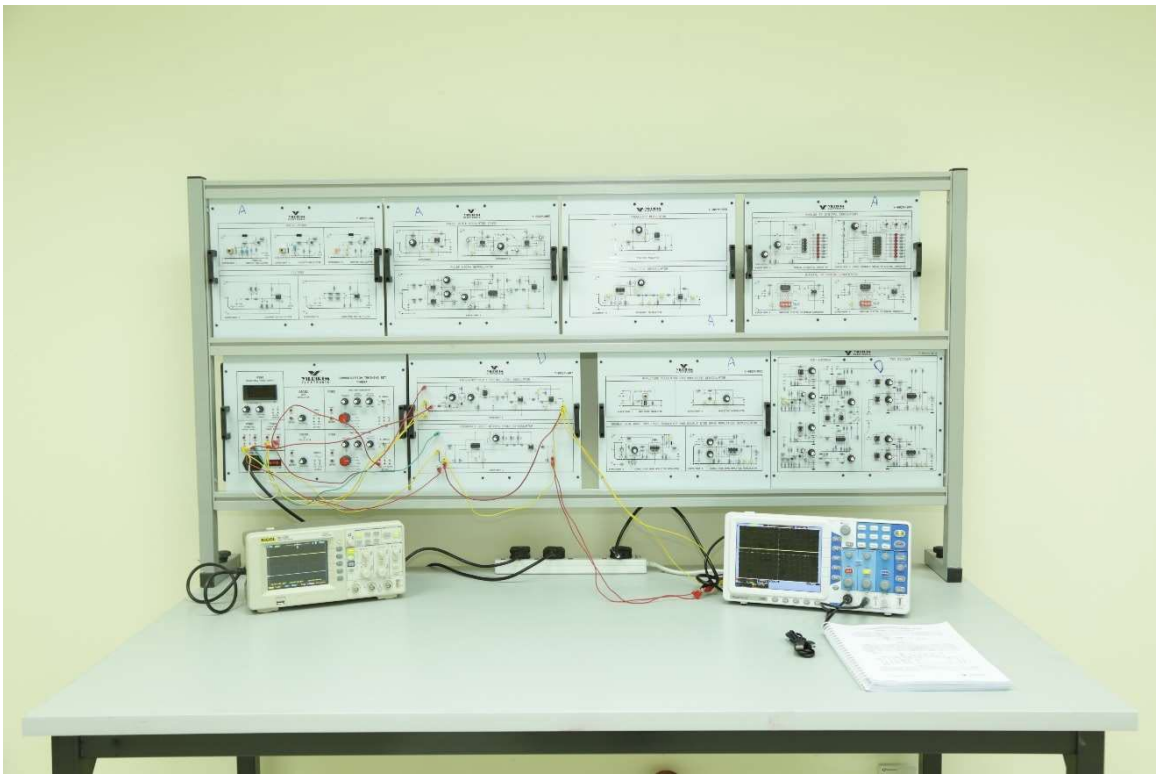


Figure 13: Communication Systems Laboratory

7.5.13 Control Systems Lab

The lab (Figure 14) constitutes the practice part of control engineering course. The laboratory has two workstations equipped with PCs, oscilloscopes, and function generators. Hardware experiments are performed using control system module trainers. It is a review of modeling, simulation using Matlab and simulation tools, and implementation of a physical dynamical system by a linear time invariant ordinary differential equation. Compensators are designed to guarantee transient and steady state specifications.

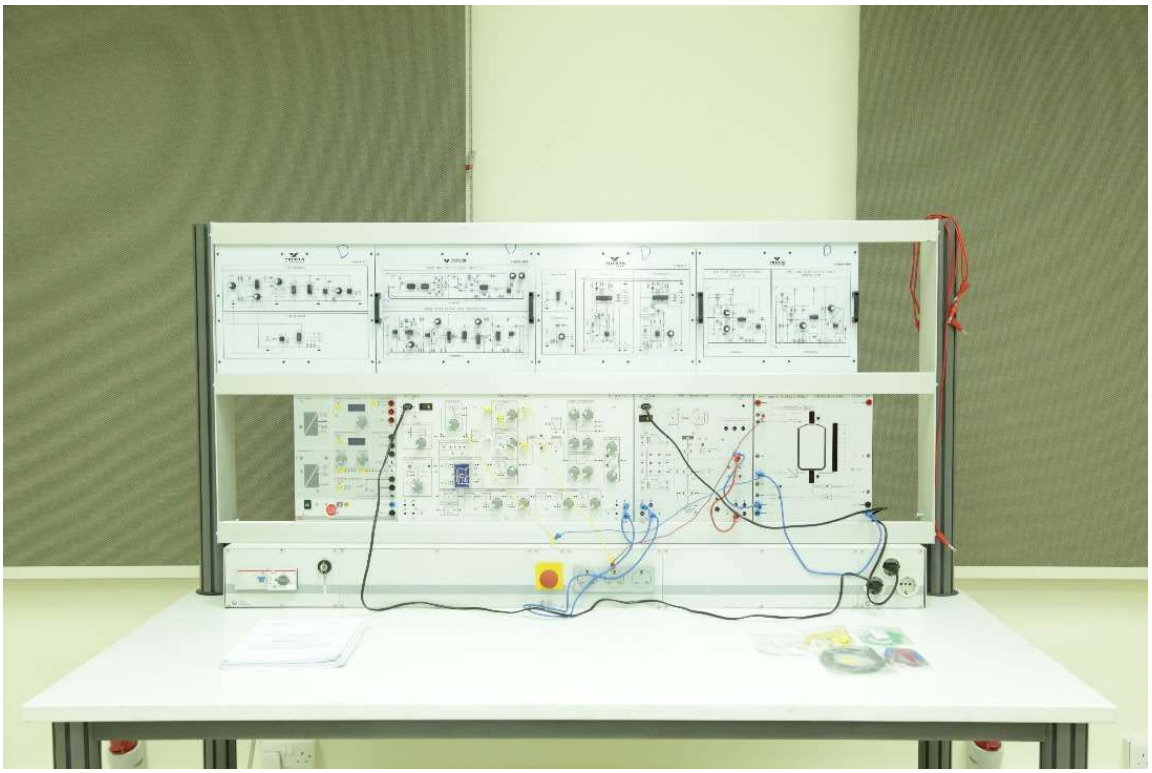


Figure 14: Control Systems Laboratory

7.5.14 Senior Design Project Lab

This lab allows students to establish their projects objectives and criteria. Technical and economic constraints. Choice of solutions. Preparation of necessary equipment. Preparation of engineering design. Theoretical studies and technical performances. Realization and experimentation and/or computer project. Communicate both orally and in writing the realized project and the obtained results. For this lab, a schedule organizes the work of students doing their senior projects. In fact, each group of no more than 5 students may be at a time according to their availability.

7.6 Laboratory Safety Policy

7.6.1 General Laboratory Safety Guidelines

- All lab users must be familiarized with the electrical hazards associated with the workplace.
- Occupants shall be familiar with the location and operation of safety and emergency equipment such as fire extinguishers, first-aid kits, emergency eye wash stations and emergency showers, emergency power off, emergency telephones, and emergency exits.
- Be as careful about the safety of others as for the safety of yourself. Think before you act. Be tidy and systematic.
- Food, drink, and related utensils shall not be brought into, stored, or consumed in a laboratory.
- Smoking is prohibited at all the University premises, especially in the University laboratories.
- Proper clothing, eye protection, and footwear be worn if directed by the lab instructor.
- Unauthorized people are not allowed in laboratories. The term "authorized person" refers to people who are working in the laboratory with the permission of the corresponding department.
- Anyone under the age of eighteen must be always accompanied with and under direct supervision of a qualified authorized person.
- All laboratories shall remain locked and are opened as needed with authorization.
- Never open (remove cover) of any lab equipment without permission.
- Report all problems to the Lab Engineers at:
  Eng. Osama Aljelani **Mobile:** 050 333 8336. **Email**: o.aljeelani@upm.edu.sa
  Eng. Ghassan Qurban **Mobile:** 056 910 5135. **Email**: g.qurban@upm.edu.sa

7.6.2 Electrical Lab Safety Guidelines

Electrical equipment is especially dangerous because even few milliamperes of current may cause heart- attacks and/or deaths. Improper use of equipment is a major fire hazard. Consequently, it is vital to adhere to the following safety guidelines for the safety of yourself and the others lab users:

- It is a must that a person becomes properly isolated by wearing proper gloves and/or footwears as directed by the lab instructors before conducting the lab experiments. Loose clothes (e.g., thoubs and/or abaya) should be avoided.
- Never touch bare copper wires even if you were isolated.
- Wet skin has less resistance and allows more current to flow through it, which increases the hazard of an electric shock. Therefore, avoid conducting experiments with wet/sweaty hands and/or clothing.
- Equipment of Power Systems, Smart Grids & Renewable Energy Lab (C122) and Electric Machines, Power Electronics & Drives Lab (C134) should never be operated without the supervision of the lab instructor.

- Circuit connections should be checked by your group members, and the lab instructor before the equipment is powered on unless directed otherwise by lab instructor. Please note that correct circuit connections are mutual responsibility of all lab users.
- Never make any changes to the circuits or the experiment set up without switching the power supply off.
- Use of extension cords is prohibited unless approved by the lab instructor. Power/amperage rating must be checked before using the extension cords. Please avoid the use of extension cords (even if allowed by the lab instructor) whenever possible.

- Excessive heat and/or foul smell are indications of malfunctioning. In case you noticed any heat and/or a foul smell, please shut down the power source immediately. Do NOT continue the experiment unless the fault is located and removed.
- Faulty equipment should be reported immediately. A note should be posted on the equipment, and the equipment should not be used until inspected and declared safe.
- Damaged wires/cables should be discarded immediately. A wire/cable should be judged damaged if it is the core (copper) is exposed, has a cut, or it produces unexpected heat.
- Learn the instructions on how to use battery cells, solar cells, capacitors, inductors, and any other devices before conducting relevant experiments.
- Experiments left unattended should be isolated from the supplies. If desired to stay on operating conditions without attendance, a warning notice is required.
- Know what you must do in an emergency.

7.6.3 Electrical Emergency Guidelines

Instant and correct response to electric shock and/or electric fires may save peoples' life, prevent severe injuries, and/or avoid life-long disability. In case of an electric shocks and fires, the followings guidelines provide preliminary actions for:

1. **In case of an Electric Shock:**

When someone suffers serious electrical shock, he or she may be knocked unconscious. If the victim is still in contact with the electrical current, immediately turn off the electrical power source. If you cannot disconnect the power source, push in the Emergency Power Off button.

IMPORTANT:

- Do not touch a victim that is still in contact with a power source; you could electrocute yourself. Have someone call for emergency medical assistance immediately.
- Administer first−aid, as appropriate.
- In case of an electric shock, or other health related emergencies, please call 997 immediately.

2. **In case of an Electrical Fire:**

If an electrical fire occurs, try to disconnect the electrical power source, if possible. If the fire is small, you are not in immediate danger, and you have been trained in fighting fires, use any type of fire extinguisher except water to extinguish the fire. When in doubt, push in the Emergency Power Off button.

IMPORTANT:

- Do not use water on an electrical fire.
- In case of an electric fire, please call 998 immediately.

7.6.4 Safety Measures and Precautions Need to be Taking

1. During Component Soldering Action:

Soldering electrical components is an everyday activity to the electrical or electronics engineer but it is not without its risks. The most obvious one is that of a burn from the hot iron or solder. There is also the risk of electric shock if the soldering equipment has a damaged lead or defective wiring.
Always check the mains lead and plug for damage before starting work and take care not to rest the iron on the lead and burn it. A less obvious risk is from the flux fumes. These contain formaldehyde, which can cause an asthma attack. While the risk is small, soldering should as far as possible, always be carry out in a well-ventilated area and care taken to minimize the inhalation of the fumes. If you feel at all unwell stop work immediately and try and get some fresh air. Remember too that solder contains lead so avoid contact between hands and mouth and wash your hands thoroughly before handling food.

2. During Project's execution

- DO NOT work on your power project in an unsupervised laboratory.
- DO ensure you know the additional rules that apply if you are working in a research laboratory. It is your responsibility to ask your supervisor about this, and his or hers to train you.
- DO NOT work with unprotected live mains. All electronic equipment should be fused with the correct rating of fuse. Projects on motors etc. using mains MUST be conducted on a bench which has mains protection. All project benches have this. MAINS PROTECTION SYSTEMS ARE NOT FOOL PROOF. MAKE SURE YOU KNOW WHICH TYPES OF FAULTS ARE NOT COVERED.
- DO NOT use the workshop equipment's without prior training. Ask the faculty to arrange this.

