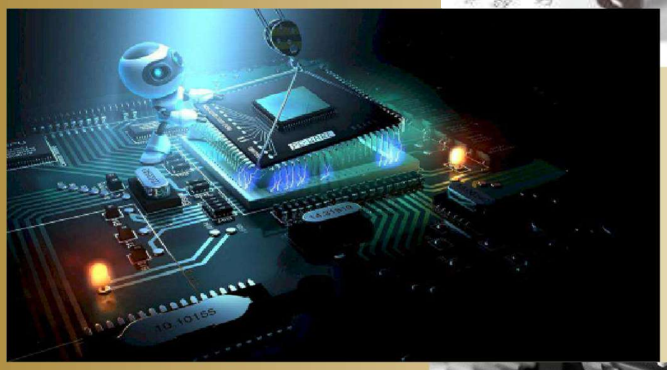
جامعة تبوك
University of Tabuk

FACULTY OF ENGINEERING HANDBOOK




بسم الله الرحمن الرحيم

Dean's Message

The student's handbook is designed to orient you in the sometimes overwhelmingly rich academic environment. It is meant to be a kind of user's manual for you as a student, giving you an overview of the options available to you and the resources that can help you make good choices.

We believe your undergraduate experience will be more enjoyable and rewarding if you take the time to read through this handbook.

A quick scan of the handbook will show you what types of information it contains. The handbook can be your guide to academic requirements, the residential system, and the many activities that take place outside the classroom. Importantly, it clarifies the standards that should guide your conduct within the Faculty of Engineering. It sets forth the academic and disciplinary rules that apply to everyone in our community. It also sketches the broad outlines of the concentrations and secondary fields offered by the Faculty of Engineering.

Life at the Faculty of Engineering, anywhere, can be confusing. Remember that there are always people standing by to help you think through choices, both academic and otherwise. Seek out advisers you like and trust, and never be afraid to ask for some of their time. Everyone at the Faculty of Engineering wants you to excel here. If you read this Handbook carefully and use it to find the support you need, you will be well on your way.

Dear student, let say that you have chosen a path that needs effort, training and practice intensively with self-reliance in the study, research and knowledge. I am sure you will be welcome here, my advice to you is to organize your time and devote attention to lectures, applications, and laboratory experiments which are the foundations of the study altogether to be graduated and qualified to carry responsibility for the renaissance of our dear country. Also, invite you to entertain activities provided to you by the Faculty of Engineering (sports and cultural events, social, etc..) to develop your talents and skills in leadership, management, and achievements.

Dr. Ibrahem Atawi
Dean, Faculty of Engineering

University of Tabuk

History

The University of Tabuk (UT) was established in 1427 H (2006 G) to fulfill the dream of the Custodian of the Two Holy Mosques to provide equal access to education to every part of the Kingdom. UT amalgamated the old Tabuk Teachers' College that had served as Tabuk region's primary source for elementary, intermediate, and secondary school teachers.

Today, UT is located on a sprawling 12 million square meters campus in the under-construction University City, Tabuk, which will soon become the home to state-of-the-art facilities that include a world-class secondary and tertiary care hospital. All Faculties, Colleges, and Departments currently occupy temporary facilities in University City and throughout the Tabuk region, while University City is being completed.

Currently, there are about 20,000 male and female undergraduate students enrolled in 10 Faculties, 1 Community College, and four outlying Colleges and Branches. Due to the cultural requirement in Saudi Arabia that the sexes be segregated, facilities at UT are bifurcated, and female students receive their education at parallel campuses scattered throughout the Tabuk region. All male Colleges, Faculties, and Departments are located in University City, on UT's main campus. The main female campuses are at Maseef and Mahrajan, two boroughs of Tabuk, and the branches in Duba, Al-Wajh, Omloj, Haql, and Taimah.

All incoming students are required to complete a one-year Preparatory Program (PYP). Classes in Arabic, biology, communication skills, English, Islamic studies, mathematics, and physics, are designed to prepare the freshman for the rigors that lie ahead. Successful completion of the PYP is required for advancement to any of the various Faculties.

Presently, degrees offered are the Diploma in occupational education through the Community College, the baccalaureate through all the Faculties, and the Master through the Faculties of Education & Arts and Science.

Vision

A distinguished university in education, research and community service

Mission

To offer a distinguished university education that prepares university graduates with the knowledge, capabilities, and skills needed by the community and developmental projects in the Tabuk region within an exceptional education and administrative environment that promotes innovative research.

Faculty of Engineering

History

The Council for Higher Education Issued its decision No. (13/44/1427) dated 21/10/1427 H concerning the establishment of the Faculty of Engineering. The decision to establish the Faculty came to keep up with the renaissance taking place in the Kingdom in many areas, as the engineering is the profession that employs science to serve the welfare of society as well as to keep pace with the progress in scientific and technological advancement in the twenty-first century. The faculty was established to address the needs of the engineering market at the national and regional levels. The faculty started with its activities and functions from the academic year 1429/1430 H, whereby 80 students have been accepted in the first year. This number of students is continuously increasing every year.

The period of study in the Faculty of Engineering is five years divided into ten semesters (levels) of education. Besides, sixteen weeks of summer training in companies and institutions under the supervision of faculty members are also a must.

Vision

A distinguished and pioneering college locally and internationally in the field of engineering education, innovative research, and building a knowledge society

Mission

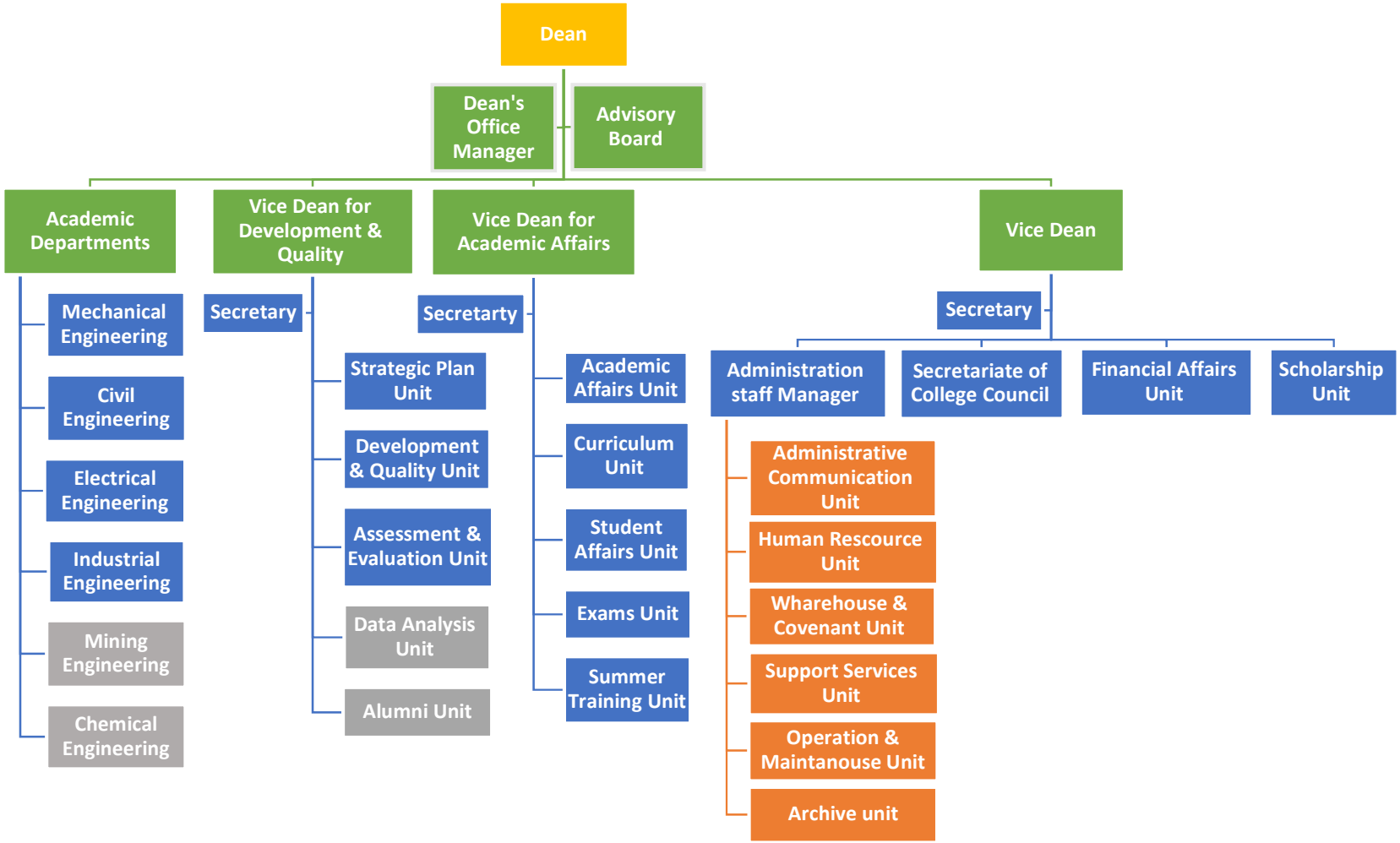
To graduate qualified engineers in accordance with the International Academic Standards and prepare them to meet the changing needs of society. These graduates will be able to compete locally and internationally. The Faculty of Engineering is committed to providing excellent education and pursuing relevant scientific research and partnership with industry and governmental societies.

Faculty Departments

The Faculty of Engineering includes the following six departments, as indicated below:

- Department of Civil Engineering
- Department of Electrical Engineering
- Department of Mechanical Engineering
- Department of Industrial Engineering
- Department of Chemical Engineering (shall commence soon)
- Department of Mining Engineering (shall commence soon)

Organizational Structure



Academic Regulations

Admission

A. Based upon the recommendation of the Faculty Council and the other concerned bodies of the University, the University Council determines the number of new students be admitted in the following academic year.
B. An applicant for admission to the university must satisfy the following conditions:
C. The student should have obtained his secondary school certificate or its equivalent from a school inside or outside the Kingdom of Saudi Arabia.
D. The student should have received the secondary school certificate in less than five years before the date of application. However, the University Council may waive this condition if the applicant has convincing reasons.
E. The student must have a record of ethical conduct.
F. The student must successfully pass any examination or personal interview as determined by the University Council.
G. The student must be physically fit and healthy.
H. The student must obtain the approval of his employer if he is an employee of any government or private agency.
I. The student must satisfy any other conditions the University Council may deem necessary at the time of application.
J. The student has not have been dismissed from another university.
K. Admission is granted to applicants who satisfy all admission requirements and is based on the applicant's grades in the secondary school examinations, personal interview, and entrance examinations if deemed necessary.

Academic Terminology

Academic Year: consists mainly of two regular semesters and a summer semester, if available.

Academic Semester: is a term of no less than (15) weeks of instruction not including the registration and final examination periods.

Summer Semester: is a term of no less than (8) weeks of instruction not including the registration and final examination periods whereby the teaching time allocated for each course is doubled.

Academic Level: indicates the study level. The levels required for graduation are eight or more per the specifications of each approved degree program.

Course: is a subject of study within a certain academic level of the approved degree plan in each major.

Credit Hours: is a weekly lecture, theoretical lecture, with duration not less than 50 minutes, or laboratory session or field study of no less than 100 minutes duration.

Academic Probation: is a notification given to a student with a cumulative GPA below the minimum acceptable limit as explained in these regulations.

Class Work Score: is the score which reflects the student's standing during a semester according to his performance in the examinations, research and other activities related to a particular course.

Final Examination: is an examination in the course, given once at the end of every semester. Final Examination Score: attained by the student in each course on the final examination. Final Score: is the total of the classwork score plus the final examination score calculated for each course out of a total of a hundred (100).

Course Grade: is a description of the percentage, or alphabetical letter for the final grade the student obtained in a course.

Incomplete Grade: is a temporarily provisional grade assigned for each course in which a student fails to complete the requirements by the required date. This is indicated in the student academic record with the letter grade "IC"

Progress Grade: is a provisional grade assigned for each course which required more than one semester to complete. The letter grade "IP" is assigned in this case.

Semester GPA: is the total number of quality points the student has achieved, divided by the total credit-hours assigned for all the courses the student has taken in any semester. The quality points are calculated by multiplying the credit-hours by the grade earning in each course.

Cumulative GPA: is the total number of quality points the student has achieved in all courses he has taken since his enrollment at the University, divided by the total number of credit-hours assigned for these courses.

Graduation Ranking: is a description of the assessment of the student's academic achievement during the period of his study at the University.

Minimum Load: is what a student must take in a semester-based on his GPA, as determined by the University Council.

Registration

The undergraduate study at Faculty of Engineering subject to the following academic rules:

A. Degree plans are designed with a minimum of eight academic levels.
B. Passing from one level to the next level is contingent upon the student passing all courses in the current level.
C. The minimum curse load is 12 credit hours during a regular semester. This condition is relaxed in the last semester before graduation. However, a student is permitted to register for 24 credit hours with the approval of Dean of Admission and Registration.
D. The student GPA determines the maximum allowed credit hour load for him.
E. The student shall be enrolled in courses automatically before the start of the semester, and the students can add and drop as per the Admission and Registration Rules.

Attendance and Withdrawal

A. Students who fail to attend 75% of the overall classes in a course will be denied access to the final exam in that course and hence the grade DN is given. Semester work grade shall be recorded as is. The faculty dean or his authorized representative approves grade denial lists.
B. The Faculty Council or his authorized representative can exempt students (from being denied access to the final exam) who maintained a minimum 60% attendance.
C. Students who miss the final exam will be given zero in the exam, and his grade will be calculated based on the attained grad in the semester work.
D. Unless a valid and acceptable excuse is presented to the Faculty Council, the student will then be given a substitute final exam during a period not exceeding the end of next semester.
E. Withdrawal from study is subject to the following rules:
    1. The student may withdraw a semester with an acceptable excuse addressed to the dean within three weeks before of the final exams. In all cases the grade "W" will, permanently, be recorded in the students' transcript and the semester are counted towards the graduation requirements.
    2. Withdrawing a maximum of two consecutive or three non- consecutive semesters is allowed.
    3. Guardian consent might be requested for withdrawal.
    4. Students can withdraw one or more courses under the following terms:
        a. Dean's Approval
        b. Dean's Approval
        c. Apply before the deadline for withdrawal.
        d. The student gets "W" grade in the course.
F. Students can apply for withdrawal during the first week of the semester with a valid excuse, acceptable to the dean, for a maximum of three semesters and no more than two consecutive semesters. Student's records will be suspended after that unless an exception is granted by the Dean. The exception of the period of withdrawal will not be counted within the time needed to complete the graduation requirements.
G. If student does not attend classed for four weeks from the beginning of the semester, he will be considered suspended.