7.6.5 FIRE HAZARDS & PROCEDURES

Fire Alarms:
The UPM buildings are fitted with a fire detection system. The system is a series of smoke detector, which are situated in the corridors, and a few selected laboratories are also connected centrally and will automatically call the Fire Brigade in the event of a fire. It is important however that in the event of a fire notify security who will call the Fire Brigade. DO NOT ASSUME THE FIRE DETECTION HAS DETECTED THE FIRE UNLESS YOU CAN HEAR THE ALARMS.

Fire Safety:
If you discover a fire, immediately make people in the vicinity aware of the danger. Then phone the Campus Security. Mention room location, floor number and the building. Only return with others to the area of the fire if it is small enough to tackle. Never place yourself in danger attempting to fight a fire alone. Do not attempt to tackle a large fire. If possible, switch off electricity and gas supplies to the area. Remove any inflammable materials. Use a suitable fire appliance at hand to contain or reduce the blaze. Wait at a distance and be available to assist the fire services.

Security:
We earnestly request your utmost cooperation in maintaining a climate of concern for proper use and care of the equipment, materials and supplies in the labs. It is requested that all students and staff keep laboratories and work areas locked when they are not in use. If you are the last person leaving the lab, be sure to close and lock all windows and doors. If you were issued keys, these are for your own personal use and should be kept under your control.
It is very important that you restrict access only to authorized persons.

Unauthorized individuals and random curiosity seekers should be challenged and asked to obtain visiting permission from Faculty or staff members.
Please notify the lab engineer or the Security immediately if any evidence of theft or unlawful entry is found. Security can be contacted 24 hours a day.

7.7 Bachelor's Degree Requirements

Program Name	Electrical Engineering
Final Awarded Degree	Bachelor of Science in Electrical Engineering
Program Code	B.Sc. EE
Credit Units	136
Language of Instruction	English
Mode of Study	Full Time
Study Duration	4 years
Number of levels	8 Levels
Number of weeks/level	15 weeks
Graduation requirements	GPA 2.0/4.00

Table 6: General Information about the Electrical Engineering Program

Requirements	Courses Type	Number of Credit Hours
General	Compulsory	15
	Elective	12
College	Compulsory	33
Major	Compulsory	48
	Supporting	11
	Professional Elective	9
	Free Elective	3
	Graduation Project	4
	Field Training	1
Total Program Credit Hours		136

Table 7: General Framework of the B.Sc. in Electrical Engineering Program

7.8 Plan of Study for B.Sc. Electrical Engineering`

First Year: First Semester (Freshmen)					First Year: Second Semester (Freshmen)				
Course code	Course Title	Credit Hours	Requisite		Course code	Course Title	Credit Hours	Requisite	
			Pre-	Co-				Pre-	Co-
MATH 101	Calculus I	4	MATH 002		MATH 102	Calculus II	4	MATH 101	
PHYS 101	General Physics I	4	MATH 002	MATH 101	PHYS 102	General Physics II	4	PHYS 101	
CHEM 101	General Chemistry	4			ENGL 102	Introduction to Report Writing	3	ENGL 101	
ENGL 101	First Year Composition	3	ENGL 005		CS 141	Introduction to Computing for Engineers	3		
GHAL xxx	Humanities, Arts and Languages Elective	3			ENGG 103	Introduction to Engineering Drawing	1		
					GDMC xxx	Diversity and Multiculturalism Elective	3		
	Total	18				Total	18		
Second Year: First Semester (Sophomore)					Second Year: Second Semester (Sophomore)				
MATH 201	Differential Equations	3	MATH 102		MATH 202	Calculus III	3	MATH 102	
EE 201	Electric Circuits I	3	MATH 102, PHYS 102		MATH 204	Linear Algebra	3	MATH 102	
EE 203	Electric Circuits I Lab	1		EE 201	EE 202	Electric Circuits II	3	MATH 201, EE 201	
EE 231	Logic Circuits Design	3	CS 141, PHYS 102		EE 222	Electronic Circuits I	3	EE 201	
EE 233	Logic Circuits Design Lab	1		EE 231	EE 224	Electronic Circuits I Lab	1		EE 222
ENGL 201	Technical Writing	3	ENGL 102		GIAS 102	Arabic Language Skills	3		
GIAS 101	Islamic Culture	3							
	Total	17				Total	16		
Summer Field Experience I (Optional)			EE 294		1	Credit			
Third Year: First Semester (Junior)					Third Year: Second Semester (Junior)				
MATH 301	Advanced Mathematics for EE	3	MATH 202, MATH 204		STAT 342	Statistical Methods for Engineers	3	MATH 102	
EE 311	Electromagnetic Fields	2	PHYS 102, MATH 202		EE 312	Electromagnetic Waves	2	EE 311, MATH 301	
EE 321	Electronic Circuits II	3	EE 222		EE 326	Microprocessor & Microcontroller	3	EE 231, EE 321	
EE 323	Electronic Circuits II Lab	1		EE 321	EE 328	Microprocessor & Microcontroller Applications Lab	1		EE 326
EE 341	Signals & Systems	3	EE 202, MATH 201		EE 342	Introduction to Digital Signal Processing	3	EE 341	
EE 351	Electric Machines	3	EE 201		EE 356	Introduction to Modern Power Systems	3	EE 201	
GSOS xxx	Social Sciences Elective	3			EE 358	Electric Machines and Power Lab	1	EE 351	EE 356
					ENGG 304	Introduction to Engineering Economy	2		
	Total	18				Total	18		
Summer Field Experience II			EE 394		1	Credit			
Fourth Year: First Semester (Senior)					Fourth Year: Second Semester (Senior)				
EE 461	Control Systems Analysis	3	EE 341, MATH 301		ENGG 401	Engineering Management	3	ENGG 304	
EE 463	Control Systems Lab	1		EE 461	EE 492	Capstone Project II	3	EE 491	
EE 471	Communication Systems	3	EE 341, STAT 342		EE 4xx	Professional Elective II	3		
EE 473	Communication Systems Lab	1		EE 471	EE 4xx	Professional Elective III	3		
EE 491	Capstone Project I	1	Senior Status*** >= 98		GIAS xxx	Islamic Studies Elective	3		
EE 4xx	Professional Elective I	3							
XXXX xxx	Free Elective	3							
	Total	15				Total	15		
Total Credit Hours Required					136				

**Minimum of 98 earned credit Hours.

The English courses ENGL 111 and ENGL 112 can be taken as an elective within any of the areas ie GHAL, GDMC and GSOS

General Compulsory Courses	Program Compulsory Courses
General Elective Courses	Program Elective Courses
College Compulsory Courses	Summer Field Experience

Table 8: Plan of Study for B.Sc. in Electrical Engineering Program

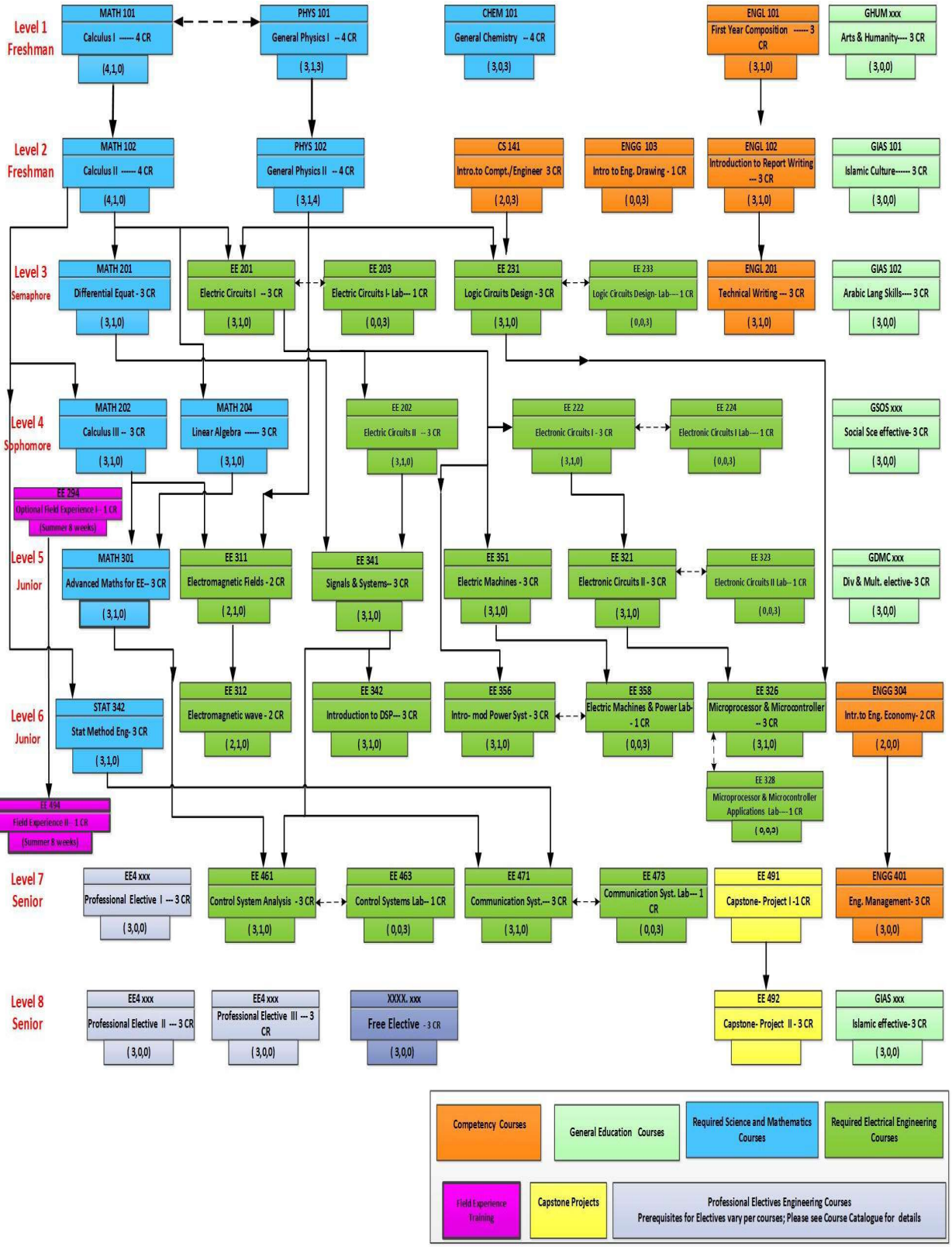


Figure 15: B.Sc. in Electrical Engineering Flow Chart

7.9 Course Description

Math 101: Calculus I
This course is designed to cover the basic concepts and methods of Calculus. It includes limits, continuity, and differentiability of functions of a single variable: polynomial, exponential, trigonometric, hyperbolic, and their inverses· Applications: related rates, local linear approximation, differentials, curve sketching and optimization problems. During the semester students will learn to recognize and express the mathematical ideas graphically, numerically and in writing. The course material will be presented in lectures (4 hrs./week). Problem solving techniques will be developed in tutorials (1hr./ week).

PHYS 101: General Physics I
The topics covered include particle kinematics and dynamics; Newton laws, conservation of energy and linear momentum; rotational kinematics; rigid body dynamics; conservation of angular momentum; gravitation; simple harmonic motion; the static and dynamics of fluids. The course material will be presented in lectures (3 hrs./week). Problem solving techniques will be shown in tutorials (1 hr./ week). The understanding of concepts will further be strengthened by laboratory work (3 hrs./ week).

CHEM 101: General Chemistry
The course is designed to give students a foundation in chemistry by providing an introduction to the following areas: atomic theory; physical and chemical properties of gases, liquids, solids, and their solutions; properties of some elements and their compounds, etc. The course laboratory will include some qualitative and quantitative measurements to formulate and analyze chemical reactions. The course material will be presented in lectures (3 hrs./week). The understanding of concepts will further be strengthened by laboratory work (3 hrs./ week).