Re-Enrollment

A student, whose enrollment status has been suspended, may apply for re-enrollment with the same University ID number and academic record he had before his suspension, provided that:

A. The student applies for re-enrollment within four regular semesters from the date of cancelation of his enrollment status.
B. The student obtains the approval of the relevant Faculty Council and related departments for re-enrollment.
C. That five or more semesters have elapsed since the cancellation of his enrollment, in which case the student can apply to the Universality for admission as a new student without considering his old academic record if he fulfills all the admission requirements as a new student.
D. That student has not been re-enrolled previously

E. That student was not on probation prior to the cancelation of his enrollment

F. A student who has been dismissed from the University for academic or disciplinary reasons- or from other universities for disciplinary reasons –will not re-enrolled at the University. If it becomes known later that a student has been dismissed for such reasons, his enrollment will, automatically, be considered null and void as of the re-enrolment date.

Dismissal

First: Dismissal from the University will occur in the following circumstances:

A. A student will be dismissed if he obtains a maximum of three consecutive academic probations as the result of his cumulative GPA being less than 2.00 out of 5.00. Following the recommendation of the Faculty Council the University Council may allow the student a fourth opportunity to improve his cumulative GPA by taking additional courses according to the following:
    1. Approval of the Faculty Council
    2. The student attainment in the last two semesters (summer session is not included) was improving.

B. A student will be dismissed if he fails to complete the graduation requirements within maximum additional period equal to one half of the period determined for his graduation in the original program period. However, the University Council may exempt the student from this restriction and give him the opportunity to complete the graduation requirements within an additional period of maximum duration equal to that of the original program according to the following:
    1. Approval of the Faculty Council
    2. There is an improvement in student performance in the last two semesters (summer session is not included).

Second: The University Council may exempt the student from his restriction and allow him to complete the graduation requirements within an additional period of maximum duration equal to that of the original program according to the following:

A. Approval of the Faculty Council

B. The student has only two semesters left for his graduations.

C. The student attainment in the last two semesters (summer session is not included) was improving.

Third: The Academic Affairs Committee, based on the recommendation of the dean, may give a maximum of two semesters for students who are dismissed as a result of academic probations.

Grades

A. The grade of “Incomplete” (IC): It is permitted to delay the grade of a course due to the non-completion of its requirements with the permission of the instructor and the approval of the Department Council. But this delay should be for no more than one main semester. If this delay lasts for more than one semester, the grade will automatically change into a «Fail» (F) grade.

B. The grade of “In Progress” (IP): Some courses need more than one semester to complete their

requirements particularly those including senior design project work or training. For these courses, the student can postpone his grade for no more than two further semesters. In this case, the student grade is IP (In Progress).

C. The grade of "Failure" (F): The student is permitted to repeat a course in which he earned an F. The new grade does not cancel the old one. The old grade is kept in the student's transcript and is counted in his GPA.

D. The grades a student earns in each course are calculated as follows:

Range of Marks	Symbol	Points
95 – 100	A+	5.00
90 – less than 95	A	4.75
85 – less than 90	B+	4.50
80 – less than 85	B	4.00
75 – less than 80	C+	3.50
70 – less than 75	C	3.00
65 – less than 70	D+	2.50
60 – less than 65	D	2.00
Less than 60	F	1.00

E. Based on the cumulative GPA achieved by a graduating student, his graduation rank is assigned to one of the following levels:

No.	Level	GPA
1	Excellent	4.50 – 5.00
2	Very Good	3.75 – less than 4.50
3	Good	2.75 – less than 3.75
4	Pass	2.00 – less than 2.75

F. Based on the cumulative GPA achieved by a graduating student, his honor rank is assigned to one of the following levels:

No.	Level	GPA
1	First Honor	4.75 – 5.00
2	Second Honor	4.25 – less than 4.75

Both statuses are subject to following conditions:

1. The student must not have failed in any course in University of Tabuk or any other university.
2. The student must have completed all graduation requirements within a period of duration ranging between the maximum and minimum limits for completing the program of study in the Faculty of Engineering.
3. The student must have completed 60% or more of the graduation requirements at the University of Tabuk from which he graduates.

General Rules

A. These regulations supersede all the preceding rules and regulation established for study and examinations at the undergraduate level.
B. The University Council may setup implementation rules which will not contradict with these regulations.
C. The Higher Education Council reserves the right to interpret these regulations.

Degree Programs

The Faculty offers the Bachelor's Degree in the following 6 programs (in alphabetical order):

A. B.Sc. Degree in Electrical Engineering.
B. B.Sc. Degree in Civil Engineering.
C. B.Sc. Degree in Mechanical Engineering.
D. B.Sc. Degree in Industrial Engineering.
E. B.Sc. Degree in Chemical Engineering (will commence soon)
F. B.Sc. Degree in Mining Engineering (will commence soon)

Graduation Requirements for the Bachelor's Degree Programs

A. The student Graduates after completing graduation requirements, successfully, based on the study plan and with at least an average cumulative GPA of (2 of 5). In the case of a student succeeds in courses and fails in the cumulative average, the Faculty Council or his representative and based on the Council of the concerned department to determine appropriate courses studied by the student to raise his cumulative average.
B. The students are not considered graduated till after the issuance of the approval of the University Council that grants the Degree.

University Requirements

The university requirements in the UT consist of 20 credits covering a broad spectrum of subject areas including communication skills, computer skills, learning and thinking skills, Arabic language, and Islamic studies. The table below shows the set of courses in the university requirements.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Communication Skills	COMM001	2	0	0	2	
2	Computer Skills	CSC001	4	0	0	3	
3	Learning, Thinking, &Research Skills	LTS001	4	0	0	3	
4	Language Skills	ARAB101	2	0	0	2	ARAB101

5	Writing Skills	ARA201	2	0	0	2	
6	Islamic Culture I	ISLS101	2	0	0	2	ISLS101
7	Islamic Culture II	ISLS201	2	0	0	2	ISLS201
8	Islamic Culture III	ISLS301	2	0	0	2	ISLS301
9	Islamic Culture IV	ISLS401	2	0	0	2	
Total			**22**	**0**	**0**	**20**	

Faculty Requirements

The Faculty of Engineering requirements consist of 62 credits covering three main subject areas. These are English, Math and Sciences. The tables below show the set of courses in the faculty requirements.

A. Faculty requirements (Preparatory Year)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language I	ELS001	15	0	0	5	
2	English Language II	ELS002	15	0	0	5	ELS001
3	Mathematics I	MATH100	3	0	0	3	
4	Mathematics II	MATH101	3	0	0	3	MATH100
5	General Physics	PHYS101	3	0	0	3	
6	General Biology	BIO101	3	0	0	3	
7	General Chemistry	CHEM101	3	0	0	3	
Total			**45**	**0**	**0**	**25**	

B. Faculty requirements (Additional Courses)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
8	Mathematica l Geometry	MATH284	3	0	1	3	MATH101
9	Statistics & Probability	MATH325	3	0	1	3	MATH284
10	Differential Equations	MATH383	3	0	1	3	MATH284
11	Linear Algebra	MATH241	3	0	1	3	MATH284
12	Physics	PHYS205	3	2	0	4	PHYS101
13	General Physics Lab	PHYS281	0	2	0	1	PHYS101
14	General Chemistry Lab	CHEM203	0	2	0	1	CHEM101

15	Engineering Drawing and Graphics	ENG201	1	4	0	3	
16	Production Tech. and Workshops	ENG202	1	4	0	3	ENG201
17	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
18	Engineering Mechanics II	ENG204	2	0	1	2	ENG203
19	Engineering Design I	ENG205	3	3	0	3	ELS002-MATH101
20	Engineering Design II	ENG213	2	2	0	2	ENG205
21	Engineering Economy	ENG214	2	0	0	2	ENG213
22	Engineering Management	ENG215	2	0	0	2	ENG214-MATH325
Total			**75**	**19**	**6**	**37**	

C. Preparatory Year

The preparatory year aims at enhancing the skills of the students through intense English course and courses that improve their communication and computer skills. It also provides foundation courses in IT, mathematics, and basic sciences. The tables below illustrate the modules studied during the preparatory year.

1. 1st Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills I	ELS001	15	0	0	5	
2	Mathematics I	MATH100	3	0	2	3	
3	Communication Skills	COMM001	2	0	0	2	
4	Computer Skills & Applications	CSC001	4	0	0	3	
5	General Physics	PHYS101	3	0	0	3	
Total			**27**	**0**	**2**	**16**	

2. 2nd Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills (2)	ELS002	15	0	0	5	
2	Mathematics II	MATH101	3	0	2	3	
3	Learning & Thinking Skills	LTS001	3	0	0	3	
4	Chemistry	CHEM101	3	0	0	3	
5	General Biology	BIO101	3	0	0	3	
Total			**27**	**0**	**2**	**17**	

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DEPARTMENT OF CIVILENGINEERING

The department of civil engineering was founded in 1428H and the studying in the preparatory year started in the academic year 1429-1430 H. The study is of 5 years duration including the preparatory year (10 semesters) in addition to two summer training of 16 weeks in companies and agencies under supervision of the faculty members.

Vision

The department's vision is innovation and leadership in education, scientific research and community services.

Mission

The mission of the department is to support the needs of Tabuk region and the Kingdom of Saudi Arabia society by providing high quality educational program, and contributing to research related to civil engineering profession.

Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe what graduates are expected to attain within five years of graduation. The PEOs support the mission of the institution and are based on the needs of the program's constituencies.

The PEOs for the Civil Engineering Program are that within five years of graduation:

PEO 1: Graduates will establish themselves in successful careers in civil engineering or related fields and will become key team member that can communicate and collaborate effectively in a multidisciplinary environment.

PEO 2: Graduates will take into account economic, environmental, societal and ethical considerations in solving the civil engineering problems.

PEO 3: Graduates will purse life-long learning, professional development, professional licensure and participation in professional societies or graduate studies.

Degree Requirements

The Department of Civil Engineering awards the B.Sc. degree in Civil Engineering. The curriculum within the Department of Civil Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework.

To obtain the B.Sc. degree in civil engineering, the student must successfully complete 167 credit hours which are split over 10 levels of studying. In addition, the students are required to complete two practical summer training sessions (16 - weeks) in the industrial field.

Towards the total of 167 credit hours, 20 credit hours represent the university requirements and 60 credit hours represent the faculty requirements whereas 87 credit hours represent the department requirements. The table below shows overall summary of requirements to obtain degree.

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	Faculty of Engineering Requirements	Compulsory	62
3	Civil Engineering Department Requirements	Compulsory	73
		Elective	12
Total			167

The civil engineering curriculum allows the student to choose four elective courses (12 credit hours) from the following tracks:

A. Structural and Geotechnical Engineering Track.
B. Construction Engineering and Management Track.
C. Transportation and Highway Engineering Track.
D. Water Resources and Environmental Engineering Track

Departmental Course Requirements (Compulsory)

The table below shows the set of compulsory courses in the civil engineering department.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Structural Analysis I	CE 302	3	0	1	3	ENG 203
2	Structural Analysis II	CE 303	3	0	1	3	CE 302
3	Steel Structures	CE 405	3	0	1	3	CE 303
4	Earthquake Engineering	CE 406	3	0	1	2	CE 303
5	Surveying	CE 311	3	2	1	3	MATH 383

6	Construction Materials	CE 323	3	2	1	4	ME 213
7	Geotechnical Engineering I	CE 331	3	2	1	4	ME 213
8	Geotechnical Engineering II	CE 432	2	2	1	3	CE 331
9	Foundation Engineering	CE 433	3	0	1	3	CE 432- CE 451
10	Transportation Engineering	CE 441	3	0	1	3	CE 311
11	Highway Design and Construction	CE 442	2	2	1	3	CE 441
12	Reinforced Concrete I	CE 451	3	0	1	3	CE 323- CE 303
13	Reinforced Concrete II	CE 452	3	0	1	3	CE 451
14	Environmental Engineering I	CE 461	3	0	1	3	CE 371; BIO 101
15	Water and Wastewater Engineering	CE 462	3	2	1	4	CE 472- CHEM 203
16	Fluid Mechanics	CE 371	2	2	1	3	PHYS 281- ENG 204
17	Hydraulics	CE 472	2	2	1	3	CE 371
18	Construction Management	CE 482	3	0	1	3	ENG 215
19	Civil Eng. Drawing	CE 391	1	4	0	3	ENG 201
20	Computer Application for CE	CE 494	2	2	1	3	MATH 241- CE 303
21	Practical training	CE 499	0	4	0	2	Department approval
21	Mechanics of Materials	ME 213	2	2	1	3	ENG 205
23	Electromechanical Engineering	CE 492	2	0	1	2	CE 323
24	Graduation Project I	CE 495	1	2	1	2	
25	Graduation Project II	CE 496	1	3	0	2	CE 495
Total						**73**	

Departmental Course Requirements (Elective Courses)

A. Structural and Geotechnical Engineering Track

The students have to choose four courses (12 credit hrs.). The name of these courses depends on the specialty area as follows:

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced Structural Analysis	CE 407	3	0	1	3	CE 303
2	Improvement of soil properties	CE 435	3	0	1	3	CE 432
3	Advanced Steel Structures	CE 408	3	0	1	3	CE 405
4	Advanced Reinforced Concrete	CE 453	3	0	1	3	CE 452
5	Introduction to rock mechanics	CE 434	3	0	1	3	CE 432
6	Foundations on Problematic soils	CE 436	3	0	1	3	CE 432-CE 433
7	Special topics in Structural and Geotechnical Engineering	CE 437	3	0	1	3	CE 452-CE 433
Total of 4 courses						**12**	

B. Construction Engineering and Management

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced Materials of Construction	CE 423	3	0	1	3	Ce 323
2	Advanced Concrete Technology	CE 424	3	0	1	3	CE 323
3	Advanced Methods of Construction	CE 483	3	0	1	3	CE 451
4	Construction Contracts	CE 484	3	0	1	3	CE 482
5	Construction Planning	CE 485	3	0	1	3	CE 482
6	Estimating Construction Costs	CE 486	3	0	1	3	CE 323- CE 482

7	Special topics in Construction Engineering and Management	CE 487	3	0	1	3	CE 482
Total of 4 courses						**12**	

C. Transportation and Highways Engineering

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced surveying	CE 412	3	0	1	3	CE 311
2	Traffic Engineering	CE 445	3	0	1	3	CE 441
3	Advanced Design of Pavements	CE 444	3	0	1	3	CE 442
4	Transportation Economics	CE 446	3	0	1	3	CE 441
5	Airports Planning and Design	CE 447	3	0	1	3	CE 442
6	Railway Engineering	CE 448	3	0	1	3	CE 441
7	Special topics in Transportation Engineering and Highways Engineering	CE 449	3	0	1	3	CE 442
Total of 4 courses						**12**	