ENGL 101: INTRODUCTION TO ACADEMIC WRITING
Students are exposed to different genres of reading material, such as encyclopedias, magazines, newspapers and websites. They are taught strategies for dealing with each genre independently and effectively. The writing component teaches argumentation and such rhetorical modes as definition writing, description, exemplification, causal analysis and comparison. Students are taught the writing process and introduced to paragraphing, cohesion, conciseness, unity and the use of specific details. They are alerted to common errors in grammar and sentence structure. The vocabulary component is based on the Academic World List, a corpus of vocabulary items based on the most frequently occurring lexis in a broad range of academic texts. In addition, students are expected to give short talks on a variety of topics.

Math 102: Calculus II
This course is a continuation of Math 101. Topics covered include definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio, and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series, Parametric function. The course material will be presented in lectures (3 hrs./week).
Problem solving techniques will be developed in tutorials (1 hr./ week).

PHYS 102: General physics II
This course is a continuation of PHYS 101. Topics covered include Coulomb's law; the electric field; Gauss' law; electric potential and energy; capacitors and dielectrics; D.C. circuits; the magnetic field; Ampere's and Faraday's laws. Students will learn the concepts and applications underlie the working of household appliances, electric motors, power generation, all types of monitoring screens, printers, MRI machines etc. The course material will be presented in lectures (3 hrs./week). Problem solving techniques will be developed in tutorials (1 hr./ week). The understanding of physical concepts will further be strengthened by a set of standard experiments carried out through the laboratory work (3 hrs./ week).

ENGL 102: An Introduction to Report Writing
In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

ENGL 201: Technical Writing
Students write a 1500-word themed, source-based report on a problem-solution topic related to their majors. They are taught the APA style of documentation and advanced internet research skills. Instruction focuses on a process-based approach which includes audience analysis, narrowing and focusing a report topic, citation methods and referencing, document design, paraphrasing, summarizing, and writing an abstract. Additional instruction is given on advanced presentation skills for their research reports. In the second half of the course, students are taught the job application process involving cover letters, résumés and interviews leading to important aspects of business correspondence, such as letter format, style, tone and two important business letters (inquiry and complaint).

Math 201: Differential Equations
This course covers the following topics: classification of differential equations, first order differential equations, higher order linear differential equations, linear systems of algebraic equations, first order linear systems of ordinary differential equations, Laplace transforms, and their application on initial value problems.

Math 202: Calculus III
This course is a continuation of Math 102. Topics covered include different aspects of vector fields: vector fields in two and three dimensions, operations on vectors such as scalar and vector products, gradient, divergence, and curl of vector fields. Basic of analytic geometry: Lines and planes in three dimensions, surfaces Equations of the tangent plane and normal line to a surface. Vector-valued functions and connecting them with single variable functions. Concepts of motion and curvature. Line and surface integrals, multiple integrals. Green and Stokes Theorems. The course material
will be presented in lectures (3hrs./week). Problem solving techniques will be developed in tutorials (1 hr./ week).

Math 204: Linear Algebra
This course topics cover: linear equations, matrix algebra, vector spaces, eigenvectors, orthogonality and least squares, symmetric matrices and quadratic forms.

STAT 342: Statistical Methods for Engineers
This course provides probabilistic modeling and quantitative engineering methods. It focuses on the application of quantitative data analysis methods in all the engineering fields. The course also emphasizes the use of engineering applications and advanced statistical tools and techniques for the data analysis, problem-solving, and decision-making.

CS 141: Introduction to Computing for Engineers
The course provides an introduction to computing logic, algorithmic thinking, and programming constructs using MATLAB, a programming language and computing environment. Knowledge obtained in this course will enable students use computer as an instrument to solve computing problems. Topics include an introduction to programming in MATLAB, including matrix operations, functions, arrays, loops and structures, working with data files and plotting. No previous programming experience is required.

ENGG 103: Introduction to Engineering Drawings
This course includes an introduction engineering drawing course. This is a laboratory course and both hand sketching and computer-aided design (CAD) are the two main tools to formulate and convey design intent. Therefore, this course is planned to introduce sufficient classical tools, which would help the student to visualize three-dimensional objects and develop orthographic projection drawings. The course topics are arranged in sequence starting from: the basic concepts of geometrical constructions & engineering curves proceed to the principles of projection techniques. Some fundamentals of computer graphics will be introduced through an introduction to the basic of computer-aided design (CAD) techniques using the software AutoCAD.

ENGG 304: Introduction to Engineering Economy
The purpose of this course is to teach students (1) the basic principles, concepts, and methodology of engineering economy; and (2) to help them develop proficiency with these methods and with the process for making rational decisions regarding situations they are likely to meet in professional practice.

ENGG 401: Engineering Management
An overview of engineering industry, contracts, contract documents and professional liabilities, tendering process, planning and scheduling, resource leveling, time and cost control, labor cost and productivity, and risk management.

EE 201: Electric Circuits I
Analysis of electrical networks incorporating passive and active elements. Basic laws and techniques of analysis. Transient and forced response of linear circuits. AC steady state power and three-phase circuits Periodic excitation and frequency of response. Computer analysis tools. Design projects are implemented and tested in the laboratory. Laboratory reports with revisions are required for each project.

EE 203: Electric Circuits I Lab
In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

EE 202: Electric Circuits II
Introduction to the analysis of AC single-phase and AC three-phase circuits, design methods for analog linear circuits, and Laplace Transform. The Laplace Transform in Circuit Analysis. Transient analysis of first and second order circuits. Frequency response of frequency selective circuits: concept of transfer function, resonance, bode plots, introduction to filters and network analysis in the s-domain. Mutual inductance and transformers. Two-Port networks.

EE 222: Electronic Circuits I
Physical electronics are underlying the operation of electronic devices. Semiconductors, the basis of electronics will be thoroughly explained. Diodes, diodes models and diode circuits are the basic electronic components that are introduced in this course. Transistors, transistor models and transistors circuits are also discussed. DC and frequency analysis of transistor amplifiers are described. Compound transistor configuration are introduced with some computer analysis tools. Design projects are implemented and tested in the laboratory.

EE 224: Electronic Circuits I Lab
Physical electronics are underlying the operation of electronics devices. Semiconductor theory will be the base of this course. Diodes, diode models, and diode circuits are the basic electronic components that are introduced in this course. Transistors, transistors models and all transistor circuits are also considered as basic components.
DC, small signal, and frequency analysis of transistor amplifiers are described. Compound transistor configuration are introduced with some computer analysis tools. Design projects are implemented and tested in the laboratory.

EE 231: Logic Circuits Design
Representation of digital information. Number systems & codes. Logic gates. Boolean algebra. Karnaugh maps. Analysis, design, and evaluation of combinational systems, decoder, multiplexers, adders and sub tractors, PLAs. Type of flip-flop. Memory concept. Counters, registers, and sequential logic circuits.

EE 233: Logic Circuits Design Laboratory

In this lab, students learn how to design, build and troubleshoot digital logic circuits. Students work with ready-to use modules and also build circuits using discrete components such as TTL Integrated Circuits (ICs). The experience gained in this lab is indispensable for students working on senior design projects. Students also learn to simulate their design using Multisim before implementing the circuit in hardware.

EE 311: Electromagnetic Fields
In this course students will review to mathematics scalar and vector calculus and then learn about Electrostatic fields; Coulomb's law; Gauss's law and divergence; Electric potential; Dielectrics and capacitance; Poisson's and Laplace's equations; Charge images; Current density and conductors; Magneto static fields; Biot-Savart and Ampere's laws; Curl and Stoke's theorem; Magnetic materials and circuits; Self and mutual inductances and Energy in static fields.

EE 312: Electromagnetic Waves
In this course students will learn how to utilize Maxwell's equations in Time varying fields; Faraday's law. Transformer and motional emfs; Displacement current; Maxwell's equations and time harmonic fields; Wave equation; Power transfer and Poynting vector; Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence; Transmission line Theory; Impedance matching,

EE 321: Electronic Circuits II
This course focuses on the frequency-based analysis and design of linear amplifiers networks. Considering The effect of feedback and stability in tuned and amplifier networks and surrounding interference such as noise and frequency
compensation. The applications encompass active filters, oscillators, and phase lock loops and nonlinear operations such as multiplication, sampling, and analog-to-digital conversion.

EE 323: Electronic Circuits II Lab
Analysis and design of linear amplifiers. The effect of feedback in tuned, video, and operational amplifiers. Noise, stability, and frequency compensation. Applications encompass active filters, oscillators, phase lock loops and nonlinear operations such as multiplication, sampling, and analog-to-digital conversion.

EE 326: Microprocessor & Microcontroller
Introducing and practicing Intel 8086 Microprocessor hardware and software Models, instruction sets, assembly language programming and debugging. The course will emphasize on the use of professional emulators and software's, such as, debugging tools (DEBUG and Turbo Debagger) and assemblers (TASM or MASM)/ Memory and input/output mapping. Input and output instructions. Input/output Interfacing. Introduction to interrupts and Intel 8051 microcontroller.

EE 328: Microprocessor and Microcontroller Applications Lab
The objective of the course is to expose to the students to the architecture and instruction set of typical 16-bit and 8-bit microprocessor and microcontroller that are based on intel 8086 and 8051 architecture respectively. The students will engage in understanding programming and debugging the executable

content of a program within the microprocessor. The student will experiment input and output mapping, instructions and interfacing. Additionally, the microcontroller is introduced, and interrupts will be examined in terms of programming and execution. Further, the students will be exposing their knowledge in microprocessor/controller on the Infinite Technologies boards practically.

EE 341: Signals and Systems
Representation of signals in the time and frequency domains. Fourier series. Fourier and Laplace transform methods for analysis of linear systems. Introduction to state space models. Introduction to sampling and discrete systems analysis via z transforms.

EE 342: Digital Signal processing
Discrete-time signals and systems. The z-transform. Digital filters; stability, frequency response, canonic realizations and state equations. Fourier methods for discrete signal representation; Fourier transform of sequences, the discrete Fourier transform, and the FFT. Design of linear digital filters in time and frequency domains. Spectrum analysis and filtering via the FFT.

EE 351: Electric Machines
Concept of a three-Phase Circuits and Balanced systems; introduction to the Per-Unit Systems; Magnetic Circuits, mmf, reluctance, flux; Concept of single-phase transformers; Introduction to the single and three-phase transformers. Concept of AC Machinery; fundamentals of synchronous machines; the three-phase synchronous generator: operation, parallel operation; concept of three-phase asynchronous motors; introduction to DC Machines: DC Generator and DC Motor.

EE 356: Introduction to Modern Power Systems
This course presents a review of electric power systems circuits and electromagnetic concepts. Electric power generations, transformers, autotransformers, three-winding transformers, transmission line parameters are covered. Calculation of transmission line parameters and electric power components modeling are included. Evaluation of steady state operation of transmission lines, power factor correction, reactive power compensation, line capability, power flow analysis, steadystate and transient stability, and symmetric fault analysis are covered.

EE 358: Electric Machines and Power Systems Lab
In this course, the student will acquire hands-on experience with electrical machines and power systems networks that are discussed in EE 351 and EE 356. It has two parts:
- Electric Machines Experiments: magnetic circuits and Transformer characteristics and Electric machines DC characteristics, Experiments on AC machines synchronous and asynchronous characteristics.
- Power Systems Experiments: generation, transmission and distribution of Electric power, operation, and management. Sustainable energy sources such as photovoltaics, solar-thermal power, wind farms, and their grid integration. Modern power system monitoring/control, fault analysis, and transient stability analysis using computer tools ETAP.

EE 394: Summer Field Experience II
Summer Field Experience training is approved by the electrical engineering department on the condition that the training is on electrical engineering field or any of its discipline, the training site is blacklisted before by the electrical engineering department, and that the paperwork is completed by the student and the organization in compliance with the UPM Summer Training Manual.

EE 408: Professional Ethics for Electrical Engineers
This course introduces students to principles of professional engineering practice, ethical conduct, applicable laws, sustainable development, and equity. Exploring and relating the applications of ethics in engineering in academic and professional careers. This development widens the vision of students towards society change and structure. Consider such questions: How do the societal functions of engineers and the practical application of technologies relate to basic moral
and intellectual values? What moral obligations are implied by the uses of technology? What are the ethical duties of engineers in the practice of their careers?

EE 429: Power Electronics
Power electronics is the technology associated with the efficient conversion, control, and conditioning of electronic power by static means from its available input form into the desired electrical output form. First, power electronic devices and solid-state drive packages are introduced. Different converters (rectifier and inverter) circuits are studied, they comprise the power and control for these drive packages. This includes power electronics circuits, power semiconductor devices, and converter topologies. The student will learn analysis and design techniques for switch mode converters using the buck, boost, and buck-boost topologies. The course will emphasize complex theoretical analysis and computer simulation tools as course project.