D. Water Resources and Environmental Engineering

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Hydrology and Groundwater	CE 474	3	0	1	3	CE 472
2	Hydraulic Structures	CE 473	3	0	1	3	CE 472-CE 452
3	Water resources	CE 463	3	0	1	3	CE 472
4	Environmental Engineering II	CE 464	3	0	1	3	CE 461
5	Wastewater Reclamation and Reuse	CE 465	3	0	1	3	CE 462
6	Solid and Hazard Wastes	CE 466	3	0	1	3	CE 462
	Special topics in Water Resources and	CE 475	3	0	1	3	CE 462

	Environmental Engineering						
Total of 4 courses						**12**	

Degree Curriculum

1. 3rd Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Theoretical	Practical (Lab)	Tutorial		
1	Engineering Drawing and Graphics	ENG 201	1	4	0	3	-
2	Engineering Mechanics (1)	ENG 203	2	0	1	2	PHYS 101
3	Introduction to Engineering Design (1)	ENG 205	2	2	0	3	MATH 101 ELS 002
4	Islamic Culture I	ISLS 101	2	0	0	2	-
5	Mathematical Geometry (3)	MATH 284	3	0	1	3	MATH 101
6	Physics	PHYS 205	3	2	0	4	PHYS 101
7	General Physics Lab	PHYS 281	0	2	0	1	PHYS 101
Total						**18**	

2. 4th Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	General Chemistry Lab	CHEM 203	0	2	0	1	CHEM 101
2	Introduction to Engineering Design (2)	ENG 213	2	2	0	2	ENG 205
3	Linear Algebra	MATH 241	3	0	1	3	MATH 284
4	Language Skills	ARB 101	2	0	0	2	-
5	Production Technology and Workshops	ENG 202	1	4	0	3	ENG 201
6	Engineering Mechanics (2)	ENG 204	2	0	1	2	ENG 203
7	Islamic Culture (2)	ISLS 201	2	0	0	2	ISLS 101

8	Differential Equations	MATH 383	3	0	1	3	MATH 284
Total						**18**	

3. 5th Level / Third Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Mechanics of Materials	ME 213	2	2	1	3	ENG 205
2	Structural Analysis (1)	CE 302	3	0	1	3	ENG 203
3	Fluid Mechanics	CE 371	2	2	1	3	PHYS 281-ENG 204
4	Civil Drawing	CE 391	1	4	0	3	ENG 201
5	Islamic Culture (3)	ISLS 301	2	0	0	2	ISLS 201
6	Statistics & Probabilities	MATH 325	3	0	1	3	MATH 284
Total						**17**	

4. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Construction Materials	CE 323	3	2	1	4	ME 213
2	Writing Skills	ARB 201	2	0	0	2	ARB 101
3	Structural Analysis (2)	CE 303	3	0	1	3	CE 302
4	Surveying	CE 311	2	2	1	3	MATH 383
5	Geotechnical Engineering (1)	CE 331	3	2	1	4	ME 213
6	Islamic Culture (4)	ISLS 401	2	0	0	2	ISLS 301
Total						**18**	

5. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Geotechnical Engineering (2)	CE 432	2	2	1	3	CE 331
2	Transportation Engineering	CE 441	3	0	1	3	CE 311
3	Reinforced Concrete I	CE 451	3	0	1	3	CE 303 - CE 323

4	Environmental Engineering (1)	CE 461	3	0	1	3	CE 371-BIO 101
5	Hydraulics	CE 472	2	2	1	3	CE 371
6	Engineering Economy	ENG 214	2	0	0	2	ENG 213
Total						**17**	

6. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Computer Applications for Civil Engineering	CE 494	2	2	1	3	MATH 241-CE 303
2	Highway Design and Construction	CE 442	2	2	1	3	CE 441
3	Reinforced Concrete II	CE 452	3	0	1	3	CE 451
4	Water and Wastewater Engineering	CE 462	3	2	1	4	CE 472-CHEM 203
5	Engineering Management	ENG 215	2	0	0	2	MATH 325 ENG 214
6	Elective Course	CE XXX	3	0	0	3	
Total						**18**	

7. Practical Training / Fourth Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Practical Training	CE 499	0	4	0	2	Department approval
Total						**2**	

8. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Foundation Engineering	CE 433	3	0	1	3	CE 451-CE 432
2	Construction Management	CE 482	3	0	1	3	ENG 215

3	Graduation Project (1)	CE 495	1	2	0	2	CE 432 or CE 452 or CE 462 or CE 442
4	Elective Course	CE XXX	3	0	0	3	-
5	Elective Course	CE XXX	3	0	0	3	-
Total						**14**	

9. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electromechanical Engineering	CE 492	2	0	1	2	CE 323
2	Steel Structures	CE 405	3	0	1	3	CE 303
3	Earthquake Engineering	CE 406	2	0	0	2	CE 303
4	Graduation Project (2)	CE 496	1	2	0	2	CE 495
5	Elective Course	CE XXX	3	0	0	3	-
Total						**12**	

Admission Requirements

1. Pass all preparatory year courses.
2. After completing 45 credit hours, the student must indicate his choices from the four engineering programs offered (**Civil**, Mechanical, Electrical, and Industrial).
3. Selection are made based on the number of students allowed by the UT Faculty Council that academic year.
4. Approval of the Dean.

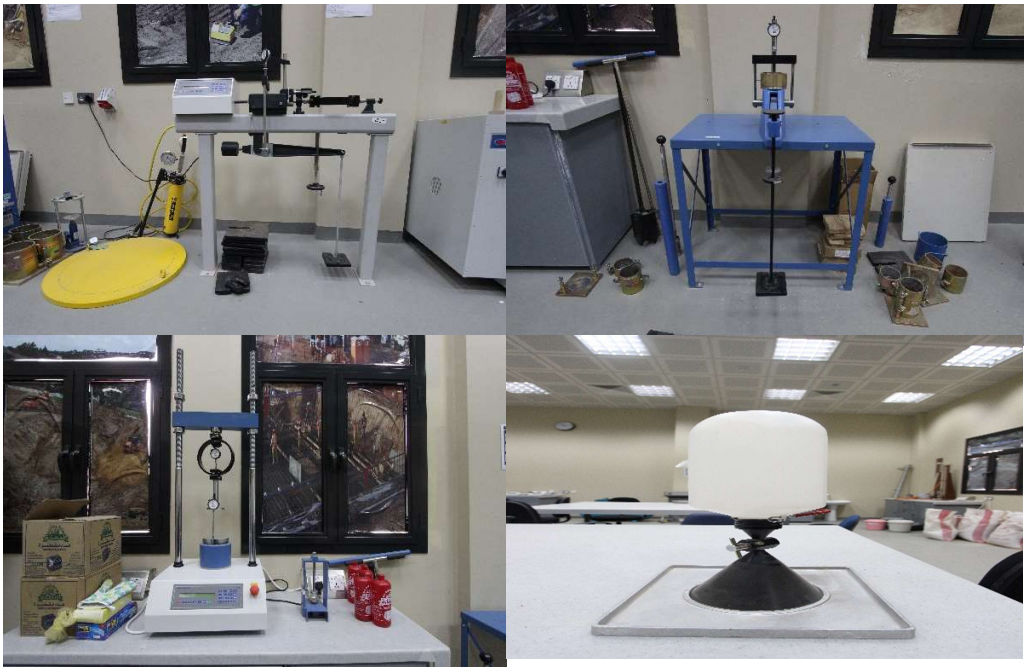
Laboratories

The laboratories in use by the CE Department are housed in buildings 11 and 12 on the UT main campus. Each lab is used to serve the experimental component in one or more courses. A short description of these laboratories and equipment in each laboratory, courses served by each lab equipment are provided in detail in the next sections. The laboratories have adequate equipment for carrying out experimental work for courses, senior design projects and research. The laboratories are well maintained and regularly upgraded. The laboratories used by the CE program adequately support the curriculum delivery These laboratories include:

A. Soil Mechanics and Foundations Laboratory.
B. Materials Engineering Laboratory.
C. Highways Engineering Laboratory.
D. Surveying Laboratory.
E. Hydraulics and Fluid Mechanics Laboratory.
F. Computer Laboratory

A. Soil Mechanics and Foundations Laboratory

Located in room 1-11-0-4, the lab actively contributes to the experimental activities in the CE Department. Its enables faculty and students are to perform a wide variety of different test in geotechnical engineering and foundations. It serves educational purposes at different levels to students at the undergraduate level. Some of major equipment are shown in Fig.7.1. This Soil mechanics and Foundation laboratory covers the experimental work associated with the CE 331, CE 432 and Senior Design Project (SDP).



B. Materials Engineering Eaboratory

The laboratory is located in room 1-11-0-3. This Laboratory is equipped with machines and apparatus for training the students in the field of concrete manufacturing. The construction material lab enables the students and Faculty to perform tests on the materials of reinforced concrete and on samples of concrete such as consistency and strength of cement paste, particle size distribution and abrasion of aggregate, consistency and workability of fresh concrete and compressive strength of hardened concrete. It provides educational facilities at different levels to students. The construction material laboratory covers the experimental work associated with CE 323, SDP courses.

C. Highways Engineering Laboratory

Highways engineering Laboratory is located in room 1-11-09. This Laboratory has advanced equipment for training the students in the field of rigid and flexible asphalt manufacturing. Students and faculties can apply tests in the highway lab on the materials of asphalt, aggregate, soil on samples of different asphalt layers such as bearing ability of base, subbase and subgrade, consistency of bituminous samples, characteristics asphalt binders such as ductility, and softening point and design asphalt mixtures using Marshall Method. It provides educational facilities at different levels to undergraduate students. The Highway Engineering laboratory covers the experimental work associated with CE 442, and SDP courses

D. Surveying Laboratory

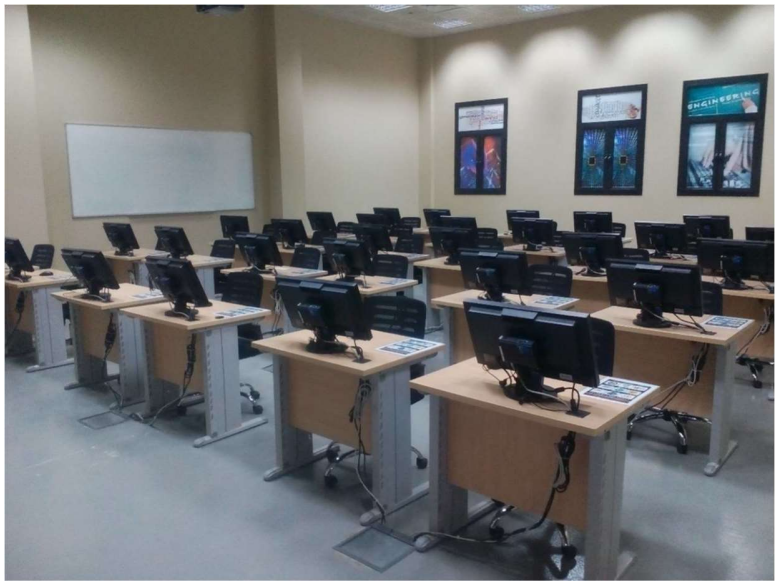
The laboratory occupies rooms 1-11-0-11 and 1-11-0-12. This laboratory has different instruments and apparatus for training the students in the field of surveying. The survey lab supports the students and Faculty to determine the dimensions, levels and angles in the site. The survey lab enables the students to measure the topography of the sites, which helps calculate the quantities of cut and fill under any civil engineering structures. The survey laboratory learns the students to make different measurement in the field to draw maps for a site with different scales. It provides educational facilities at different levels to undergraduate students. The Survey Engineering laboratory covers the experimental work associated with CE 311, CE 412, SDP courses.

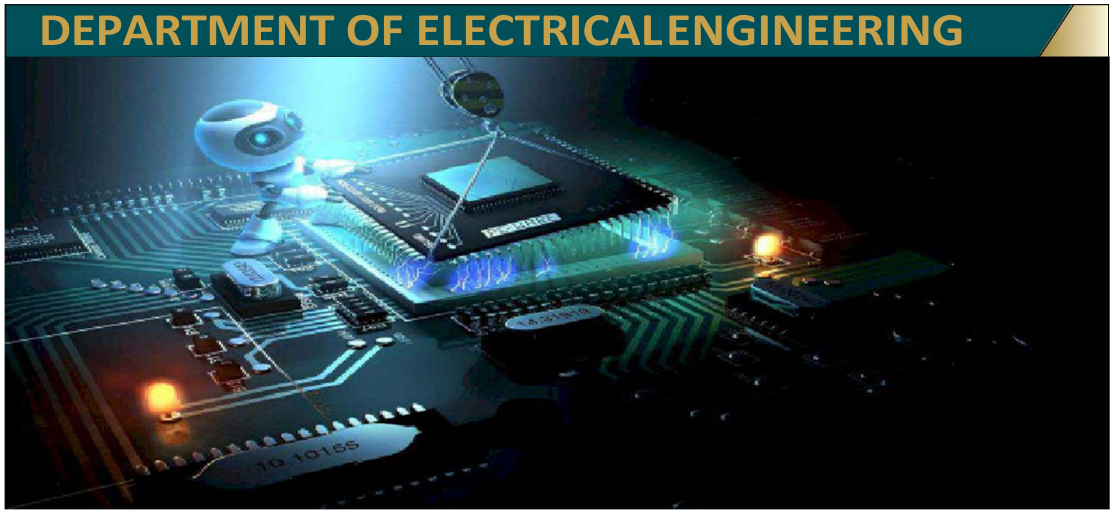
E. Hydraulics and Fluid Mechanics Laboratory

The Hydraulics and Fluid Mechanics laboratory provides a “hands on” environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of characteristics of pipe and open channel flows. The lab is equipped with test instruments to aid students to demonstrate the Bernoulli’s equation, Buoyancy law and Pascal’s law. The students in the lab are able to demonstrate the flow over notches and weirs. The Fluid Mechanics and Hydraulic laboratory covers the experimental work associated with CE 371, CE 472.

F. Computer Laboratory

The students of the CE department have access to a computer lab. The systems are supplied with all necessary software for the students to carry out their tasks as: MS-Office (complete), AUTOCAD and other software. Total Number of PCs is 30 with total capacity of the laboratory maximum of 30 students. It is used for teaching different courses like Engineering Drawing, CAD, Numerical methods, etc.





The department of electrical engineering was founded in 1428H and the studying in the preparatory year started in the academic year 14291430- H. The study is of 5 years duration including the preparatory year (10 semesters) in addition two summer training of 16 weeks in companies and agencies under supervision of the faculty members.

Vision

The mission of the Department of Electrical Engineering is to offer a rigorous program that emphasizes engineering design; instills moral values and ethical behavior; and promotes professionalism and economic prosperity.

Mission

The vision of the Department of Electrical Engineering is to produce highly qualified electrical engineers who conceive the technologies of the future that improve the lifestyles of the Saudi Citizens.

Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe what graduates are expected to attain within five years of graduation. The PEOs support the mission of the institution and are based on the needs of the program's constituencies.

The PEOs for the Electrical Engineering Program are that within five years of graduation:

PEO 1: Getting involved in career development

PEO 2: Being successful in participating, identifying and solving problems

PEO 3: Successful participation on inter-disciplinary engineering teams

PEO 4: Being ethical and responsible

Degree Requirements

The Department of Electrical Engineering awards the B.Sc. degree in Electrical Engineering. The curriculum within the Department of Electrical Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework.

To obtain the B.Sc. degree in electrical engineering, the student must successfully complete 164 credit hours, which are split over 10 semesters of studying. In addition, the students are required to complete a practical summer training session (8 weeks) in the industrial field. Towards the total of 164 credit hours, 20 credit hours represent the university requirements, 57 credit hours represent the faculty requirements, and 87 credit hours represent the department requirements. The table below shows overall summary of requirements to obtain degree

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	FE Requirements	Compulsory	57
3	Electrical Dept. Requirement	Compulsory	75
		Electives	12
Total			164

*Note: Electrical Engineering are not required to take ENG204 (Engineering Mechanics II) and MATH325 (Statistics & Probability).

Departmental Course Requirements (Compulsory)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electrical Circuits I	ELEN200	3	0	1	3	MATH101 - PHYS 205
2	Electrical Circuits II	ELEN202	3	0	0	3	ELEN200
3	Measurement and Instrumentation	ELEN204	2	0	0	2	ELEN310
4	Circuit Lab	ELEN203	0	3	0	1	Co ELEN202 Pre ELEN200
5	Electronics I	ELEN210	3	0	1	3	ELEN200
6	Electronics II	ELEN310	3	0	0	3	ELEN202, ELEN210

7	Electronics Lab	ELEN311	0	3	0	1	Co ELEN310, Pre ELEN203, ELEN210
8	Complex analysis and discrete math	ELEN220	3	0	0	3	MATH101
9	Numerical Methods	ELEN322	3	0	0	3	MATH241
10	Probabilistic Methods in EE	ELEN224	3	0	1	3	ELEN230
11	Engineering Programming	ELEN326	2	3	0	3	CSC001
12	Signals and Systems	ELEN230	3	0	1	3	ELEN200 MATH241
13	Control Systems	ELEN232	3	0	0	3	ELEN230, MATH383
14	Control Lab	ELEN233	0	3	0	1	ELEN232, ELEN203
15	Digital Signal Processing	ELEN330	3	0	0	3	ELEN230
16	Electromagnetics I	ELEN240	3	0	1	3	MATH284, PHYS 205
17	Electromagnetics II	ELEN340	3	0	1	3	ELEN240, MATH383
18	Electromagnetics LAB	ELEN341	0	3	0	1	CO ELEN340, Pre ELEN203, ELEN240
19	Logic Design	ELEN250	3	0	0	3	ELEN200
20	Logic Design Lab	ELEN251	0	3	0	1	ELEN203, ELEN250
21	Embedded Systems	ELEN352	3	3	0	4	ELEN326, ELEN250
22	Communication Eng. I	ELEN260	3	0	1	3	ELEN230, ELEN224
23	Communications Lab	ELEN361	0	3	0	1	ELEN260, ELEN203
24	Electrical Machines	ELEN370	3	0	1	3	ELEN340, ELEN202

25	Electric Energy Eng.	ELEN372	3	0	1	3	ELEN370
26	Electric Machines and Energy Lab	ELEN373	0	3	0	1	Co ELEN372, Pre ELEN270, ELEN203
27	Scientific computing	ELEN331	2	0	0	2	ELEN200 MATH241
28	Power Electronics	ELEN410	3	0	0	3	ELEN310
29	Graduation Project I	ELEN495	0	6	0	1	ENG213, ELEN311, ELEN370
30	Graduation Project II	ELEN496	0	6	0	3	ELEN495
31	Electrical Circuits I	ELEN200	3	0	1	3	MATH101, PHYS 205
32	Summer Training	ELEN399	0	0	0	2	-
Total			**60**	**39**	**9**	**75**	

Departmental Course Requirements (Elective)

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Optical Communication	ELEN464	3	0	0	3	ELEN260 -PHYS205
2	Wireless Communications	ELEN462	3	0	0	3	ELEN260
3	Communication Eng. II	ELEN360	3	0	0	3	ELEN260
4	Satellite Communications	ELEN466	3	0	0	3	ELEN260 - ELEN340
5	Power Electronics Applica-tions	ELEN412	3	0	0	3	ELEN410
6	Power Systems Analysis	ELEN474	3	0	0	3	ELEN372
7	Power Systems Operation and Control	ELEN470	3	0	0	3	ELEN372 - ELEN232
8	Renewable Energy & Smart Grids	ELEN476	3	0	0	3	ELEN372
9	Protection of Power Systems	ELEN472	3	0	0	3	ELEN372

10	Special Electric Motors	ELEN478	3	0	0	3	ELEN370
11	Data networks	ELEN468	3	0	0	3	ELEN260
12	Industrial Automation	ELEN432	3	0	0	3	ELEN352 - ELEN202
13	Selected Topics in Electrical Eng.	ELEN490	3	0	0	3	ELENxxx
14	Fundamentals of Energy Efficiency	ELEN480	3	0	0	3	ELEN372
15	Industrial Motor Control	ELEN436	3	0	0	3	ELEN370 -ELEN310
16	Antennas	ELEN440	3	0	0	3	ELEN340
17	High Voltage Engineering	ELEN482	3	0	0	3	ELEN372
Total			51			51	

Degree Curriculum

A. 3rd Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Physics	PHYS205	3	2	0	4	PHYS101
2	Mathematical Geometry	MATH284	3	0	1	3	MATH101
3	Engineering Drawing and Graphics	ENG201	1	4	0	3	
4	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
5	Engineering Design I	ENG205	3	3	0	3	ELS002-MATH101
6	General Physics Lab	PHYS281	0	2	0	1	PHYS101
7	Islamic Culture I	ISLS101	2	0	0	2	
Total						18	

B. 4th Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Differential Equations	MATH383	3	0	1	3	MATH284
2	Electrical Circuits I	ELEN200	3	0	1	3	MATH101 - PHYS205
3	Complex analysis & discrete math	ELEN220	3	0	0	3	MATH101
4	Production Tech. and Work-shops	ENG202	1	4	0	3	ENG201
5	Linear Algebra	MATH241	3	0	1	3	MATH284
6	General Chemistry Lab	CHEM203	0	2	0	1	CHEM101
7	Introduction to Eng. Design (2)	ENG213	2	2	0	2	ENG205
Total						18	

C. 5th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electrical Circuits II	ELEN202	3	0	0	3	ELEN200
2	Electric Circuits Lab	ELEN203	0	3	0	1	Co ELEN202 -ELEN200
3	Electronics I	ELEN210	3	0	1	3	ELEN200
4	Logic Design	ELEN250	3	0	0	3	ELEN200
5	Signals and Systems	ELEN230	3	0	1	3	ELEN200 -MATH241
6	Electromagnetics I	ELEN240	3	0	1	3	PHYS205 - MATH284
Total						**16**	

D. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electromagnetics II	ELEN340	3	0	1	3	ELEN240 - MATH383
2	Electromagnetics Lab	ELEN341	0	3	0	1	ELEN203 - ELEN240 - Co ELEN340
3	Eng. Programming	ELEN326	2	3	0	3	CSC001

4	Control Systems	ELEN232	3	0	0	3	ELEN230 - MATH383
5	Electronics II	ELEN310	3	0	0	3	ELEN202 - ELEN210
6	Electronic Lab	ELEN311	0	3	0	1	ELEN203 - ELEN210 - Co ELEN310
7	Numerical Methods	ELEN322	3	0	0	3	MATH241
8	Logic Design Lab	ELEN251	0	3	0	1	ELEN250 - ELEN203
Total						18	

E. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Engineering Economy	ENG214	2	0	0	2	ENG213
2	Probabilistic Methods in EE	ELEN224	3	0	1	3	ELEN230
3	Embedded Systems	ELEN352	3	3	0	4	ELEN326 - ELEN250
4	Electrical Machines	ELEN370	3	0	1	3	ELEN202 - ELEN340
5	Islamic Culture II	ISLS201				2	ISLS101
6	Control lab	ELEN233	0	3	0	1	ELEN232 - ELEN203
7	Scientific Computing	ELEN331	2	0	0	2	MATH241 - ELEN200
Total						**17**	

F. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Measurements and Instru-mentation	ELEN204	2	0	0	2	ELEN310
2	Communication Engineer-ing I	ELEN260	3	0	1	3	ELEN224 - ELEN230
3	Electric Energy Eng.	ELEN372	3	0	1	3	ELEN370
4	Electric Machines & Energy Lab	ELEN373	0	3	0	1	Co ELEN372 - ELEN203
5	Summer Training	ELEN399	0	0	0	2	

6	Language Skills	ARB101	2	0	0	2	
7	Islamic Culture III	ISLS301	2	0	0	2	ISLS201
8	Eng. Management	ENG215	2	0	0	2	ENG214
Total						**17**	

G. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Digital Signal Processing	ELEN330	3	0	0	3	ELEN230
2	Communication Engineer-ing Lab	ELEN361	0	3	0	1	ELEN260 - ELEN203
3	Power electronics	ELEN410	3	0	0	3	ELEN310
4	Graduation Project I	ELEN495	0	6	0	1	ELEN311 - ELEN370 - ENG213
5	Writing Skills	ARB201	2	0	0	2	ARB101
6	Elective 1	ELEN4xx	3	0	0	3	
7	Elective 2	ELEN4xx	3	0	0	3	
Total						**16**	

H. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Graduation Project II	ELEN496	0	6	0	3	ELEN495
2	Islamic Culture IV	ISLS401	2	0	0	2	ISLS301
3	Elective 1	ELEN4xx	3	0	0	3	
4	Elective 2	ELEN4xx	3	0	0	3	

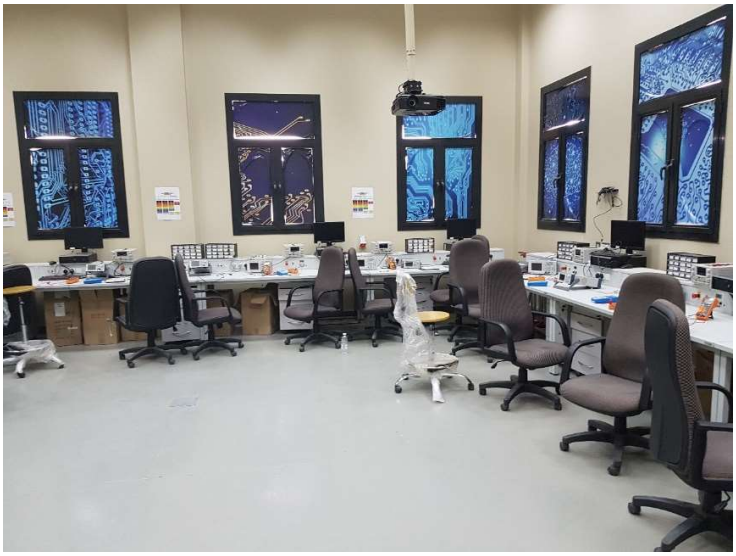
Admission Requirements

1. Pass all preparatory year courses.
2. After completing 45 credit hours, the student must indicate his choices from the four engineering programs offered (Civil, Mechanical, **Electrical**, and Industrial).
3. Selection are made based on the number of students allowed by the UT Faculty Council that academic year.
4. Approval of the Dean.

Laboratories

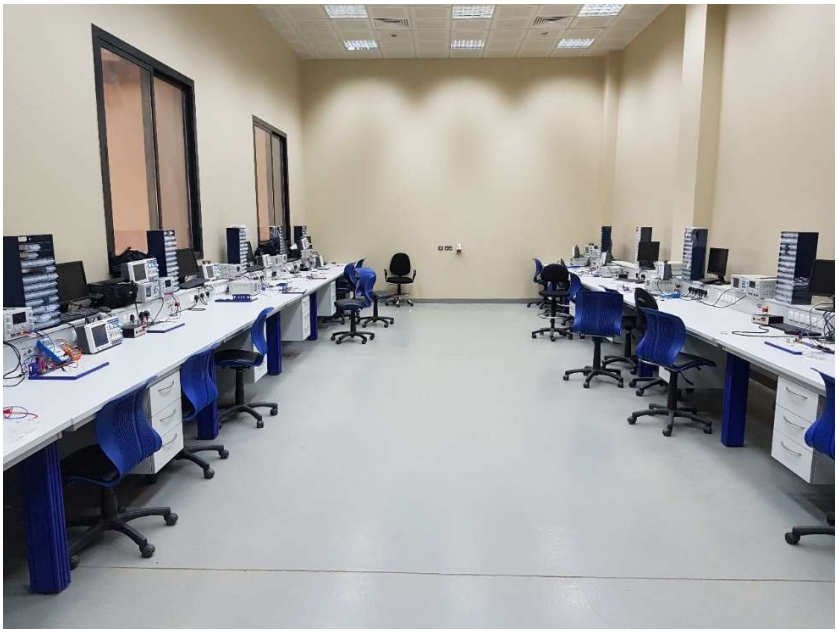
A. Electrical Circuits Lab

In this lab, students learn the basics of electrical engineering and become familiar with the components of the electrical circuit. They also learn how to measure electric current, voltage difference, and resistance and apply of some electrical laws such as Ohm's law and Kirchhoff's law.



B. Electronics Lab

In this lab, students learn the basics of electronics and its components such as diodes and transistors. They also learn how to build and test electronic circuits and some of their applications.



C. Communications Lab

The lab includes devices that help students to understand the theories of analog and digital communications and used in broadcasting of radio stations of both AM and FM

D. Electromagnetic Fields Lab

The Electromagnetic Fields Laboratory contains advanced equipment and software used to conduct experiments about antennas and electromagnetic field theories and their applications in the area of wave propagation, radiation, and radio communication.