EE 456: Power Distribution Systems
This course will provide the fundamental principles of the electric power delivery system with emphasis on distribution systems. Components of distribution system shall be discussed: substations, switchgear, feeders, sub transmission lines, primary and secondary systems; K factors, Voltage drop and power losses consideration; application of capacitors in distribution system. The performances of type A step-voltage regulator and type B step-voltage are compared and the generalized constants for single-phase step-voltage regulators are analyzed. Symmetric fault current calculation, power distribution systems protection shall be discussed with the system reliability and power quality issues.

EE 458: Smart Electric Power Grid
The course will provide students with a working knowledge of fundamentals, design, analysis, and development of Smart Electric Power Grid. The course offers an introduction to the basic concepts of power systems along with the inherent elements of computational intelligence, communication technology and decision support system. The automation and computational techniques needed to ensure that the Smart Grid guarantees adaptability and capability of handling new systems and components are discussed. The interoperability of different renewable energy sources is included to ensure that there will be minimum changes in the existing legacy system. Standards and requirements needed for designing new devices, systems and products for the Smart Grid are discussed.

EE 459: Renewable Energy
This course explores society's present needs and future energy demands, examine conventional energy sources, including fossil fuels and nuclear energy, and then focus on alternate renewable energy sources; it provides an overview of the latest technologies and developments in renewable energies, as well as the diversity of their applications. It will explore society's present needs and future energy demands, focus on alternate renewable energy sources such as wind power, solar energy: Solar Cells and Photovoltaic Systems; hydro energy conservation methods: types of hydraulic turbines; brief introduction on geothermal, biomass, and Marine Energy; Energy storage.

EE 461: Control Systems
In this course students will learn how to analyze linear feedback systems and design feedback control systems. The course covers: Modeling of controlled systems using differential equations, transfer functions and state space representation; Analyzes of the first and the second order systems in terms of stability, transient and steady state performance in the time and the frequency domains; and Design of feedback control systems.

EE 463: Control Systems Lab
In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

EE 464: Control Systems Application
Introducing and practicing the engineering standards in control components selection and design. Fundamentals of industrial transducers and actuators are given. Problem definition and techniques for stimulation of ideas are given. Students learn the analysis and design of different control problems with special emphasis on concepts and design creativity. They acquire the basic skills of how to approach and deal with different requirements to analyses and to design real time applications.

EE 468: Digital Control Systems
Introduction to the analysis and design of discrete-time feedback control systems. Topics include mathematical representation of physical systems with linear difference equations, z-transforms, transfer functions, sampling, A/D and D/A converters, sampled-data systems, discrete equivalent systems, transient specifications, steady-state tracking errors, stability, controller design, quantization effects.

EE 469: Programmable Logic Controllers
This course introduces the fundamentals of programmable logic controllers (PLCs) and their applications. It provides the knowledge and skills needed to understand hardware, basic methods of programming, and programming techniques. The course focuses on the major components of PLC hardware structure, the types of input/output devices and their functions, logical operators, ladder

diagrams, and how they work together to solve control problems. Students perform real and simulated hands-on experiments which enhance their skills in using SIMATIC STEP 7 PLC and IOFactory.

EE 471: Communication Systems
Communication of information over noisy channels. Fourier transform review, spectral analysis, and sampling. Amplitude, phase, and frequency modulation of a sinusoidal carrier. Time and frequency division multiplexing. Random processes and analysis of communication of systems in noise. Elements of digital communication systems.

EE 473: Communication Systems Lab
This Lab covers a wide range of experiments in analog and digital communication systems including Amplitude Modulation types and demodulation, angle modulation and demodulation, sampling and quantization, and Pulse code modulation encoder and decoder. Lab experiments emphasis on design aspects and performance analysis of different systems, techniques and methods in modern communication systems.

EE 491: Capstone Project I
Discussion of the design process; project statement, specifications, project planning, scheduling and division of responsibility, ethics in engineering design, safety, environmental considerations, economic constraints, liability,
manufacturing, and marketing. Projects are carried out using a team-based approach. Written progress reports, a proposal, an interim project report, a final report, and oral presentations are required.

EE 492: Capstone Project II
Design of a device, circuit, system, process, or algorithm. Team solution to an engineering design problem as formulated in EE491, from first concepts through evaluation and documentation. Written progress reports, a final report, and an oral presentation are required.

EE484: Introduction to Artificial Intelligence
Introduction to artificial intelligence, Intelligent agents, solving problems by searching, Game playing, logical agents and first order logic, learning from observations, Learning in neural and belief networks, Practical language processing, Fuzzy logic and reasoning, Perception and pattern recognition, Artificial neural networks. Applications in image processing,
robotics, and projects.

8. *Civil Engineering*

8.1 Program Mission

To graduate professionals in the field of civil engineering by providing sustainable and productive environment with research exposure that enables them to contribute to the profession and play a leading role in society.

8.2 Program Educational Objectives (PEOs)

PEO 1: Become engineers who can professionally apply engineering knowledge and ethical aspects to design, construct and provide services that serve the community and consider environmental aspects.
PEO 2: Actively engage and contribute to engineering practice in one or more of technical areas of civil engineering fields in public or private sectors.
PEO 3: Commit to lifelong learning by pursuing graduate studies or professional development and to stay updated with evolving engineering practices.

8.3 Student Outcomes (SOs)

SO1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
SO2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
SO3: an ability to communicate effectively with a range of audiences.
SO4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
SO5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
SO6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
SO7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

8.4 Potential Careers For Civil Engineering Graduates[2]

Career Name	Code
Civil Engineers	2142
civil engineer	214201
Technical Civil Engineer	214202
Civil Engineering Technology Specialist	214203
Geotechnical engineer	214204
Structural Engineer	214205
Roads Engineer	214206
Bridge Engineer	214207
Environmental Engineers	2143

[2] دليل التصنيف السعودي الموحد للمهن (masar.sa)

Environmental Engineer	214301
Water treatment engineer	214302
sanitary engineer	214303
Engineering professionals not classified elsewhere.	2149
Materials engineer	214904
Quantity surveyor 2	214905
Quality Control and Control Engineer	14906
Health, Safety and Environment Engineer	214907
Project Management Engineer	214909
Construction operations managers	1323
Civil Engineering Operations Manager	132301
Roads and Bridges Operations Manager	132302
Construction Operations Manager	132303

8.5 Civil Engineering Laboratories

8.5.1 Surveying Laboratory

The Surveying Laboratory enables students to understand and practice the basic principles of surveying by conducting:

- **Chain Surveying:** Open Traverse, Closed Traverse
- **Leveling**: Simple leveling, Differential leveling, Profile leveling, Contouring, Calculation of area and volumes.
- **Study of Total Station;** Measurement of Azimuth, Measurement of heights and Distances

Figure 16: Surveying Lab

8.5.2 Civil Engineering Material Laboratory

Civil Engineering Materials Laboratory contributes mainly teaching activities and Capstone Project activities in the Civil Engineering Department. It provides support in a wide range of specialized areas of civil engineering materials analysis and testing to the students. This includes Consistency, Initial

and Final Setting time of cement, Measurement of Workability of Concrete (Slump Test), Compressive Strength of Cement cubes, Fineness of Cement, Determination of Water Permeability of Concrete Cubes and Concrete mix design.

Figure 17: Engineering Material Lab

8.5.3 Soil Laboratory

Soil Laboratory contributes mainly teaching activities and Capstone Project activities in the Civil Engineering Department. It provides support in a wide range of specialized areas of soil characterization and stability of soil mass analysis and testing of soil properties to the students. This includes Determination of Consistency Limits and Indices, Determination of Specific Gravity (Using Pycnometer), Determination of Field Density of Soil (Sand Replacement Method), Compaction Test (Standard and Modified Proctor Compaction), Permeability Test (Constant and Variable head), Grain Size Analysis (Sieve Analysis), Direct Shear Test, Consolidation Test, Triaxial Compression Test, Unconfined Compression Test.

Figure 18: Soil Laboratory

8.5.4 Water Resources Laboratory

Water resources is a full equipped UpToDate equipment's laboratory in the new "Labs Building". The Water Resources Engineering Laboratory contributes mainly teaching activities and Capstone Project activities in the Civil Engineering Department. It provides support in a wide range of specialized areas of water resources engineering analysis and hydraulic structural analysis to the students. This includes Study of Hydraulic Bench, Head Loss by Friction, Determination of Meta centric Height, Impact of Jet, Dead Weight Pressure Calibration, Flow Over Weirs, Minor Losses, Measurement of Flow in Pipes, Verification of Bernoulli's Theorem, Hydrostatic Pressure.

Figure 19: Water Resources Laboratory

8.5.5 Transportation Laboratory

Transportation Engineering Laboratory contributes mainly teaching activities and Capstone Project activities in the Civil Engineering Department. It provides support in a wide range of specialized areas of transportation engineering analysis and bitumen analysis and testing to the students. This includes Marshal Test, CBR Test, Viscosity of Asphalt Using Saybolt Viscometer, Measurement of Flash point of Asphalt, Measurement of Specific gravity of highway materials California Bearing Ratio, Penetration Test, Ductility Test, Softening Point, Extraction of Bitumen, Sieve Analysis.

Figure 20: Transportation Laboratory

8.6 Bachelor's Degree Requirements

Program Name	Civil Engineering
Final Award Degree	Bachelor of Science in Civil Engineering
Program Code	BSCE
Credits Units	137
Language of Instruction	English
Mode of Study	English
Study Duration	4 Years
Number of Levels	8 Levels
Number of weeks\levels	15 Weeks
Graduation requirements	GPA 2.0/4.00

Table 9: General Information about the Civil Engineering Program

Program Structure	Required/Elective	Credit Hours
Institution Requirements	Required	15
	Elective	12
College Requirements	Required	33
	Elective	-
Program Requirements	Required	49
	Elective	9
	Supporting	11
Capstone Course/Project Requirements	Required	4
Field Experience/Internship	Required	1
Other "Free Elective"	Required	3

Table 10: General Framework of the B.Sc. in Civil Engineering Program

8.7 Labarotry Safety Policy

1. Responsibility

While the students are primarily responsible to have clearly understood and acknowledge in writing the safety guidelines described herein and abide by them, the laboratory technicians, instructors and the academic staff bear the overall responsibility to ensure that the safety precautions are adequately maintained within the laboratory.

- Provide a 15-minute safety briefing prior to each laboratory session and ensure that each student understands, signs and dates the acknowledgement form.
- Under no circumstances should a student be allowed to involve in any laboratory activity associated with potential risks without completing the safety acknowledgement form.
- Misbehavior of any nature and breaching of safety rules during an experiment must not be tolerated.
- Students must not be left unattended for an extended period of time during the experiments.
- The level of supervision must be made on the basis of the maturity of students: the younger the students, the greater the level of supervision should be.
- No defective equipment should be allowed for any reason.

2. General

- If you are not sure about what and why you are doing any task, please ask your instructor.
- While conducting a lab experiment, safety of yourself and that of those around you areparamount – make sure that everyone around you is aware of what is going on.
- Please do not leave any equipment unattended. Equipment should be cleaned andreturned to its original condition and position when you leave the instrument.
- Please do not touch anything in the laboratory that is not a part of your experiment.

3. Laboratory Dress

While attending a laboratory class, you must be appropriately attired for the particular work related to the lab work.

Some of the simple guidelines include:

- Wear sensible closed-toed shoes or boots; open-toed shoes, sandals, or bare feet are not acceptable laboratory attire
- Wear long pants; shorts are not acceptable laboratory attire.
- Refrain from wearing clothing accessories that may become caught in laboratory equipment.
- Remove loose or dangling objects such as bracelets and necklaces
- Tie back and secure long hair, or contain them properly.
- Wear eyeglasses or contacts, if needed.
- Use ear plugs when necessary.
- Wear gloves, face masks, protective shoes or boots, as appropriate, depending upon the nature of the lab work.

4. Laboratory Procedures

A wide variety of equipment and testing apparatus are available in the laboratory. The complexity of many of these devices necessitates specific care and consideration while operating them. If there is any doubt or any question on operating any piece of equipment while performing laboratory work, consult with the instructor or the lab technician.

Guidelines for laboratory safety are necessary to minimize accidents and to ensure that expensive equipment is not damaged by carelessness or negligence.