E. Control Lab

Contains the equipment that are necessary to conduct experiments about the basics of control and its application in different systems. They also learn how to adjust the controller to get the desired output.

F. Logic circuit lab

Students learn the basics of designing and implementing combinational and sequential digital circuits and systems such as adders, encoders, multiplexers, and counters using logic gates.

G. Electrical and Power Machines Lab

In this lab, students use different electrical measuring devices and components to conduct basic experiments about electrical power systems and study the general characteristics of power systems such as generators, motors, transformers, loads of various types, and transmission lines.

DEPARTMENT OF MECHANICAL ENGINEERING

The department of mechanical engineering was founded in 1428H and the studying in the preparatory year started in the academic year 1429-1430 H. The study is of 5 years duration including the preparatory year (10 semesters) in addition two summer training of 16 weeks in companies and agencies under supervision of the faculty members.

Vision

The department's vision is innovation and leadership in education, scientific research and community services.

Mission

The mission of the Department of Mechanical Engineering which stems from the mission of the Faculty of Engineering of Tabuk University is to provide high quality education in mechanical engineering to be professionally equipped engineers in the fields of Energy and Thermo-Fluid Engineering, Mechanical Systems and Design, Engineering Materials and Manufacturing, and Mechatronics and Controls, and promotes excellence, ethics and welfare of society.

Program Educational Objectives

The ME Program Educational Objectives (PEOs) describe what graduates are expected to attain within a few years of graduation. The department has established three broad program educational objectives (PEOs) for graduates as they progress through their careers:

PEO 1: Career Contribution and Advancement: Through their ability to solve engineering problems, meaningful design and hands-on experience, critical thinking skills, and training in teamwork and communication, graduates will make significant contribution to their chosen field and advance professionally in mechanical engineering or allied disciplines.

PEO 2: Professionalism: Graduates will act with both professional and social responsibility in their career field, including a commitment to protect both occupational and public health and safety, and apply ethical standards related to the practice of engineering.

PEO 3: Life-Long Learning: Graduates will understand that their undergraduate education was just the beginning of their training, and will continue to develop their knowledge and skills through progress toward or completion of graduate education, and/or professional development through short courses or seminars, and/or professional certification, and/or participation in professional societies.

The PEOs also provide the link between the program and the needs of stakeholders in the ME program as well as a link between the program and the missions of the university and the Faculty of Engineering. Our curriculum and associated processes are planned and organized to ensure that these PEOs can be achieved. To support PEOs, the ME program offers a curriculum that prepares students for work or pursue postgraduate studies. The ME curriculum is well balanced among the technical areas of energy and thermal-fluid sciences, energy and mechanical systems and design, engineering materials and manufacturing, and mechatronics and controls.

Degree Requirements

The Department of Mechanical Engineering awards the B.Sc. degree in Mechanical Engineering. The curriculum within the Department of Mechanical Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework.

To obtain the B.Sc. degree in mechanical engineering, the student must successfully complete 167 credit hours which are split over 10 levels of studying. In addition, the students are required to complete two practical summer training sessions (16 - weeks) in the industrial field.

Towards the total of 167 credit hours, 20 credit hours represent the university requirements and 62 credit hours represent the faculty requirements whereas 85 credit hours represent the department requirements. The table below shows overall summary of requirements to obtain degree.

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	FE Requirements	Compulsory	62
3	Mechanical Department Requirements	Compulsory	73
		Electives	12
Total			167

The mechanical engineering curriculum allows the student to choose four elective courses (12 credit hours) from the following tracks:

A. Energy, Thermal and Fluid Systems Track.
B. Mechanical Systems and Design Track.
C. Materials and Manufacturing Engineering Track.
D. Mechatronics and Controls Track.
E. General Mechanical Engineering Track. (The student should select four courses from the previous options with academic advisor)

Departmental Course Requirements (Compulsory)

The tables below show the set of compulsory courses in the mechanical department.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Engineering Materials	ME201	2	2	0	3	CHEM101
2	Manufacturing Processes	ME202	2	2	1	3	ME201-ENG202
3	Mechanical Drawing and Graphics	ME211	1	4	0	3	ENG201
4	Mechanics of Machines	ME212	2	2	1	3	ENG204- ME211
5	Mechanics of Materials	ME213	2	2	1	3	ENG203
6	Thermodynamics I	ME221	2	2	1	3	MATH284-PHYS205
7	Fluid Mechanics I	ME231	2	2	1	3	MATH383-ENG204
8	Electrical Engineering Fundamentals	ME243	2	2	1	3	PHYS205-MATH284
9	Mechanical Vibrations	ME314	2	2	1	3	ME212-MATH383
10	Mechanical Design I	ME315	2	2	1	3	ME212-ME213
11	Automatic Control and Systems	ME316	2	2	1	3	ME314-ME341
12	Mechanical Design II	ME317	2	2	1	3	ME315
13	Heat Transfer	ME322	2	2	1	3	ME221-ME231
14	Thermodynamics II	ME323	2	2	1	3	ME221
15	Turbomachinery I	ME332	2	2	1	3	ME231
16	Instrumentation and Measurements	ME333	2	2	1	3	ME243-ME314
17	Numerical Methods	ME341	3	0	1	3	MATH383-MATH241
18	Computer Aided Design	ME342	2	2	1	3	ME315-ME341
19	Refrigeration and Air Conditioning	ME424	2	2	1	3	ME323- ME333
20	Power and Desalination plants	ME425	2	2	1	3	ME323- ME444
21	Basic Hydraulic and Pneumatic Systems	ME434	2	2	1	3	ME332-ME333
22	Mechatronics I	ME444	2	2	1	3	ME243-ME316
23	Graduation Project I	ME493	0	4	0	2	ME315-ME392
24	Graduation Project II	ME494	0	6	0	3	ME493
25	Practical Training I	ME291	0	4	0	1	
26	Practical Training II	ME392	0	4	0	1	ME291
Total			**46**	**62**	**20**	**73**	

Departmental Course Requirements (Elective)

A. Energy, Thermal and Fluid Systems Track

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Heating, Ventilation and Air Conditioning Systems (HVAC)	ME451	2	2	0	3	ME424
2	Pipelines Engineering	ME452	2	2	0	3	ME231
3	Renewable Energy Systems	ME453	2	2	0	3	ME322-ME332
4	Aircraft propulsion Systems	ME454	2	2	0	3	ME323-ME332
5	Fluid Mechanics II	ME455	2	2	0	3	ME322-ME341
6	Computational Fluid Dynamics	ME456	2	2	0	3	ME322-ME342
7	Turbomachinery II	ME457	2	2	0	3	ME322-ME332
8	Internal Combustion Engines	ME458	2	2	0	3	ME322-ME323
9	Design of Thermal-Fluid Systems	ME459	2	2	0	3	ME317-ME322
10	Computer Programming and Applications	ME445	2	2	o	3	CSC001-ME341

B. Mechanical Systems and Design Track

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Materials Selection for Design	ME461	2	2	0	3	ME201-ME317

2	Numerical control machines	ME462	2	2	0	3	ME202-ME316
3	Air vessels and Piping Systems	ME463	2	2	0	3	ME213-ME231
4	Tools Design and Production Facilities	ME464	2	2	0	3	ME342-ME 202
5	Automotive Engineering	ME465	2	2	0	3	ME317-ME314
6	Finite Elements Method and Applications in Design	ME466	2	2	0	3	ME342-ME317
7	Robotics Engineering	ME467	2	2	0	3	ME316-ME444
8	Tribology	ME468	2	2	0	3	ME315- ME317
9	Fault Diagnoses and Failure Analysis in Mechanical Systems	ME469	2	2	0	3	ME213-ME333
10	Computer Programming and Applications	ME445	2	2	o	3	CSC001-ME341

C. Materials and Manufacturing Track

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Materials and process Selection	ME471	2	2	0	3	ME213-ME202
2	Advanced Manufacturing Technology	ME472	2	2	0	3	ME202-ME444
3	Composite Materials	ME473	2	2	0	3	ME213-ME202
4	Automation and Production Systems	ME474	2	2	0	3	ME444-ME202
5	Theory of Metal Cutting	ME475	2	2	0	3	ME317-ME202
6	Engineering Polymers and Ceramics	ME476	2	2	0	3	ME201-ME202
7	Plasticity and Metal Forming	ME477	2	2	0	3	ME213-ME202

8	Corrosion Engineering	ME478	2	2	0	3	ME201-ME213
9	Welding Technology	ME479	2	2	0	3	ME202
10	Computer Programming and Applications	ME445	2	2	0	3	CSC001-ME341

D. Mechatronics and Controls Track

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electronic Fundamentals	ME481	2	2	0	3	ME243-MATH284
2	Programmable Logic Controllers	ME482	2	2	0	3	ME316-ME342
3	Mechatronics (2)	ME483	2	2	0	3	ME444-ME434
4	Engineering Programming	ME484	2	2	0	3	CSC001-ME341
5	Image Sensors and Processing	ME485	2	2	0	3	ME434
6	Modeling and Simulation in Mechatronics	ME486	2	2	0	3	ME316-ME434
7	Machine Design Applications in Mechatronics	ME487	2	2	0	3	ME317-ME444
8	Robotics and Industrial Automation	ME488	2	2	0	3	ME444-ME341
9	Introduction to Intelligent Building Systems	ME489	2	2	0	3	ME231-ME444
10	Computer Programming and Applications	ME445	2	2	o	3	CSC001-ME341

E. General Mechanical Engineering Track

The student should select four courses (12 credit hours) from the previous options with academic advisor.

Degree Curriculum

1. 3rd Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Physics	PHYS205	3	2	0	4	PHYS101
2	Mathematical Geometry	MATH284	3	0	1	3	MATH101
3	Engineering Drawing and Graphics	ENG201	1	4	0	3	
4	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
5	Engineering Design I	ENG205	3	3	0	3	ELS002-MATH101
6	General Physics Lab	PHYS281	0	2	0	1	PHYS101
7	Islamic Culture I	ISLS101	2	0	0	2	
Total			**14**	**11**	**2**	**18**	

2. 4th Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Engineering Design II	ENG213	2	2	0	2	ENG205
2	Differential Equations	MATH383	3	0	1	3	MATH284
3	Engineering Mechanics II	ENG204	2	0	1	2	ENG203
4	Islamic Culture II	ISLS201	2	0	0	2	ISLS101
5	Production Technology and Workshops	ENG202	1	4	0	3	ENG201
6	Linear Algebra	MATH241	3	0	1	3	MATH284
7	General Chemistry Lab	CHEM203	0	2	0	1	CHEM101
Total			**13**	**8**	**3**	**16**	

3. 5th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Mechanical Drawing and Graphics	ME211	1	4	0	3	ENG201
2	Engineering Materials	ME201	2	2	1	3	CHEM101
3	Thermodynamics I	ME221	2	2	1	3	MATH284-PHYS205
4	Electrical Engineering Fundamentals	ME243	2	2	1	3	PHYS205-MATH284
5	Islamic Culture III	ISLS301	2	0	0	2	ISLS201
6	Statistics & Probabilities	MATH325	3	0	1	3	MATH284
Total			**12**	**10**	**4**	**17**	

4. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Mechanics of Machines	ME212	2	2	1	3	ENG204-ME211
2	Engineering Economy	ENG214	2	0	0	2	ENG213
3	Language Skills	ARB101	2	0	0	2	
4	Manufacturing Processes	ME202	2	2	1	3	ME201-ENG202
5	Mechanics of Materials	ME213	2	2	1	3	ENG203
6	Fluid Mechanics I	ME 231	2	2	1	3	ENG204-MATH383
Total			**12**	**8**	**4**	**16**	

5. 1st Summer Training / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Summer Training, I	ME 291	0	4	0	1	
Total							

6. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Writing Skills	ARB201	2	0	0	2	ARB101
2	Turbomachinery II	ME323	2	2	1	3	ME221

3	Mechanical Vibrations	ME314	2	2	1	3	ME212-MATH383
4	Mechanical Design I	ME315	2	2	1	3	ME212-ME213
5	Numerical Methods	ME341	3	0	1	3	MATH383-MATH241
6	Heat Transfer	ME322	2	2	1	3	ME211-ME231
Total			**12**	**10**	**5**	**17**	

7. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Computer-aided Design	ME342	2	2	1	3	ME341-ME315
2	Turbomachinery I	ME332	2	2	1	3	ME231
3	Automatic Control and Systems	ME316	2	2	1	3	ME314-ME341
4	Islamic Culture IV	ISLS401	2	0	0	2	ISLS301
5	Mechanical Design II	ME317	2	2	1	3	ME315
6	Instrumentation and Measurements	ME333	2	2	1	3	ME243-ME314
Total			**12**	**10**	**5**	**17**	

8. 2nd Summer Training / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Summer Training II	ME392	0	4	0	1	ME291
Total			**0**	**4**	**0**	**1**	

9. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Refrigeration and Air Conditioning	ME424	2	2	1	3	ME323-ME333
2	Mechatronics I	ME444	2	2	0	3	ME243-ME316
3	Basic Hydraulic and Pneumatic Systems	ME434	2	2	1	3	ME332-ME333
4	Elective Course	ME4XX	2	2	0	3	MEXXX
5	Elective Course	ME4XX	2	2	0	3	MEXXX
6	Graduation Project I	ME493	0	4	0	2	ME315-ME392
Total			10	14	2	17	

10. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Power and Desalination plants	ME425	2	2	1	3	ME323- ME444
2	Engineering Management	ENG215	2	0	0	2	ENG214-MATH325
3	Elective Course	ME4XX	2	2	0	3	MEXXX
4	Elective Course	ME4XX	2	2	0	3	MEXXX
5	Graduation Project II	ME494	0	6	0	3	ME493
Total			8	12	1	14	

Admission Requirements

1. Pass all preparatory year courses.
2. After completing 45 credit hours, the student must indicate his choices from the four engineering programs offered (Civil, **Mechanical,** Electrical, and Industrial).
3. Selection are made based on the number of students allowed by the UT Faculty Council that academic year.
4. Approval of the Dean.

Laboratories

The laboratories used by the ME Department are located in the Laboratories Buildings (Buildings-11 and 12). The laboratories have adequate equipment for carrying out experimental work for courses, senior

projects and community service. The laboratories are well maintained and regularly upgraded. The laboratories thus adequately support the curriculum delivery. These include the following laboratories:

A. Engineering Workshop
B. Mechanics of materials and engineering materials laboratory
C. Mechanical systems and vibration laboratory
D. Robotics and theory of machines laboratory
E. Heat transfer, thermodynamics and combustion laboratory
F. Fluid mechanics and hydraulic laboratory
G. Refrigeration and air condition laboratory
H. Energy laboratory

A. Engineering Workshop

The ME workshop is equipped with machines and apparatus for training the students in the fields of casting, metal forming, and machining processes. This Engineering Workshop covers the experimental work associated with the ENG 202, ENG 205, ENG 213, ME 493 and ME 494 courses.

B. Mechanics of materials and engineering materials laboratory

This lab actively contributes to teaching activities in the ME Department. Its enables faculty and students are to provide tests such as tension, compression, shear, buckling, hardness, bending, deep drawing, impact and metallurgical observations, and is used in determining the mechanical properties and characterization of materials and testing for students. It provides educational facilities at different levels to undergraduate students. The lab is used in the graduation projects related to mechanical testing of materials and the graduation projects related to material science. The mechanics of materials and engineering materials laboratory which covers the experimental work associated with ME 201, ME 213, ME 493 and ME 494 courses.

C. Mechanical Systems Laboratory

The Mechanical Systems and Vibration Lab is used to perform the experiments of the mechanical systems and vibration courses and to introduce the nature of mechanical mechanisms and their operation, as well as the vibration phenomena and effects on sensitive parts and how to control the vibration and its damping. The lab covers the experimental work associated with the ME 314, ME 315, ME 317, ME 493 and ME 494 courses.

D. Fluid Mechanics and Hydraulic Laboratory

The Fluid Mechanics and Hydraulic laboratory provides a “hands on” environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of fluid statics as well as kinematics and kinetics of fluid flow to enhance the hands-on experience of our students. The lab is equipped with test rigs for experiments pertinent to fluid mechanics, pumping machinery, and hydraulic turbines. The pumping machinery and hydraulic turbines devices aim to give students hands-on experience at conducting experiments and analyzing the data to obtain the performance characteristics of various types of pumps, fans and compressors. The Fluid Mechanics and Hydraulic lab covers the experimental work associated with the ME 231, ME 332, ME 493, ME 494, ME 452 and ME 455 courses. The lab has an essential and effective role enabling mechanical engineering students to gain educational understanding and experimental information in the field of fluid mechanics and hydraulics, turbomachines and projects.

E. Refrigeration and Air Conditioning Laboratory

The Refrigeration and Air Conditioning laboratory is equipped with a wide variety of instructional facilities in the area of refrigeration and air-conditioning. The laboratory contains modern instruments which are used to train students in the practical aspect of the refrigeration and air conditioning. This lab provides students opportunity to develop an overall background in the components of Refrigeration and Air-Conditioning systems. Determination of the coefficient of performance, cooling and heating loads, rates of humidification and dehumidification of Refrigeration and Air-Conditioning systems. Construction and systems evaluation of graduate projects. Possibilities of organizing short training courses in Refrigeration and Air-Conditioning systems design, operation, performance evaluation and fault simulation. The Refrigeration and Air Conditioning laboratory covers the experimental work associated with the ME 221, ME 424, ME 451, ME 493 and ME 494 courses.

F. Energy Laboratory

The Energy Laboratory provides students opportunity to develop an overall background in the thermal and electrical applications of solar energy for domestic and industrial uses. It also enables students to study and practice Determination of the feasibility and efficiency of solar engineering systems, like water and air heating, water desalination, solar ovens, solar concentrators for industrial processes heat and power generation and solar energy storage systems, Construction and systems evaluation of graduate projects, Possibilities of organizing short training courses engineering solar systems design, operation and performance evaluation. The Energy laboratory covers the experimental work associated with the ME 221, ME 322, ME 323, ME 425, ME 453, ME 493 and ME 494 courses.

G. Heat Transfer, Thermodynamics and Combustion Laboratory

This lab provides students an overall background in the thermal applications of thermodynamics, heat transfer, and heat engines for industrial uses. This laboratory covers the experimental work associated with the ME 221, ME 322, ME 323, ME 425, ME 465, ME 458, ME 459, ME 493 and ME 494 courses.

H. The mechanics of machines and Mechanical vibrations laboratory

The mechanics of machines and Mechanical vibrations laboratory aims to give students hands-on experience at conducting experiments and analyzing the data to obtain the characteristics of various types of mechanisms of machines. This laboratory covers the experimental work associated with the ME 212, ME 315, ME 467, ME 493 and ME 494 courses.

DEPARTMENT OF INDUSTRIAL ENGINEERING

The department of industrial engineering was founded in 1433H and the studying in the preparatory year started in the academic year 14341435- H. The study is of 5 years duration including the preparatory year (10 semesters) in addition to one summer training of 8 weeks in companies and agencies under supervision of the faculty members.

Vision

Towards innovation and excellence in industrial engineering education, conducting research work in collaboration with the local industry and stand by our community by providing helpful services and contribute to their activities.

Mission

Providing high-quality education in Industrial Engineering and prepare qualified engineers, and providing services to local societies through scientific research and partnership with industrial sectors in the region.

Program Educational Objectives

The IE department has established three broad program educational objectives (PEOs) for graduates as they progress through their careers. Within a few years of graduation, our graduates

PEO 1: Provide effective solutions that add value to engineering, business and industry processes.

PEO 2: Engage in life-long learning and career development.

PEO 3: Demonstrate professional, ethical and leadership qualities in engineering practice.

Degree Requirements

The Department of Industrial Engineering awards the B.Sc. degree in Industrial Engineering. The curriculum within the Department of Industrial Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework. To obtain the B.Sc. degree in Industrial engineering, the student must successfully complete 165 credit hours which are split over 10 levels of studying. In addition, the students are required to complete one practical summer training sessions (8 - weeks) in the industrial field. Towards the total of 165 credit hours, 20 credit hours represent the university requirements and 60 credit hours represent the faculty requirements whereas 85 credit hours represent the department requirements. The table below shows overall summary of requirements to obtain degree.

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	FE Requirements	Compulsory	60
3	Industrial Department Requirements	Compulsory	73
		Electives	12
Total			165

Departmental Course Requirements (Compulsory)

The table below shows the set of compulsory courses in the Industrial Engineering Department.

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Introduction to Industrial Engineering	INEN 210	2	0	0	2	
2	Engineering Materials	ME201	2	2	0	3	CHEM101
3	Operations Research I	INEN221	2	2	1	3	MATH241
4	Fundamentals of Com-puter Systems	INEN231	2	2	0	3	CSC001
5	Project Management	INEN261	2	0	0	2	ENG214
6	Manufacturing Processes I	INEN212	2	2	1	3	ENG202 -ME 201
7	Mechanics of Materials	ME213	2	2	1	3	ENG203
8	Fundamentals of Electrical Engineering	INEN214	2	2	1	3	PHYS205
9	Thermo-Fluid Engineering	INEN216	2	2	1	3	CHEM101 -ENG 204
10	Production Planning and Control	INEN301	3	0	1	3	INEN221 INEN261

11	Work Study	INEN305	2	2	0	3	MATH383 -INEN210
12	Operations Research II	INEN445				3	INEN221
13	Control Systems	INEN311	2	2	1	3	INEN214 -INEN216
14	Engineering Statistics	INEN320	3	0	1	3	MATH325
15	Computer Applications in Industrial Engineering	INEN302	2	2	1	3	INEN231
16	Human Factors Engineering	INEN321	2	2	1	3	INEN305
17	Manufacturing Processes II	INEN331	2	2	1	3	INEN212 - ME213
18	Safety Engineering	INEN400	3	0	1	3	INEN212
19	Statistical Quality Control	INEN444				3	INEN320
20	Summer Training	INEN350	0	4	0	2	Department Approval
21	Design and Analysis of Experiments	INEN546	3	0	1	3	INEN320
22	Facilities Planning and Material Handling	INEN522	3	0	1	3	INEN301
23	Industrial Systems Simulation	INEN547	2	2	1	3	INEN445
24	Senior Design Project (1)	INEN592	0	2	0	1	Department Approval
25	Industrial Automation	INEN535	2	2	1	3	INEN311
26	Senior Design Project (2)	INEN593	1	2	0	3	INEN592
Total						73	

Departmental Course Requirements (Elective)

The student should select four courses (12 credit hours) from elective courses in the table below with academic advisor.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Computer Integrated Manufacturing	INEN536	2	2	1	3	INEN331
2	Special Topics in Industrial Engineering	INEN594	3	0	1	3	INEN301 INEN210
3	Maintenance Engineering	INEN527	3	0	1	3	INEN261

4	Supply Chain Management	INEN523	3	0	1	3	INEN301
5	Design and Analysis of Production Systems	INEN524	3	0	1	3	INEN301
6	Production Economics and Cost Analysis	INEN525	3	0	1	3	ENG214
7	Lean and Agile Manufacturing	INEN526	3	0	1	3	INEN301
8	Total Quality Management	INEN548	3	0	1	3	INEN444
9	Special Topics in Engineering Management	INEN595	3	0	1	3	INEN261
10	Decision Making and Analysis	INEN549	3	0	1	3	INEN221
Total						30	

Degree Curriculum

1. 3rd Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Physics	PHYS205	3	2	0	4	PHYS101
2	Mathematical Geometry	MATH284	3	0	1	3	MATH101
3	Engineering Drawing and Graphics	ENG201	1	4	0	3	
4	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
5	Introduction to Eng. Design I	ENG205	3	3	0	3	ELS002-MATH101
6	General Physics Lab	PHYS281	0	2	0	1	PHYS101
7	Islamic Culture I	ISLS101	2	0	0	2	
Total						18	

2. 4th Level / 2nd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Differential Equations	MATH383	3	0	1	3	MATH284
2	Islamic Culture II	ISLS201	2	0	0	2	ISLS101
3	Introduction to Industrial Engineering	INEN210	2	0	0	2	
4	Production Tech. and Workshops	ENG202	1	4	0	3	ENG201
5	Linear Algebra	MATH241	3	0	1	3	MATH284
6	General Chemistry Lab	CHEM203	0	2	0	1	CHEM101

7	Introduction to Eng. Design II	ENG213	2	2	0	2	ENG205
Total						16	

3. 5th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Engineering Materials	ME201	2	2	1	3	CHEM101
2	Operations Research I	INEN221	2	2	1	3	MATH241
3	Fundamentals of Computer Systems	INEN231	2	2	0	3	CSC001
4	Engineering Economy	ENG214	2	0	0	2	ENG 213
5	Engineering Mechanics II	ME204	2	0	1	2	ME203
6	Probability and Statistics	MATH325	3	0	1	3	MATH284
Total						**16**	

4. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Manufacturing Processes I	INEN212	2	2	1	3	ENG202 - ME201
2	Mechanics of Materials	ME213	2	2	1	3	ENG203
3	Fundamentals of Electrical Engineering	INEN214	2	2	1	3	PHYS205
4	Thermo-Fluid Engineering	INEN216	2	2	1	3	CHEM101 - ENG204
5	Project Management	INEN261	2	0	0	2	ENG214
6	Islamic Culture (III)	ISLS301	2	0	0	2	ISLS201
Total						**16**	

5. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi - sites
			Lecture	Lab	Tutorial		
1	Production Planning and Control	INEN301	3	0	1	3	INEN221 - INEN261
2	Work Study	INEN305	2	2	0	3	MATH383 -INEN210
3	Control Systems	INEN311	2	2	1	3	INEN214 - INEN216
4	Engineering Statistics	INEN320	3	0	1	3	MATH325

5	Operations Research II	INEN445	3	0	1	3	INEN221
6	Arabic Language (I)	ARB101	2	0	0	2	
Total						**16**	

6. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi - sites
			Lecture	Lab	Tutorial		
1	Islamic Culture (IV)	ISLS401	2	0	0	2	ISLS301
2	Human Factors Engineering	INEN321	2	2	1	3	INEN305
3	Manufacturing Processes II	ELEN331	2	2	1	3	INEN212 - ME213
4	Computer Applications in Industrial Engineering	ELEN302	2	2	1	3	INEN231
5	Statistical Quality Control	INEN444	3	0	1	3	INEN320
6	Safety Engineering	INEN400	3	0	1	3	INEN212
Total						**16**	

7. Summer Training / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi - sites
			Lecture	Lab	Tutorial		
1	Summer Training	INEN350	0	4	0	2	Department Approval
Total						**2**	

8. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Design and Analysis of Experiments	INEN546	3	0	1	3	INEN320
2	Facilities Planning and Material Handling	INEN522	3	0	1	3	INEN301
3	Industrial Systems Simulation	INEN547	2	2	1	3	INEN445
4	Senior Design Project (1)	INEN592	0	2	0	1	Department Approval
5	Elective I	INEN5xx				3	

6	Elective II	INEN5xx				3	
Total						**16**	

9. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequi-sites
			Lecture	Lab	Tutorial		
1	Industrial Automation	INEN535	2	2	1	3	INEN311
2	Graduation Project (2)	INEN593	1	2	0	3	INEN592
3	Arabic Language (II)	ARB201	2	0	0	2	ARB101
4	Elective III	INEN5xx				3	
5	Elective IV	INEN5xx				3	
Total						**14**	

Admission Requirements

1. Pass all preparatory year courses.
2. After completing 45 credit hours, the student must indicate his choices from the four engineering programs offered (Civil, Mechanical**,** Electrical, and **Industrial**).
3. Selection are made based on the number of students allowed by the UT Faculty Council that academic year.
4. Approval of the Dean.

Laboratories

The laboratories used by the IE Department are located in the Laboratories Buildings (Buildings-11 and 12). The laboratories have adequate equipment for carrying out experimental work for courses, senior projects and community service. The laboratories are well maintained and regularly upgraded. The laboratories thus adequately support the curriculum delivery. These include the following laboratories:

A. Engineering Workshop
B. Mechanics of materials and engineering materials laboratory
C. Fluid Mechanics and Hydraulic Lab.
D. Work Study Lab
E. Human Factors Lab.
F. Manufacturing Processes and CIM Lab.
G. Electrical Circuits Lab.
H. Control Systems and Automation Lab.
I. Computer Lab.

A. Engineering Workshop

The IE workshop is equipped with machines and apparatus for training the students in the fields of casting, metal forming, and machining processes. This Engineering Workshop covers the experimental work associated with the ENG 202, ENG 205, ENG 213, INEN 212 and INEN 331 courses.

B. Mechanics of materials and engineering materials laboratory

This lab actively contributes to teaching activities in the IE Department. Its enables faculty and students are to provide tests such as tension, compression, shear, buckling, hardness, bending, deep drawing, impact and metallurgical observations, and used in determining the mechanical properties and characterization of materials and testing for students. It provides educational facilities at different levels to undergraduate students. The lab used in the graduation projects related to mechanical testing of materials and the graduation projects related to material science. The mechanics of materials and engineering materials laboratory, which covers the experimental work associated with ME 201 and ME 213 courses.