The following are some of the basic rules pertinent to lab safety:

- Ensure adequate lighting is available at the experimental area. Consult the instructor in case of poor lighting conditions before handling any equipment.
- Do not handle any materials or operate any equipment unrelated to the laboratory experiment to be performed on that particular day.
- Never operate any unfamiliar equipment without a specific approval of the instructor or a lab technician.
- Be sure to clean and dry out the equipment after you have finished the experiment.
- When operating very important equipment, be sure that at least two persons are always present.
- Avoid situations when nobody is available within sight or earshot that could assist in the event of an emergency. This applies to circumstances where, in the event of injury or emergency, immediate assistance is not readily available and the student may not be able to self-rescue or activate emergency services
- Be careful while using and storing sharp edge equipment like knives.
- No food or beverages are allowed in the laboratory.
- Be aware of your surroundings. Keep fingers away from large machinery.
- Wear appropriate clothing and shoes.
- Place all laboratory equipment in their proper storage area after use with the help of the technician.
- Always act in a professional manner.

5. Accidents

- In case of any type of accident and/or if someone is hurt, seek help immediately. Behave as a responsible citizen in case of serious accidents and report to the authorities concerned.
- If equipment is damaged, please report the situation to the instructor promptly. This will ensure a proper and quick repair or replacement.
- In the event of major fire, please evacuate the building immediately and seek professional help. In the event of a minor fire, use the nearest fire extinguisher to extinguish the flame if you are trained, if not seek the assistance of the instructor and/or lab technician.

6. Electric Hazards

- Switch off all electrical equipment when not in use.
- Do not attempt to do any electrical repairs or investigations. Consult qualified staff.
- If equipment is to be left on for a specific reason (over an extended period), display a ‘TEST IN PROGRESS’ sign with the time and date.
- All electrical equipment should be regularly checked.
- Report to the lab instructor any problem/malfunctioning of any equipment for appropriate action to be taken.

- Never short circuit the terminal on a power supply, battery, or other voltage source unless instructed to do so.
- Be sure wires leads and patch cords have sufficient insulation when creating electrical circuits.
- Never test battery voltage and capacity using anything other than a voltage sensor or voltmeter.

7. Security

Proper security of the laboratory facilities also ensures a safe working environment. The following are some of the guidelines:

- If you are working late and the last to leave the laboratory inform the lab technician beforehand.
- After you have finished using any equipment, please return it to its proper storage area and cabinet.
- Report any suspicious individuals or unwelcome visitors not related to the laboratory to the lab technician or faculty security.

8. Computing Safety

Computers in the laboratories are secured using a combination of physical and software-based method to ensure the safety and security of our students, staff and equipment and also the computer network.

- Restricted computer access:
  To prevent unauthorized use of computing resources
- Physical security:
  Equipment is placed in a manner to limit access to physical ports on the CPU.
- Software based security and prevention of installation of malicious software:
  All computers are protected with standard anti-virus and anti-spyware. As a further measure, all computers require a unique, authorized login for authentication before granting network access. Any malicious action against the departmental computer security is an offence.

9. Safe Use of Ergonomics

To escape aching muscles and tiring eyes while working at a desk or a computer, try the following:

- Check your posture
- Take short breaks regularly.
- Adjust chair height so that your arms are approximately parallel with the floor.
- If the front of the chair is causing pressure on your back of thighs or behind your knees, readjust the chair.
- Locate the computer screen approximately one full arms lengths away and position it so that your line of sight to the screen is slightly below horizontal. Relax those muscles.
- A total of 4 hours (not including breaks) of intensive keyboard work is the maximum recommended for a day.

10. Risk Control

This step provides a means by which risk can be systematically evaluated against a set of control options (the hierarchy of controls). The risk control considers ranked risks from the highest to the least weighty.

The hierarchy of controls is as follows:

- Eliminate the hazard.
- Substitute with a lesser hazard.
- Use engineering controls to reduce hazard.
- Administrative controls such as workplace procedures.
- Personal protection equipment.

11. Safe Policy Communications

Safety instructions, guidelines are communicated through different media:

- Posters
- Signs
- Flyers
- Manuals

Laboratory safety signs and posters are displayed within the laboratory at appropriate locations.

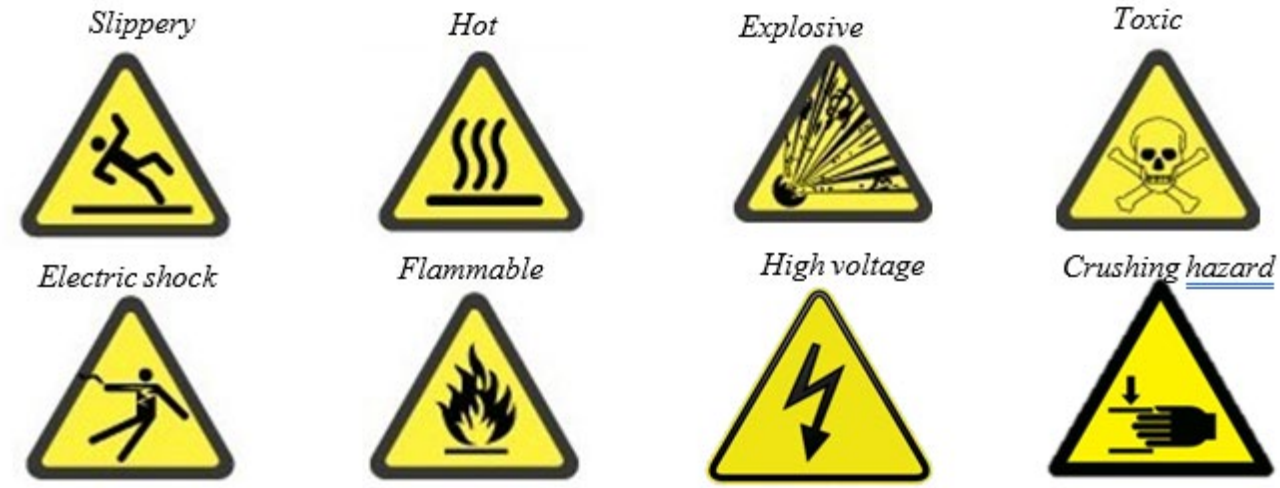
12. Signboards

- Exits
- Fire extinguishers
- Showers
- Eye washes
- Chemical and supply storage areas
- Gas lines
- Special depositories (e.g., biohazardous waste, glass, chemical garbage)
- Emergency plan and phone numbers

a. Prohibiting signs

b. Mandatory signs

c. **Triangular signs**



d. **Emergency escape, fire-fighting signs**

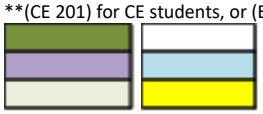
e. **In the event of fire and extinguisher has to be used, keep remember the P A S S approach**


HOW TO USE A FIRE EXTINGUISHER
P A S S
Pull the pin in the handle
Aim the nozzle at the base of the fire
Squeeze the lever slowly
Sweep from side to side

8.8 Plan of Study for B.Sc. Cvil Engineering

First Year: First Semester (Freshmen)					First Year: Second Semester (Freshmen)				
Course code	Course Title	Credit Hours	Requisite		Course code	Course Title	Credit Hours	Requisite	
			Pre-	Co-				Pre-	Co-
MATH 101	Calculus I	4	MATH 002		MATH 102	Calculus II	4	MATH 101	
PHYS 101	General Physics I	4	MATH 002	MATH 101	PHYS 102	General Physics II	4	PHYS 101	
CHEM 101	General Chemistry	4			ENGL 102	Introduction to Report Writing	3	ENGL 101	
ENGL 101	First Year Composition	3	ENGL 005		CS 141	Introduction to Computing for Engineers	3		
GHAL xxx	Humanities, Arts and Languages Elective	3			ENGG 103	Introduction to Engineering Drawing	1		
					GDMC xxx	Diversity and Multiculturalism Elective	3		
	Total	**18**				**Total**	**18**		
Second Year: First Semester (Sophomore)					**Second Year: Second Semester (Sophomore)**				
MATH 201	Differential Equations	3	MATH 102		MATH 202	Calculus III	3	MATH 102	
CE 201	Statics	3	PHYS 101		GEO 144	Geology	3		
CE 203	Computer Graphics	2	ENGG 103		CE 202	Dynamics	3	CE 201	
ME 201	Thermodynamics	3	PHYS 102, MATH 102		CE 212	Strength of Materials	3	ENGG 203 or CE 201 **	
ENGL 201	Technical Writing	3	ENGL 102		CE 262	Surveying	2	MATH 102	
GIAS 101	Islamic Culture	3			GIAS 102	Arabic Language Skills	3		
	Total	**17**				**Total**	**17**		
Summer Field Experience I (Optional)			CE 294		1	Credit			
Third Year: First Semester (Junior)					**Third Year: Second Semester (Junior)**				
STAT 342	Statistical Methods for Engineers	3	MATH 102		CE 312	Reinforced Concrete Design	3	CE 311	
MATH 303	Numerical Methods	3	MATH 201		CE 332	Soil Mechanics	4	CE 212	
CE 301	Civil Engineering Materials	3	CE 212		CE 342	Water Resources Engineering	4	CE 303	
CE 303	Fluid Mechanics	3	CE 202, ME 201		CE 362	Transportation Engineering	3	CE 262	
CE 311	Structural Analysis	3	CE 212		CE 372	Introduction to Engineering Design	1		
GSOS xxx	Social Sciences Elective	3			GIAS xxx	Islamic Studies Elective	3		
	Total	**18**				**Total**	**18**		
Summer Field Experience II			CE 394		1	Credit			
Fourth Year: First Semester (Senior)					**Fourth Year: Second Semester (Senior)**				
CE 411	Foundation Design	3	CE 332		ENGG 404	Engineering Economy	2		
CE 413	Steel Design	3	CE 311		CE 472	Construction Engineering & Management	3		
CE 451	Environmental Engineering	3	CHEM 101		CE 492	Capstone Project II	3	CE 491	
CE 491	Capstone Project I	1	Senior Status*** >= 98		CE 4xx	Professional Elective III	3		
CE 4xx	Professional Elective I	3			XXXX xxx	Free Elective	3		
CE 4xx	Professional Elective II	3							
	Total	**16**				**Total**	**14**		
Total Credit Hours Required					**137**				

(CE 201) for CE students, or (ENGG203) for AE students.*Minimum of 98 earned credit Hours.



The English courses ENGL 111 and ENGL 112 can be taken as an elective within any of the areas ie GHAL, GDMC and GSOS General Compulsory Courses Program Compulsory Courses
General Elective Courses Program Elective Courses
College Compulsory Courses Summer Field Experience

8.9 Course Description

MATH 101 – Calculus I (4,1,0)
This course is designed to cover the basic concepts and methods of Calculus. It includes limits, continuity, and differentiability of functions of a single variable: polynomial, exponential, trigonometric, hyperbolic, and their inverses· Applications: related rates, local linear approximation, differentials, curve sketching and optimization problems. During the semester students will learn to recognize and express the mathematical ideas graphically, numerically and in writing. The course material will be presented in lectures (4 hrs./week). Problem solving techniques will be developed in tutorials.

MATH 102 – Calculus II (4,1,0)
This course is a continuation of Math 101. Topics covered include definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio, and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series, Parametric function.

MATH 201 – Differential Equations (3,1,0)
This course covers the following topics: classification of differential equations , first order differential equations, higher order linear differential equations, linear systems of algebraic equations ,first order linear systems of ordinary differential equations, Laplace transforms, and their application on initial value problems

MATH 202 – Calculus III (3,1,0)
This course is a continuation of Math 102. Topics covered include different aspects of vector fields: vector fields in two and three dimensions, operations on vectors such as scalar and vector products, gradient, divergence, and curl of vector fields.

Basic of analytic geometry: Lines and planes in three dimensions, surfaces Equations of the tangent plane and normal line to a surface. Vector-valued functions and connecting them with single variable functions. Concepts of motion and curvature. Line and surface integrals, multiple integrals. Green and Stokes Theorems.

STAT 342 – Statistical Methods for Engineers (3,1,0)
This course provides probabilistic modeling and quantitative engineering methods. It focuses on the application of quantitative data analysis methods in all the engineering fields. The course also emphasizes the use of engineering applications and advanced statistical tools and techniques for the data analysis, problem-solving, and decision-making.

PHYS 101- General Physics I (3,1,3)
The topics covered include particle kinematics and dynamics; Newton laws, conservation of energy and linear momentum; rotational kinematics; rigid body dynamics; conservation of angular momentum; gravitation; simple harmonic motion; the static and dynamics of fluids.

PHYS 102- General Physics II (3,1,3)
This course is a continuation of PHYS 101. Topics covered include Coulomb's law; the electric field; Gauss' law; electric potential and energy; capacitors and dielectrics; D.C. circuits; the magnetic field; Ampere's and Faraday's laws. Students will learn the concepts and applications underlie the working of household appliances, electric motors, power generation, all types of monitoring screens, printers, MRI machines etc.

CHEM 101– General Chemistry (3,0,3)
The course is designed to give students a foundation in chemistry by providing an introduction to the following areas: atomic theory; physical and chemical properties of gases, liquids, solids, and their solutions; properties of some elements and their compounds, etc. The course laboratory will include some qualitative and quantitative measurements to formulate and analyze chemical reactions.

CS 141 – Introduction to Computing for Engineers (2,0,3)
The course provides an introduction to computing logic, algorithmic thinking, and programming constructs using MATLAB, a programming language and computing environment. Knowledge obtained in this course will enable students use computer as an instrument to solve computing problems. Topics include an introduction to programming in MATLAB, including matrix operations, functions, arrays, loops and structures, working with data files and plotting. No previous programming experience is required.

ENGG 103 – Introduction to Engineering Drawing (0,0,3)
This course includes an introduction engineering drawing course. This is a laboratory course and both hand sketching and computer-aided design (CAD) are the two main tools to formulate and convey design intent. Therefore, this course is planned to introduce sufficient classical tools, which would help the student to visualize three-dimensional objects and develop orthographic projection drawings. The course topics are arranged in sequence starting from: the basic concepts of geometrical constructions & engineering curves proceed to the principles of projection techniques. Some fundamentals of computer graphics will be introduced through an introduction to the basic of computer-aided design (CAD) techniques using the software AutoCAD.

ENGL 101 – First Year Composition (3,1,0)
English 101 is an intensive course (45 contact hours spread over a fifteen-week semester) in reading and writing English focusing on the language skills needed for success in college courses. The focus of this class is on developing fluency in academic reading and writing: "read well to write well". Students are exposed to different genres of reading material such as encyclopedias, magazines, newspapers and websites. They are taught strategies for dealing with each genre independently and effectively. The writing component teaches argumentation and such rhetorical modes as definition writing, description, exemplification, causal analysis and comparison. Students are taught the writing process and introduced to paragraphing, cohesion, conciseness, unity and the use of specific details. They are alerted to common errors in grammar and sentence structure. The vocabulary component is based on the Academic World List, a corpus of vocabulary items based on the most frequently occurring lexis in a broad range of academic texts. In addition, students are expected to give short talks on a variety of topics
.

ENGL 102 – Introduction to Report Writing (3,1,0)
Students write a term report on a themed topic. They are introduced to basic research skills involving the Internet and the University's databases and print collections. They are taught about document design, the MLA (Modern Language Association) style of documentation, evaluating sources, summarizing, outlining, note taking, drafting, revising and editing. Academic integrity in report writing is strongly emphasized. Their reading skills are further enhanced through exposure to a variety of graphical sources such as charts, graphs and diagrams. Students are taught presentation skills culminating in a PowerPoint presentation based on their term report. The ENGL 102 course explores then three common academic rhetorical modes: summary and critique, analysis, discussion synthesis and report writing. Students will learn the purpose and key elements of each, and practice writing, evaluating, and revising. Students will also learn techniques for introducing, developing, and concluding their productions and term reports and present it verbally. These three modes are going to be based on selected reading themes assigned by the teacher, as well as related vocabulary.

ENGL 201– Technical Writing (3,1,0)
The ultimate goal of Technical Communication is to enhance students' reading, writing, oral and electronic skills in order for them to become able to effectively communicate in English. The course comprises leading research, organization of collected information and writing audience-centered technical reports and correspondence documents as well as preparing oral presentations of their reports. The current course will also enable students to develop skills of collaborative work. It will help students build effective abilities to compose various types of business correspondence such as memos, emails, and business letters. The course then will provide them with significant opportunities to effectively function not only in the academic environment but also in their future professional environment.

GIAS 101– Islamic culture (3, 0 ,0)
The Islamic culture course includes the concept of culture in language and terminology and the relationship of Islamic culture with other cultures. The concept of the pillars of the Islamic faith includes the characteristics of the belief and its effects on the individual and society. It deals with the concept of worship, its pillars and conditions, in addition to an overview of morals and its status in Islam. It deals with examples of the morals of the Prophet Muhammad, may God bless him and grant him peace. Peace be upon him, as well as the course is exposed to human rights in Islam and models of their applications through the Kingdom of Saudi Arabia.

GIAS 102– Arabic Language Skills (3, 0 ,0)
The language skills curriculum contains the basics of Arabic grammar that the learner must be familiar with. To be able to read, write, and formulate structures correctly, and there are exercises and texts that help the student to access in a smooth and easy way.

CHEM 101 – General Chemistry (3, 0, 3)
The course is designed to give students a foundation in chemistry by providing an introduction to the following areas: atomic theory; physical and chemical properties of gases, liquids, solids, and their solutions; properties of some elements and their compounds, etc. The course laboratory will include

some qualitative and quantitative measurements to formulate and analyze chemical reactions. Three class periods and one 3-hour laboratory period.

CE 201: Statics (3, 1, 0)
This course discusses the following topics: Basic concepts and principles of mechanics; vector algebra; equilibrium of particles in two and three dimensions; definition of moment and couple; reduction of systems forces; equilibrium of rigid bodies; statically determinate structures including beams, trusses, frames, and machines; internal forces; shear force and bending moment diagrams in beams; friction and its applications, centroid and canter of gravity of lines, areas, and volumes; moment of inertia and radius of gyration.

CE 202: Dynamics (3, 1, 0)
This course includes the Fundamentals of dynamics using vector methods. Rectilinear and curvilinear motion, translation, rotation, plane motion; work, energy, and power; impulse and momentum. Kinematics of rectilinear and curvilinear motion of particles. Dynamics of particles and systems of particles. Kinematics of rotation and plane motion of rigid bodies. Work and energy relations. Impulse and momentum principles. Dynamics of rigid bodies in plane motion

CE 203: Computer Graphics (2, 0, 6)
The course focus on the following topics: Introduction to Computer Aided Design and Drafting for civil engineers (CAD), 2D Drawings with AutoCAD includes Multiview projection, dimensions, sections, Introduction to civil and architectural Drawings, preparing CAD documents for civil and architectural engineering.

CE 212: Strength of Materials (3, 1, 0)
The course focus on the Concepts of stress, strain, and constitutive relations; stress and deformation of axially loaded members; thermal stresses; pressure vessels; energy concepts; torsion of circular and thin-walled sections; shear and bending moment diagrams in beams; elastic bending and shear stresses in beams; compound stresses; stress transformation; bending moment-curvature equation; deflection of beams; singularity functions methods, analysis and design applications.

CE 262: Surveying (1, 0, 3)
This is an introductory course to plane surveying as related to the construction industry. Emphasis is placed on obtaining field skills in linear measurement and the operation of levels, transits, theodolites and total stations. Elevations, horizontal, vertical, and spiral curves are explored.

CE 301: Civil Engineering Materials (2, 0, 3)
The course focus on the discussion of basic mechanical and physical properties of a variety of civil engineering materials such as concrete, asphalt, wood and fiber composites. Evaluation and design for properties, load-time deformation characteristics, response to typical service environments.

CE 303: Fluid Mechanics (3,1,0)
The course focus on the properties of fluids, hydrostatics with applications to manometers, forces on plane and curved surfaces, buoyancy, equations of continuity, energy and linear momentum with applications, dimensional analysis, dynamic similarity, conduit flow, open channel flow.

CE 311: Structural Analysis (3,1,0)
This course discusses the following topics: Shear force and bending moment diagrams for frames; Influence lines for beams and trusses; Displacement analysis for beams; Virtual work method for beams, Frames and trusses; Castigliano's Theorem; Analysis of statically indeterminate structures; the Force Method; the Slope-Deflection Method, the Moment Distribution Method; Introduction to Stiffness Method for beams and frames.

CE 312: Reinforced Concrete Design (3,1,0)
This course discusses the following topics: Introduction to reinforced concrete structures; Basic material properties; Loads; Design codes; Design for flexure; Design for shear; Design for compression; bond and detailing. Design of rectangular beams, flanged sections, short columns, one-way slabs, two-way slabs, isolated footings, serviceability considerations, Design project.

CE 332: Soil Mechanics (3,1,0)
The course focus on the central concepts to be covered in this course are: Composition and classification of soils; Engineering soil properties and their measurement; Soil permeability and pore water movement; Stresses in soil and the effective stress concept; soil compressibility, consolidation, and settlements; and Shear strength of soil and bearing capacity.

CE 342: Water Resources Engineering (3,0,3)
The course is an Introduction to hydrologic engineering. Descriptive and quantitative hydrology and groundwater. Surface hydrology and runoff modeling. Subsurface flow and hydraulics of wells. Flow of water through pipes and channels. Analysis and design of watershed hydraulic systems and storm water management. Open channel hydraulics, and flow modeling.

CE 362: Transportation Engineering (2,0,3)
This course introduces students to the fundamentals of planning, design, and operation of highway transportation facilities. Topics covered include driver and vehicle performance characteristics, highway geometric design principles, basics of traffic analysis, and transportation planning, application of transportation related software.

CE 372: Introduction to Civil Engineering Design (1,0,0)
This course is A broad introduction to design in all four disciplines; design and requirements related to data, information, specification and codes, methods and tools, design considerations and constraints; issues related to safety, economy and impact; professional ethics and responsibility; design drawings; a small-scale project work to complement student's understanding.

CE 411: Foundation Design (3,1,0)
The course focus on the Site investigation, including determination of soil properties for design; bearing capacity theory of shallow foundation; settlement of building foundations; design and analysis of retaining walls, sheet piles and braced excavations; design of pile and pier foundations.

CE 413: Steel Design (3,1,0)
This course is designed to introduce the behavior and design of steel structural members according to the limit states design concept. The course includes behavior and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and design of connections as per American Institute of Steel Construction (AISC) code. Students are expected to obtain basic knowledge about the design and failure mode of steel structural members after finishing this course.

CE 451: Environmental Engineering (3,0,0)
The course focus on the Concepts of aqueous chemistry, biology, and physics applied in a quantitative manner to environmental problems and solutions. Mass and energy balances, chemical reaction engineering. Quantitative and fundamental description of water and air pollution problems. Environmental regulations and policy, pollution prevention, risk assessment. Written and oral reports.

CE 472: Construction Engineering & Management (3,0,0)
This course focus on the construction industry, contracts, contract documents and professional liabilities, issues during construction phase, business ownership, cost estimation, equipment productivity; concrete form design; planning and scheduling, resource leveling, cost control; introduction to pert, construction management aspects; materials management, construction productivity and safety.

ME 201: Thermodynamics (3,1,0)

Introduction and basic thermodynamic concepts and definitions, System and control volume concepts. Properties and behavior of a pure substance, equation of states, table of properties Work and heat, The first law of thermodynamics applied to a system and control volume, Internal energy, enthalpy, steady state, Unsteady state, the second law of thermodynamics analysis for the control volume, heat engines, refrigerators and heat pumps, Carnot cycle, reversible and irreversible processes, Entropy, Clausius inequality, principle of the increase of entropy, Efficiencies. Entropy of ideal gas.

GEO 144: Geology (3,0,0)
This course consists of two sections: basic geology and engineering geology. The basic geology section includes: formation and evolution of the earth, common rocks and minerals, internal and external dynamic geological process, geological structures, geological maps and other basic knowledge of the earth's geology. The engineering geology section includes engineering geological natures of groundwater, rock and soil, stability analysis of slope, surrounding rock of underground cavern and rock foundation, geological analysis, subsidence; earthquakes; strong ground motion.

ENGG 404 – ENGINEERING ECONOMICS (2,1,0)
The purpose of this course is to teach students (1) the basic principles, concepts, and methodology of engineering economy; and (2) to help them develop proficiency with these methods and with the process for making rational decisions regarding situations they are likely to meet in professional practice.

CE 491: Capstone Project- I (0,0,2)
This course focus on the design of Civil Engineering Projects. Students working singly or in groups produce solutions to Civil Engineering design projects from the first concepts through preliminary proposals, sketches, cost estimations, design, evaluation, oral presentation and written reports.