C. Fluid Mechanics and Hydraulic Lab.

The Fluid Mechanics and Hydraulic laboratory provides a “hands on” environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of fluid statics as well as kinematics and kinetics of fluid flow to enhance the hands-on experience of our students. The lab is equipped with test rigs for experiments pertinent to fluid mechanics, pumping machinery, and hydraulic turbines. The pumping machinery and hydraulic turbines devices aim to give students hands-on experience at conducting experiments and analyzing the data to obtain the performance characteristics of various types of pumps, fans and compressors. Many experiments are conducting in the lab such as Performance characteristics of a centrifugal radial flow pump, Effect of impeller size on the performance of a centrifugal pump, Performance characteristics of an axial flow pump, Performance of centrifugal fans, Performance characteristics of a jet pump, Performance characteristics of a multi-stage centrifugal compressor. The Fluid Mechanics and Hydraulic lab covers the experimental work associated with the INEN 216 course. The lab has an essential and effective role enabling industrial engineering students to gain educational understanding and experimental information in the field of fluid mechanics and hydraulics, turbomachines and projects.

D. Work Study Laboratory

The Work Study laboratory is equipped with a wide variety of instructional facilities in work study. The laboratory contains modern instruments which are used to train students in the practical aspect of the work study. This laboratory class aims to provide students with a general knowledge of work study and methods engineering. Also, the laboratory session is an introductory laboratory in which students obtain general knowledge of human factor engineering as well as the nature of experiments and laboratory exercises that are covered throughout the semester. Safety instructions that must be followed during each laboratory session will be explained and discussed with students in the first day of lab. The work study laboratory covers the experimental work associated with the INEN 305, course.

E. Human Factors Laboratory

Human Factors Engineering (Ergonomics) is the study, design and integration of human capabilities and limitations into the workplace. The Human Factors Engineering Lab provides undergraduate students with

the tools and measurement to collect data, analyze and provide recommendations for improved human effectiveness and productivity in the workplace. The lab covers the experimental work associated with the INEN 321 course.

F. Manufacturing Processes and CIM Laboratory

This laboratory is aiming to providing an introduction of Know-how of common processes used in industries for manufacturing parts by removal of material in a controlled manner. Auxiliary methods for machining to desired accuracy and quality will also be covered. The emphasis throughout the laboratory course will be on understanding the basic features of the processes rather than details of constructions of machine, or common practices in manufacturing or acquiring skill in the operation of machines. The Manufacturing Processes and CIM Lab covers the experimental work associated with the INEN 212, INEN 331and INEN 536 courses.

G. Electrical Circuits Lab

This lab is designed to give the student an overview of the electrical and electronic engineering lab instruments, such as Digital Multi-Meters (DMM), Power supply Oscilloscopes and the Training Electronic Boards (prototype boards) and to practice the use of these lab instruments. In the Electrical Circuit Lab. students can create their own electrical circuits and do measurements on it. The laboratory emphasizes the practical, hands-on component of Electrical circuit's course. It complements the theoretical material presented in lectures. The lab demonstrates DC circuits, KVL, Network theorems, Transient analysis in RL, RC, and RLC circuits, and Power measurements. Students can analyze the collected data by creating graphs of the data and use the graphs in the conclusion. The lab covers the experimental work associated with the INEN 214 course.

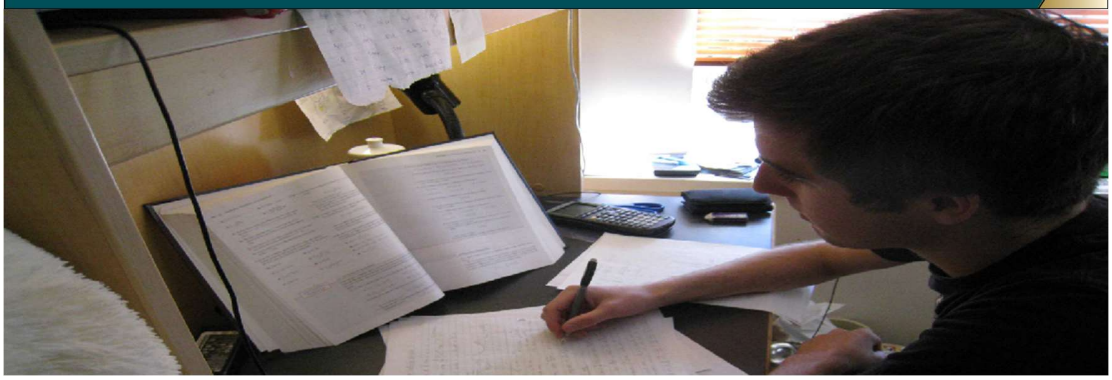
H. Control Systems and Automation Laboratory

This lab consists of appropriate training kits and equipment to investigate the implementation of control systems principles on various applications and to explore the effect of tuning the control gains on the system responses. This lab provides students an overall background in the applications of engineering control for industrial uses. This laboratory covers the experimental work associated with the INEN 311and INEN 535 courses.

I. Computer Laboratory

The students of the IE department have access to computer lab provided by the FAO. The complete description of the FAO computer center is shown in Table 7-2. The systems are supplied with all necessary software for the students to carry out their tasks like: MS-Office (complete), AUTOCAD, MATLAB and other software. Total Number of PCs is 30 with total capacity of the laboratory maximum of 30 students (see Fig 7.9). It is used for teaching different courses like Engineering Drawing, Supply chain Management, Computer Application in IE, Engineering Simulation, etc.,

APPENDIX: COURSES DESCRIPTION



General Courses

PHYS205 Physics

Geometrical Optics: Nature and propagation of light; Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration, image formation-paraxial approximation; optical instruments; superposition of waves; standing waves beats; Wave motion and sound; two-beam and multiple-beam interference; polarization; Fraunhofer and Fresnel diffraction; holography; lasers; Selected Topics in Modern Physics; nuclear physics; Experiments.

Prerequisite: PHYS101

PHYS281 General Physics Lab

Determination of thermal conductivity of a bad conductor; Determination of the coefficient of surface tension of a liquid; Determination of Young›s modulus; Determination of the coefficient of viscosity of a viscous liquid; Determination of shear modulus; Comparison and determination of an EMF and R using potentiometer and

meter – bridge; Determination of the resistivity of a material (metal wire). Prerequisite: PHYS101

CHEM101 General Chemistry

Physical chemistry: Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter, gases, liquid state; Chemical equilibria; Chemical kinetics; Nuclear chemistry; Thermo- chemistry; Electrochemistry: corrosion of metals; Water treatment; Chemistry of cements; Chemistry of polymers; Fuels combustion; Pollution and its control; Experiments.

Prerequisite: None

MATH284 Mathematical Geometry

Definite and indefinite integrals of functions of single variable; Applications of the definite integral; Fundamental theorem of calculus; Techniques of integration; Mean value theorems and Hospital›s rule; Integration and its applications in parametric and polar coordinates; Hyperbolic functions; Improper integrals; Sequences and series; Alternating series; Absolute and conditional convergence; Power series; Laplace transform.

Prerequisite: MATH101

MATH383 Differential Equations

Differential equations of the first order including basic concepts; Solving methods of differential equations; Differential equations of higher orders and their solutions; Euler›s equations and systems of linear equations; Solution by matrices: some applications; Fourier series; Partial differential equations including Alembert›s equations and

separation of variables methods for solving heat; Wave and Laplace equations. Prerequisite: MATH284

MATH325 Probability and Statistics

Descriptive statistics; Axiomatic probability; Random variables and their moments; Special discrete and continuous distributions; Sampling distributions; Estimation; Hypothesis testing; Linear regression; Analysis of variance; Analysis of categorical data.

Prerequisite: MATH284

MATH241 Linear Algebra

Systems of linear equations: matrices, determinants, inverse of a matrix, Cramer's rule. Vector spaces and subspaces; linear transformations; Determinants; Vectors in two and three dimensions: scalar and vector products; Equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions; Functions in two and three variables; Chain rule; Tangent planes and normal lines to surfaces; Extreme of functions of several variables, Lagrange multipliers.

Prerequisite: MATH284

ENG201 Engineering Drawing and Graphics

Engineering drawing techniques and skills; Orthographic projection of engineering bodies: points, lines, surfaces and bodies; Derivation of views from isometric drawings and vice versa; Derivation of views and sections from given views; Intersection of bodies and surfaces; Assembly drawings for some mechanical components; Introduction to Computer Aided Drawing (CAD); Fundamentals of engineering graphics in 2D and 3D drawings.

Prerequisite: None

ENG202 Production Technology and Workshops

Introduction; Function and planning of workshops; Properties of engineering materials and their applications; Workshop metrology; Basic bench work operations; Machining operations; Tools; Equipment and machinery used in basic workshop processes: turning, milling, grinding, forging, sheet metal-work; Measurements: standardization, international measuring systems; Cost analysis and estimation of maintenance; Welding processes; Casting processes; Industrial safety; Workshops.

Prerequisite: ENG201

ENG203 Engineering Mechanics I

Basic concepts and principles of engineering mechanics; Vector analysis of forces; Moment and reduction of forces: moment and couples, reduction of a system force, equivalent system forces, equivalent couples; Equilibrium of particles in two and three dimensions; Equilibrium of rigid bodies; Friction and its applications; Analysis of trusses; Center of gravity and moment of inertia.

Prerequisite: PHYS101

ENG204 Engineering Mechanics II

Kinematics of a particle: rectilinear and curvilinear motion, and relative motion of a particles, plane motion of a rigid body; Dynamics of systems of particles: Newton›s laws of motion, equations of motion for rectilinear and curvilinear motion; Kinetics of particles: work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, work and energy, impulse and momentum.

Prerequisite: ENG203

ENG205 Engineering Design I

Introduction to active learning: working in teams, team dynamic, team norms and communication, conducting effective meetings and quality assessment; Problem solving: problem definition, generation of solutions, selection methodology, solution implementation, assessment of implementation; Levels of learning and degrees of internalization; Ethical decision; Organization of the work and design notebook; Engineering history; Technology and environment; Engineering Professions.

Prerequisite: ELS002-MATH101

ENG213 Engineering Design II

Engineering design process; Computer modeling of processes and products; Presentation, organization, and assessment of technical or Engineering work and the preparation of brief reports; quality principles; and self- regulation or the behaviors associated with taking personal responsibility for time management, learning new material, setting goals; Basic elements of technical report; Types of technical reports.

Prerequisite: ENG205

ENG214 Engineering Economy

Principles of engineering economy, Design and manufacturing processes, Cost terminology and estimation, Accounting, Balance sheet, Profit loss statement, Money time relationships, Simple and compound interest rates, Single amounts and uniform series, Increasing and decreasing gradient, Application of money, Time relationships, Present value, Internal and External rate of return, Payback period, Evaluation of alternatives for different useful life and study period, Depreciation methods, Replacement analysis, Determination of the economic life of challenger and defender,

Engineering economy techniques for evaluation of public projects; Requires final project and presentation.

Prerequisite: ENG213

ENG215 Engineering Management

Introduction to engineering management, Types and characteristics of production systems, Forecasting methods and techniques, Product design, Capacity planning, Aggregate planning, Inventory planning and materials management, Short term scheduling, Quality management and quality control, Job design and work methods, Project planning and scheduling.

Prerequisite: ENG214- MATH325

Civil Engineering Courses

CE391 Civil Engineering Drawing

Drawing steel connections: column base, riveted joints, connections between girders and beams, columns and beams; Drawing steel bridges: truss connections, main girders (upper and lower chords, verticals and diagonals), cross girders and stringers; drawing reinforced concrete structures and its detailing: footings, retaining walls, column slabs and beams.

Prerequisite: ENG201

CE302 Structural Analysis I

Types of loads; Types of supports; Reactions; Stability of statically determinate structures; Internal forces in statically determinate structures: beams, frames and arches; analyses of statically determinate trusses; Deflection calculations; Influence lines for determinate structures; Distribution of normal stresses on homogeneous sections; Core of cross sections.

Prerequisite: ENG203

CE371 Fluid Mechanics

Review of fluid properties and hydrostatics: Manometry Forces on plane and curved surfaces, Buoyancy, Fluid masses subject to acceleration (forced vortex). Kinematics of fluid motion: Fluid flow, Classification of flow, Continuity equation. Flow of Incompressible fluid: One-dimensional flow, Euler›s Equation in three dimensions, Bernoulli›s, Energy equation, and its applications. Pipe flow: Laminar and turbulent flow, Reynolds number, Shear stress distribution, Velocity distribution, Main losses,

Secondary losses, Single pipe, Pipe connections (parallel and series. The Impulse- Momentum principle: Development of the principle, Pipe bends, Enlargements and contractions, Hydraulic structures in open channels.

Prerequisite: PHYS281 - ENG204

CE303 Structural Analysis II

Analysis of statically indeterminate structures (normal force, shearing force, bending moments): trusses, beams, plane frames and arches; Method of consistent deformation; Slope deflection method; Method of moment distribution; Euler theory for buckling of compressive members; Introduction to computer applications.

Prerequisite: CE302

CE323 Construction Materials

Properties and testing of steel, Concrete materials: Cement, Aggregate, Concrete manufacturing. Properties of fresh concrete. Properties of hardened concrete. Concrete mix design. Non-destructive testing. Quality control of concrete mixes. Special concrete. Floor types, joints construction, Surface finishing and preparation. Properties and testing of bricks.

Prerequisite: ME213

CE331 Geotechnical Engineering I

Introduction to geological engineering; Types of rocks: igneous rock, sedimentary rock, metamorphic rock; Weathering processes; Soil formation; Soil structures; Soil minerals; Basic soil properties: weight-volume relationships, definitions, laboratory tests; Soil classifications; Types of water in soil; Total and effective stresses; Hydraulic

soil properties: laboratory and field soil permeability; Stresses in soil mass: stresses under point, line and distributed loads; Soil compaction: relative density, laboratory compaction tests, field compaction, compaction equipment, site control of compaction; Experimental tests.

Prerequisite: ME213

CE311 Surveying

Introduction to Surveying and Geomatics Engineering. Units of measurements and map scales. Mapping operations; reconnaissance and field sketches. Linear measurements, theory of errors and coordinate transformations. Compass, magnetic and geographic north directions and bearings. Theodolite instruments, horizontal and vertical angle observations and horizontal angle setting out. Traverse; types, observations, corrections and coordinate computations. Leveling; theory, equipment, fieldprocedures,computationsandContourmaps.Areacalculationsandlanddivisions. Earth works and volumecomputations.