CE 492: Capstone Project-I I (0,0,9)
This course focuses on the design of Civil Engineering Projects. Students working singly or in groups produce solutions to Civil Engineering design projects from the first concepts through preliminary proposals, sketches, cost estimations, design, evaluation, oral presentation and written reports.

MATH 303 – Numerical Methods (3,1,0)
This course covers the following topics: Floating-point arithmetic and error analysis, solution of non-linear equations, polynomial interpolation, numerical integration and differentiation. Data fitting, solution of linear and non-linear algebraic systems, initial and boundary value problems of ordinary differential equations.

12. Architectural Engineering

12.1 Program Mission

The mission of the "Architectural Engineering Department" (AE) is to pursue architectural engineering as a humanistic and professional inter-discipline, which synthesizes art, engineering sciences and technology through critical thinking, creative judgment, technical understanding, and concerns for environment and sustainability. The department achieves its mission through teaching, creative work, and research. In this realm, the AE program commits itself to the highest ideals of the profession and culture of architectural engineering in KSA. The program supports excellence, open discourse activities, inclusiveness, cooperation, inter-disciplinary experience, and responsibility towards the community.

12.2 Program Educational Objectives (PEOs)

PEO 1: Function successfully in the many fields of architectural engineering practice.
PEO2: Serve the society through providing solutions for architectural engineering problems while upholding necessary professional and social ethics.
PEO3: Seek life-long professional development through self-learning, postgraduate studies, training and workshops.

12.3 Student Outcomes (SOs)

SO1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
SO2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
SO3: an ability to communicate effectively with a range of audiences.
SO4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
SO5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
SO6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
SO7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

12.4 Potential Careers For Archetictural Engineering Graduates[3]

Career Name	Code
Architects, planners, surveyors and designers	216
Architect	216101
Interior Architect	216102
Landscape Engineer	216201
City Planner	216401
Urban Planner	216403

[3] دليل التصنيف السعودي الموحد للمهن (masar.sa)

12.5 Archetictural Engineering Laboratories

12.5.1 Physics Laboratories

These labs (shown in Figure 21) are prepared for the courses PHYS 101, and PHYS 102. There are the basic science labs which are common for all branches of freshman year with facilities for the group of 20 students/lab to carry out experiments independently. COE has 4 full equipped physics laboratories; two labs in each campus. Each lab is well-equipped and enables students to understand the fundamentals of Engineering Physics. Major Equipment: Newton's Ring Apparatus, Diffraction Grating Polarimeter, E/M Thomsons's Apparatus, Resolving Power Apparatus, Carey Foster's Bridge, Sonometer, P-N Junction Diode, Plancks Constant Apparatus, Cauchy Constant Apparatus, Cathode Ray Oscillator, De-Sauty Bridge, Ionisation Potential Apparatus, Solar Cell Apparatus, B-H Curve Apparatus etc.

Figure 21: Physics Laboratory

12.5.2 Chemistry Laboratories

These labs are prepared for the course CHEM101 (Figure 22). The COE has two engineering chemistry laboratories, one in each campus. Each lab is aptly prepared to impart education in chemistry in a neatly designed, spacious and well-ventilated laboratory with a capacity to accommodate 20 students. It provides students with a practical approach towards the various techniques used in modern engineering application. Practical awareness is inculcated, and students are trained both quantitatively and qualitatively during the lab sessions so that their understanding and problem-solving abilities can be enhanced. Major Equipment: UV-Spectrophotometer, Digital Conductivity Meters, Flame Photometer, Redwood Viscometers, Pensky Marten's Flash & Fire Point Apparatus, Electrical Balance, Distillation Unit, Digital pH Meters etc.

Figure 22: General Chemistry Laboratory

12.5.3 Architectural Engineering Laboratories

Each course is allocated to classrooms or studios at a certain time. These are equipped with data show devices, white and smart boards, and teacher PC unit. Studios are equipped with special tables and model making tools.

Figure 23: Architectural Engineering Studio

12.5.4 Surveying Laboratories

Students can access to Surveying equipment managed by AE program through a professional elective course. These include levelling tools and theodolite.

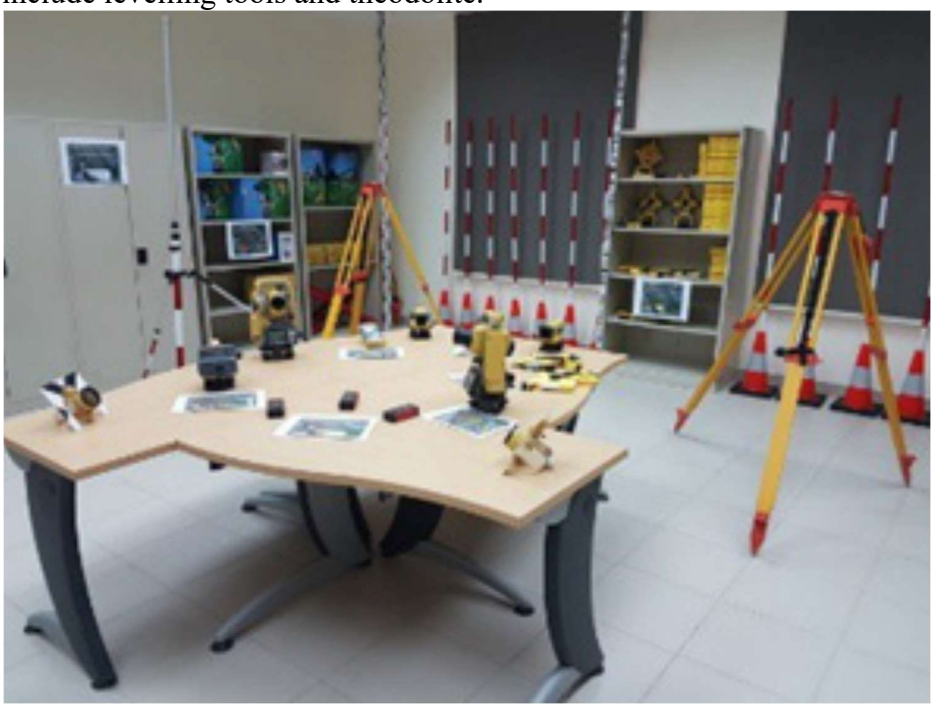


Figure 24: Surveying Equipment

12.6 Bachelor's Degree Requirements

Program Name	Archetictural Engineering
Final Award Degree	Bachelor of Science in Archetictural Engineering
Program Code	BSAE
Credits Units	134
Language of Instruction	English
Mode of Study	English
Study Duration	4 Years
Number of Levels	8 Levels
Number of weeks\levels	15 Weeks
Graduation requirements	GPA 2.0/4.00

Table 11: General Information about the Archetictural Engineering Program

Program Structure	Required/Elective	Credit Hours
Institution Requirements	Required	15
	Elective	12
College Requirements	Required	33
	Elective	
Program Requirements	Required	57
	Elective	12
Capstone Course/Project Requirements	Required	4
Field Experience/Internship	Required	1

Table 12: General Framework of the B.Sc. in Archetictural Engineering Program

12.7 Plan of Study for B.Sc. Archetictural Engineering

Study Plan for Current Students

First Year: First Semester (Freshmen)					First Year: Second Semester (Freshmen)				
Course code	Course Title	Credit Hours	Requisite		Course code	Course Title	Credit Hours	Requisite	
			Pre-	Co-				Pre-	Co-
MATH 101	Calculus I	4	MATH 002		MATH 102	Calculus II	4	MATH 101	
PHYS 101	General Physics I	4	MATH 002	MATH 101	PHYS 102	General Physics II	4	PHYS 101	
CHEM 101	General Chemistry	4			ENGL 102	Introduction to Report Writing	3	ENGL 101	
ENGL 101	First Year Composition	3	ENGL 005		CS 141	Introduction to Computing for Engineers	3		
GHAL xxx	Humanities, Arts and Languages Elective	3			ENGG 103	Introduction to Engineering Drawing	1		
					GEO 144	Geology	3		
	Total	**18**				**Total**	**18**		
Second Year: First Semester (Sophomore)					**Second Year: Second Semester (Sophomore)**				
MATH 201	Differential Equations	3	MATH 102		MATH 202	Calculus III	3	MATH 102	
AE 211	Introduction to Architecture Design & Graphics	2	ENGG 103		AE 212	Architectural Design I	3	AE 211	
AE 213	History and Theory of Architecture	2			AE 222	Applications of CAD & BIM Systems	2	CS 141, AE 211	
ENGG 203	Statics and Dynamics	4	PHYS 101		AE 232	Building Construction, Materials & Technology I	2	AE 211	
ENGL 201	Technical Writing	3	ENGL 102		ME 201	Thermodynamics	3	PHYS 102, MATH 102	
GIAS 101	Islamic Culture	3			CE 212	Strength of Materials	3	ENGG 203 or CE201 **	
	Total	**17**				**Total**	**16**		
	Summer Field Experience I (Optional)		AE 294		1	Credit			
Third Year: First Semester (Junior)					**Third Year: Second Semester (Junior)**				
AE 301	Fluid Mechanics	3	ENGG 203, ME 201		AE 332	Building Construction Documents	2	AE 331	
AE 311	Architectural Design II	3	AE 212		AE 342	Electrical Systems & Illumination in Building	3	PHYS 102	
AE 331	Building Construction, Materials & Technology II	2	AE 232		AE 344	HVAC Systems	3	AE 301	
AE 343	Mechanical Systems in Buildings	3	ENGG 203		CE 312	Reinforced Concrete Design	3	CE 311	
CE 311	Structural Analysis	3	CE 212		STAT 342	Statistical Methods for Engineers	3	MATH 102	
GIAS 102	Arabic Language Skills	3			GSOS xxx	Social Sciences Elective	3		
	Total	**17**				**Total**	**17**		
AE 394	Summer Field Experience II	1							
Fourth Year: First Semester (Senior)					**Fourth Year: Second Semester (Senior)**				
AE 411	Architectural Design III	3	AE 311		AE 462	Projects Management	3		
AE 461	Construction Economy	2			AE 492	Capstone Project II	3	AE 491	
CE 413	Steel Design	3	CE 311		AE 4xx	Professional Elective II	3	Depends on Topic	
AE 491	Capstone Project I	1	Senior Status***		AE 4xx	Professional Elective III	3	Depends on Topic	
AE 4xx	Professional Elective I	3	Depends on Topic		GIAS xxx	Islamic Studies Elective	3		
GDMC xxx	Diversity and Multiculturalism Elective	3							
	Total	**15**				**Total**	**15**		
Total Credit Hours Required					**134**				

	UPM General Compulsory Courses		Program Compulsory Courses
	UPM General Elective Courses		Program Elective Courses
	College Compulsory Courses		Summer Field Experience

Study Plan with Summer Training Option

First Year: First Semester (Freshmen)					First Year: Second Semester (Freshmen)				
Course code	Course Title	Credit Hours	Requisite		Course code	Course Title	Credit Hours	Requisite	
			Pre-	Co-				Pre-	Co-
MATH 101	Calculus I	4	MATH 002		MATH 102	Calculus II	4	MATH 101	
PHYS 101	General Physics I	4	MATH 002	MATH 101	PHYS 102	General Physics II	4	PHYS 101	
CHEM 101	General Chemistry	4			ENGL 102	Introduction to Report Writing	3	ENGL 101	
ENGL 101	First Year Composition	3	ENGL 005		ENGG 103	Introduction to Engineering Drawing	1		
GEO 144	Geology	3			EE 111	Introduction to Programming (Python)	3		
					GHAL xxx	Humanities, Arts and Languages Elective	3		
	Total	**18**				**Total**	**18**		
Second Year: First Semester (Sophomore)					**Second Year: Second Semester (Sophomore)**				
MATH 201	Differential Equations	3	MATH 102		MATH 202	Calculus III	3	MATH 102	
AE 211	Introduction to Architecture Design & Graphics	2	ENGG 103		AE 212	Architectural Design I	3	AE 211	
AE 214	History and Theory of Architecture	2	ENGG 103		AE 232	Building Construction, Materials & Technology I	2	AE 211	
AE 215	Professional Practice and Ethics	3	ENGG 103		EE 284	Introduction to Artificial Intelligence	3	STAT 342, EE 111	
AE 222	Applications of CAD & BIM Systems	2	ENGG 103, EE 111		ENGG 221	Statics and Strength of Materials	4	PHYS 101	
STAT 342	Statistical Methods for Engineers	3	MATH 102		GSOS xxx	Social Sciences Elective	3		
ENGL 201	Technical Writing	3	ENGL 102						
	Total	**18**				**Total**	**18**		
AE 294	Summer Field Experience I (Optional)	1							
Third Year: First Semester (Junior)					**Third Year: Second Semester (Junior)**				
AE 343	Mechanical Systems in Buildings	3	ENGG 221		AE 332	Building Construction Documents	2	AE 331, AE 312	
AE 311	Architectural Design II	3	AE 212		AE 411	Architectural Design III	3	AE 311	
AE 331	Building Construction, Materials & Technology II	2	AE 232		CE 312	Reinforced Concrete Design	3	CE 311	
CE 311	Structural Analysis	3	ENGG 221		AE 342	Electrical Systems & Illumination in Building	3	PHYS 102	
AE 312	Construction Economy	2	AE 232		AE 344	HVAC Systems	3	AE 313, AE 343	
AE 313	Thermofluids	4	ENGG 221, PHYS 102		GIAS 101	Islamic Culture	3		
	Total	**17**				**Total**	**17**		
AE 394	Summer Field Experience II	1							
Fourth Year: First Semester (Senior)					**Fourth Year: Second Semester (Senior)**				
AE 412	Architectural Design IV	2	AE 411		AE 422	Environmental Systems in Buildings	3	AE 411, AE 344	
AE 4xx	Professional Elective I	3	Depends on Topic		AE 462	Projects Management	3	AE 312	
AE 4xx	Professional Elective II	3	Depends on Topic		AE 492	Capstone Project II	3	AE 491	
XXXX xxx	Free Elective	3			AE 4xx	Professional Elective III	3	Depends on Topic	
AE 491	Capstone Project I	1	Senior Status*** >=		GIAS 102	Arabic Language Skills	3		
	Total	**12**				**Total**	**15**		
	TotalCredit HoursRequired				**134**				

	UPM General Compulsory Courses		Program Compulsory Courses
	UPM General Elective Courses		Program Elective Courses
	College Compulsory Courses		Summer Field Experience

Amended

GDMC xxx	Diversity and Multiculturalism Elective	3
GIAS xxx	Islamic Studies Elective	3

12.8 Course Description

AE 211- Intro. To Arch. Design and Graphics

This course is an introduction to basic principles of design, composition, form making, freehand drafting techniques, orthographic projections of plans, elevations, sections, isometric drawing, perspectives, shade and shadow, and color theory. Each of these topics will be examined holistically, beginning with their historical origins, contemporary applications, and finally in the context of the student's own artistic practice. Two- and three-dimensional solutions will be explored. Projects and class meetings will be structured to help students develop a design process and critique skills.

AE 212- Architectural Design I

This is a studio- based course. It provides the students with the fundamentals of design, utilizing graphic thinking in the design process. Topics covered include: principles of design, composition of shapes, volumes and spatial relationships, designing in behavioral and socio- cultural contexts. Analyses of an existing simple building; spaces, partitions and functions. Design will be generated through the study of functional and behavioral use of space. Issues of age, gender, culture and individuality as well as complex functional relationships will be examined in their influence on architectural design. Studio work is individual developing plans, facades, sections and three dimensional drawings.

AE 213- History of Architecture I

This course presents an introduction to architectural history, contexts and settlement forms from the prehistoric beginnings to contemporary architecture. It will cover Middle Eastern and North African civilizations of the Nile Valley, Mesopotamia, Phoenicia, and Crete, and to the Classical civilizations of Greece and Rome, Byzantine, Early Christian architecture; evolution of western architecture: Romanesque, Gothic, the development of architecture in the Islamic context, modern architecture and city evolution from the mid-eighteenth century, i.e. from the Enlightenment and the Industrial Revolution, Modernity, Post-Modernity, Deconstruction. It covers also It covers also the modern and contemporary Islamic architecture in both Arab and Islamic world, besides the contemporary architecture in KSA.

AE 222- Applications of CAD and BIM

The aim of this course is to explore current CAD technologies and develop skills to produce 2D and 3D design specifications and to transform CAD drawings into photo realistic virtual products. At the end of the course, the students will understand a variety of terms and terminologies as applied to BIM (Building-Information Modeling). The course demonstrates the use of an industry standard operating system to create 2D and 3D digital fabrication and parametric design.

AE 232- Building Construction, Materials, Technology I

This course is an introduction for the principles of construction elements and techniques. The course aims to clear the main elements of the building, Building materials and building systems (bearing walls, skeleton, shell construction and other new structural systems) and to train the student to draw the constructional details through the study of: Bearing wall buildings (bricks and stones), Architectural symbols, Building methods, Bonds, Tools, Wall thickness, Openings. Lintels and arches, Vaults and domes, Foundations, Damp proofing, Heat and sound insulation, Expansion and settlement

joints, Retaining walls, Erection requirements, Concrete components, Structural elements, Stairs, and external finishes.

AE 301- Fluid Mechanics
Statics of fluids, analysis of fluid flow using principles of mass, momentum and energy conservation from a differential and control volume approach. Dimensional analysis.
Application to pipe flow and open channel flow.

AE 311- Architectural Design II
This course is a studio on environment and sustainability. It aims at introducing environmental design strategies in response to climate, human comfort and energy consumption. It focuses on the integration of sustainable and passive design principles, into conceptual and practical architectural design. Topics will include the fundamentals of sustainable building and design, energy efficient design, day-lighting, "green" materials selection, and other sustainability initiatives. Studio work is individual developing design project and studies.

AE 331- Building Construction, Materials, Technology II
This course introduces the state-of-the-art and major innovations in building technologies and structural, enclosure, mechanical, and interior systems. The course continues the mandate for Total Building Performance, clarifying the full range of building performance mandates required in today's architecture. It focuses also on construction phases and working details, descriptions and techniques. The course identifies a variety of systems, methods, and materials used for building construction technology and develop the understanding of architectural details and finishing. It improves the skills of students in detailed drawings. The course also included site visits for construction projects sites.

AE 332- Building Construction Documents
The course prepares students to transform ideas and CAD drawings into site construction documents for the building industry. Students are exposed to the standards, regulations, and contract liabilities of the Saudi building code. As a training exercise, students are assigned to produce the construction documents for a design project they produced in the studio.

AE 342- Electrical Systems and Illumination in Building
This course covers: Basic electrical circuits, panel board, wiring and system distribution in buildings. Building total electrical system design. Protection, security systems, electric codes. Introduction to basic phenomena, and concepts of architectural lighting and electrical light sources. Lighting system, and design methods, quantity and quality of illumination. Day lighting, lighting measurements, instruments and methods. Measuring method and equipment. Impact of lighting system on architectural design. Computer applications.

AE 343- Mechanical Systems in Buildings
This course covers an introduction to all the mechanical systems of the building. Topics included: Mechanical services required in different building types. Human thermal comfort in relation to heating, cooling and humidification; environmental systems and energy consumption; mechanical ventilation and air movement; energy loads and initial costs. Smoke and fire control; the different types of water piping; sanitary systems, plumbing, sewerage and health environment concerns. Use of vertical transportation systems; water heating and cold storage; solar energy and

oil and gas storage. It includes the needed computer applications related to the field.

AE 344- HVAC Systems
This course intrudes the fundamental principles and engineering procedures for the design of heating, ventilating, and air conditioning systems; HVAC system characteristics; system and equipment selection; duct design and layout. The course covers also energy conservation techniques and the computer applications and tools related to the field.

AE 411- Architectural Design III
This is a studio-based course on the Art of Structure and Technology. The course aims at developing the student's skills in dealing with complex architectural problems taking in account the integration of all the building systems.
This studio's will link the two basic components of architecture- art and engineering. Based on a firm understanding of structural systems and their appropriate application to architectural design, projects will be designed to incorporate both aesthetic beauty and structural thinking. The influence of technology in the form of new materials and methods will be examined through their design potential. Three-Dimensional manual and digital models will play an essential role in the design development processes of this studio.

AE 461- Construction Economy
Introduction to the basic concepts and principles of engineering and construction economics. It covers of the different cost components, cost estimation techniques, cash flow analysis, and time value of money. It covers also main components of construction cost in relation to quality and time. Cost of materials, labors, equipment, overhead and profit. Work breakdown structure and quantity take off. Bid preparations, tenders, and contracts awards.

AE 462- Projects Management
This course is an introduction to the various field operations and systems activities necessary for construction project management, including basic aspects of construction methodology, such as estimating, scheduling, contracts, subcontractor management, cost control, and project administration. It covers basic managerial functions: planning, strategies, objectives, MBO; organizing, departmentalizing, job descriptions; elements of human resource management: staffing, directing, controlling, total quality management, continuous improvement, critical management methods, and exposure of various engineering applications.

AE 491- Capstone Design Project I
This course represents the first step of the graduation project. This including the selection of the project based on the real needs of society. Initiation of an engineering design process through research and design methods, literature review, data gathering, analysis of potential sites and similar existing buildings as well as assessment of alternative building engineering solutions to the design problem. Emphasis is on physical and social documentation, visual surveying, users' needs, generating alternative solutions, and evaluation in preparation for "Capstone Design Project II" course.

AE 492- Capstone Design Project II

This course is the second step of the Capstone Design Project after the course "Capstone Design Project I". This course is a semester long project that is divided into three components. The first part focuses on conceptual, strategic, and formal skills. The second part focuses on the demonstration of synthesis and integration. The third part (a design project) focuses on process and craft. The aim of the project is to provide the students with an opportunity to implement the concepts and techniques appropriate to a design. A dissertation on the project should be submitted on which the student is examined orally.

CE 212 – Strength of Materials

The course focus on the Concepts of stress, strain, and constitutive relations; stress and deformation of axially loaded members; thermal stresses; pressure vessels; energy concepts; torsion of circular and thin-walled sections; shear and bending moment diagrams in beams; elastic bending and shear stresses in beams; compound stresses; stress transformation; bending moment curvature equation; deflection of beams; singularity functions methods, analysis and design applications.

CE 311 –Structural Analysis

The course focus on the analysis of statistically determinate structures; influence lines; deflection of trusses, beams, and frames; introduction to indeterminate analysis using consistent deformation and moment distribution; computer programming.

CE 312 – Reinforced Concrete Design

The course focus on the loads design philosophies, current design codes, design for flexure, shear, torsion and axial loads. Design of beams, columns, beam-columns, two-way slabs; serviceability considerations; applications to buildings. Design project.

CE 413 – Steel Design

The course focus on the properties of structural steel; steel sections, introduction to load resistance factor design (LFRD), design of tension members, compression members and capacity calculations; width thickness ratios; design of beams with and without lateral supports; design of members under combined axial and bending loads; design and details of simple bolted and welded connections, and an introduction to common building connections; use of STAAD. Pro software for design of elements and overall design of frames; completion of a design project; site visit.

ENGG 203- Statics and Dynamics

This Course is a combination of statics and dynamics for non-CE Majors. The objective is to prepare students for courses dealing with engineering design of components and systems based on the fundamentals of statics and dynamics. The course covers principles of forces and force systems, resultants and components of force systems, forces due to friction, condition of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia, review of kinematics and kinetics of particle motion, two-dimensional motion of rigid bodies.

ME 201- Thermodynamics

Introduction and basic thermodynamic concepts and definitions, System and control volume concepts. Properties and behavior of a pure substance, equation of states, table of properties Work and heat, the first law of thermodynamics applied to a system and control volume, Internal energy, enthalpy, steady state, Unsteady state, the second law of thermodynamics analysis for the control volume, heat engines, refrigerators and heat pumps, Carnot cycle, reversible and irreversible processes, Entropy, Clausius inequality, principle of the increase of entropy, Efficiencies. Entropy of ideal gas.

AE 294- Field Experience I (Optional)
Students obtain a position in the government or private sector as a full-time trainee for at least 8 weeks during the summer prior to their graduation. Students will work on a hands-on, real- world architecture design and implementation process, under the supervision of the field supervisor, who is on-site at the company, agency, or research laboratory where the field experience is taking place.

AE 394- Field Experience II**
Students obtain a position in the government or private sector as a full time trainee for at least 8 weeks during the summer. Students will work on a hands-on, real-world architecture design and implementation process, under the supervision of the field supervisor, who is on-site at the company, agency, or research laboratory where the field experience is taking place.