Prerequisite: MATH383

CE494 Computer Application for CE

Importance, components and operation of microcomputers; Elementary programming

using FORTRAN language: data types, variables, operators, control Structures, simple input/output statements, relational and logical expressions, GO TO statement; IF-ELSE control statement, looping statements, arrays matrix methods, vectors; Applications for civil engineering problems; Simple design project using computer.

Prerequisite: CE303 - MATH241

CE451 Reinforced Concrete I

Properties of concrete and reinforcing steel; Limit-state design of reinforced concrete structures; ACI Code requirements; Loads and load combinations acting on reinforced concrete structures; Analysis and design of beams: rectangular beams, T-beams, doubly-reinforced beams, continuous beams; Bond and development length of reinforcement; Deflections and cracks.

Prerequisite: CE323 - CE303

CE432 Geotechnical Engineering II

Compressibility and theory of consolidation: compressibility, e-logp relationship, consolidation test, types of soil settlements; Shear strength of soil: shear failures in soil, More-Coulomb theory, shear strength parameters, direct shear test, Triaxial test, unconfined compression test, vane shear test, pocket penetrometer test; Lateral earth pressure: conditions of lateral earth pressure, Rankine theory, Coulomb theory; Stability of slopes: infinite slope in cohesive and cohesionless soils, finite slope in

cohesive and cohesionless soils, mass methods, method of slices, friction circle method, design charts; Experimental tests.

Prerequisite: CE331

CE441 Transportation Engineering

Transportation planning; Mass transit plans design and operation: bus and rail; Traffic flow parameters: speed-flow-density, spacing and time headway, highway capacity and level of service for urban arterial highways; Analysis and design of signalized intersections; Traffic signal coordination.

Prerequisite: CE311

CE472 Hydraulics

Pipe flow, energy losses and pipe networks: Analysis, Design and Model. Open channel flow: Introduction, Types, States and Properties of open channels flow, Velocity distribution, Equations for uniform steady flow, Energy equation, Gradually and Rapidly varied flow, Roughness coefficient, Design of open channels cross sections, Applications. Water hammer in pipes: Unsteady flow equations, Water hammer theories, effects and control. Hydraulic machines: Types of turbines, Types of pumps, Pump characteristics and performance, Operation of pumps, Cavitation phenomena.

Prerequisite: CE371

CE461 Environmental Engineering

Elements of the environment, Population growth, Natural resources, Survey of environmental problems, Municipal and industrial water and waste water systems, Water pollution in Coastal areas and groundwater aquifers. Basic biological treatment of water and waste water. Air pollution sources and quality measurements, Global atmospheric changes, Environmental protection, Environmental impact assessment of engineering projects.

Prerequisite: CE371 – BIO101

CE462 Water and Wastewater Engineering

Introduction to water supply works, Sources of water and water quality. Biology of water and wastewater. Rate of water consumption, Analysis of water distribution and wastewater collection systems, computer modeling of network systems; water treatment including coagulation, flocculation, softening, sedimentation, filtration, desalination and disinfection; water and wastewater treatment, principles of biological treatment systems including activated sludge, extended aeration, aerated lagoons, and stabilization ponds.

Prerequisite: CE472 – CHEM203

CE405 Steel Structures

Analysis and design of roof trusses. Design of tension and compression members, columns under eccentric loadings, column bases and footings. Design of beams. Welded and bolted connections. Design of building frames. Introduction to plastic analysis. Industrial building project. All according to AISC specifications.

Prerequisite: CE303

CE452 Reinforced Concrete II

Analysis and design of slabs: one-way slab, two-way slab, ribbed slab, flat slab, stairs; Analysis and design of statically determinate frames; Floor systems for covering large halls; Analysis and design of columns subject to axial load and bending; Analysis and design of water tanks; Design of reinforced concrete elements using the working stress design method.

Prerequisite: CE451

CE442 Highway Design and Construction

Classification of roads; Design control and criteria; Highway cross section; Horizontal alignment including design of curves and super-elevation; Vertical alignment design including grades and vertical curves; Highway drainage; Intersection design of both at-grade and interchanges; Structural design including loading analysis: design of asphalt layers; Highway construction; Operation and road safety.

Prerequisite: CE441

CE499 Practical Training

In this training course, all students must participate in an approved training program in the Civil engineering field, developing a multidisciplinary and teamwork experience. At the completion of 8 week of supervised training each student must submit a formal report and oral presentation.

Prerequisite: Department Approval

CE492 Electromechanical Engineering

Fundamentals of electric circuit theory, Ohm's law, Kirchhoff's laws, A circuits, Polyphase systems. Electric motors: Dc motors, Induction motors, Fractional horsepower motors. Fluid mechanics: Fluid properties, similitude, fluid statics, Bernoulli's equation, applications of the mass, momentum and energy equations, viscous flow in pipes, flow over immersed bodies, introduction to hydraulic machines. Thermodynamics: The first law of thermodynamics, Reversible processes, Irreversible processes. The second law of thermodynamics, Thermal cycles, Steam cycles, Entropy, fuel and combustion. Heat transfer : Heat transfer by conduction, Forced convection, Heat transfer by radiation, Heat exchangers.

Prerequisite: CE323

CE433 Foundation Engineering

Site investigation: importance, objectives, planning, boreholes, open and test pits, soil sampling, rock coring, visual inspection, SPT, CPT, vane shear test, plate load test, soil report; Bearing capacity of the soil; Foundation settlements; Shallow foundations: isolated footings, combined footings, strip footings, strap footing, and raft foundations; Stability of retaining walls and sheet pile walls; Deep foundations.

Prerequisite: CE432 - CE 451

CE495 Graduated Project I

In coordination with the department, the student or group of students choose theoretical or practical project topic that is related to one of civil engineering majors; literature review pertaining to the topic; preparing for/or preliminary conducting the experiments; collecting the field data and developing the mathematical/computer model if applicable; writing the first two chapters along with any preliminary

findings.

Prerequisite: CE432 or CE442 or CE452 or CE462

CE482 Construction Management

Understanding topics necessary for effective construction management. Using a generic construction project life cycle, essential aspects of construction projects including client brief preparation, the tendering process, preparing tenders, tender evaluation, project planning, resource allocation, teamwork, site safety, and contract types are covered. Case studies are used to reinforce the application of theoretical ideas to the successful running of construction. Practice teamwork by performing case studies about the requirements of Saudi Tender Regulations, scheduling and cash flow.

Prerequisite: ENG215

CE496 Graduated Project II

The students are assigned to complete the integrated design project I involving various disciplines of civil engineering. The module define design objectives, constraints, compare alternatives, and select one alternative based on evaluation criteria and feasibility analysis. Plan an effective design strategy and a project work plan, using standard project planning techniques, to ensure project completion on time and within budget. Implement a planned strategy for an Experimental Project, if applicable. Implement a planned strategy for a Product-Based Project, if applicable. Demonstrate ability to achieve project objectives while acting as an effective member of a multidisciplinary team.

Prerequisite: CE495

CE406 Earthquake Engineering

Causes of earthquakes; Characteristics of earthquake ground motions; Earthquake magnitude and intensity measurements; Seismic response analysis of simple structures; Derivation of elastic response spectra and earthquake design spectra; Earthquake design criteria; Free and forced vibration analysis of frame structures; Soil liquefaction phenomena; Seismic performance of slopes, earth structures and soil-structure interaction; Design codes; Computer applications for frames.

Prerequisite: CE303

CE407 Advanced Structural analysis

Matrix analysis of plane frames: force method and displacement method; Formulation of stiffness and flexibility matrices; Influence of temperature change and settlement of supports on the internal forces; Influence lines of displacements and internal forces for statically determinate structures; Introduction to plastic analysis: applications on beams and frames; Finite element method; Introduction to plates and shells.

Prerequisite: CE303

CE435 Improvement of Soil Properties

Soil and rocks cycle; Analysis of Stress and Strain: Mohr›s circle, shear stress, strain tensor; Deformation and failure of rocks: stress-strain curve, axial stress; Engineering properties of rocks: compressive strength, tensile strength, shear strength, permeability; Methods of rock classification; Rocks as a construction

material; Bearing capacity of rocks.

Prerequisite: CE432

CE408 Advanced steel Structures

Advanced knowledge on the design methodology for steel and composite structures. It also provides a learning experience on the key concepts and engineering concerns of steel-concrete composite frames and tubular structures. The topics covered innovative design by exploring various steel structural schemes include steel frame structures, steel-concrete composite systems, tubular structures and joints and long-span structures. The students are expected to demonstrate their proficiency in structural steel design through term paper projects.

Prerequisite: CE405

CE453 Advanced Reinforced Concrete

Basic concepts of pre-stressing: pre- and post-tension techniques, wires, bars, stands, cables, tendons and pre-stressing end anchors; Fiber stresses in a pre-stressed beam; Load balancing; permissible stress in concrete and pre-stressing steel; Pre-stress partial losses; Pre-stressed concrete hollow core slabs; Elastic design of pre-stressed concrete members: selection of concrete section, tendon eccentricity and profile; Flexure design of pre-stressed concrete elements; Shear and torsion strength design; Rehabilitation of reinforced concrete structures: flexure strengthening of beams and slabs, shear strengthening of beams, rehabilitation of columns.

Prerequisite: CE452

CE434 Introduction to Rock Mechanics

Soil and rocks cycle; Analysis of Stress and Strain: Mohr›s circle, shear stress, strain tensor; Deformation and failure of rocks: stress-strain curve, axial stress; Engineering properties of rocks: compressive strength, tensile strength, shear strength, permeability; Methods of rock classification; Rocks as a construction material; Bearing capacity of rocks.

Prerequisite: CE432

CE437 Special Topics in Structural and Geotechnical Engineering

This course covers emerging and advanced topics in the field of structural and geotechnical engineering. The course contents and prerequisite will vary depending on the topics.

Prerequisite: CE452- CE433

CE423 Advanced Materials of Construction

Advanced technology of finishing and insulating materials, Adapted technology of alternative building materials for low-cost construction, New developments and innovative uses of construction materials, Miscellaneous non-conventional construction materials and products : ceramics, refractories, polymers and plastics, injection materials and joint sealants, composite, optical fibers, carbon fibers, pipes for water and sewage networks, Material-related failures of structures, maintenance and repair techniques structures, Welding technology, Modern technique

for non- destructive testing..

Prerequisite: CE322

CE424 Advanced Concrete Technology

The course provides students with an in-depth knowledge on the advanced role of constituents of concrete mix including admixtures and their interactions that affect the properties of fresh and hardened concrete including durability. It also discusses the latest development and progress in concrete technology for selection of correct ingredients to achieve a suitable mix and to obtain a technically execution of concrete works in hot weather. The course provides full examples in understanding the basic considerations and design philosophy required for concrete mixes with respect to the most widespread methods of mixdesign.

Prerequisite: CE322

CE483 Advanced Methods of Construction

Introduction to the advanced methods of construction - Earth work - Foundation technology – False-work – Pre-stressed concrete – Precast concrete – Fabrication and erection of steel constructions – Formwork: types, materials, loads, design, economics– Scaffolds: materials, couplers and fittings, fundamentals of erection and design, economics, safety - basis of the quality control process and testing in the advanced construction method - Equipment: types, economy, method of selection.

Prerequisite: CE451

CE484 Construction Contracts

The course gives an overview of the liabilities and rights according to the valid laws and regulations governing the engineering works in all its specializations. It reviews and explains theoretically and practically, such laws and makes references known. It concentrates on the relationship between the parties of local and international contracts in civil and administrative laws, the claims and/or disputes resulting thereof during execution of the works, The engineer›s decision in this respect and the settlement of such disputes in local and international contracts amicably or by institutional arbitration.

Prerequisite: CE452

CE485 Construction Planning

The course gives an overview of the study of the planning process and fundamental management procedures for construction projects. Special attention given to: planning of methods and resources; use of schedules; monitoring time; managing cash flow and costs; and overall project administration and record keeping. Types, selection, utilization, and unit cost of construction equipment regarding different types of projects; Formwork design types and unit cost for horizontal and vertical structural elements; Planning process for buildingconstruction.

Prerequisite: CE482

CE486 Estimating Construction Costs

This course introduces construction engineering cost planning. Key subjects include estimating and prediction throughout the project lifecycle; principles and applications of cost planning, control and

design economics. Construction cost data sources and applications, standard forms of cost analysis, estimating and tendering; effects of procurement methods and contract conditions on pricing; preliminaries costing and contractor›s cash flow and biddingstrategy.

Prerequisite: CE452

CE487 Special topics in Construction Engineering and Management

This course covers emerging and advanced topics in the field of Construction Engineering and Management and prerequisite will depend on the topics.

Prerequisite: CE482

CE412 Advanced Surveying

Role of Surveying in Civil Engineering projects. EDM and total station instruments with applications. Coordinate determination by intersection and resection. Setting out of highways, Roads, Airports, Runways and their correlated horizontal and vertical curves. Tunnel Surveying. Setting out of water Sewerage, infrastructure networks and buildings. Deformation mentoring. Geometric geodesy and map projection. GPS principles and observing techniques. Photogrammetry and Remote Sensing; aerial photography and space imaging satellite systems. GIS/LIS, Digital Mapping and Digital Elevation Models.

Prerequisite: CE311

CE443 Traffic Engineering

Introduction to traffic engineering; Traffic studies: volume, speed, density, and travel time, delay; Traffic flow characteristics; Traffic control devices: definition, types, purpose of devices; Intersection control: conflict points at intersections, types of intersection control, traffic signals design, green weaves; Parking survey; Design principles of parking spaces; Accidents and road safety.

Prerequisite: CE442

CE444 Advanced Design of Pavements

Review of engineering soil properties; Soil classification for highway construction; Soil field compaction and construction equipment; Types and behavior of pavements; Bituminous materials: uses, properties, and tests of asphalted materials; Advanced design procedures for hot and cold mixes of flexible pavements; Components of pavements; Design parameters of pavements; Advanced structural design methods of pavements.

Prerequisite: CE442

CE446 Transportation Economics

Introduction; Modes of transportation: road, railway, air and water transport, comparison between the modes, criteria of choice between them; Buses: types, comparison between their specifications and prices; Factors affecting economy of transport: rolling resistance, air resistance, etc. and the methods used to improve the economy of road transport; Economic evaluation of transportation plans: cost and benefit to traffic; Elements of cost: breakeven point concept, vehicle operating cost, factors affecting vehicle operating cost, fuel consumption and spare parts consumption, replacement policy of transportation fleet.

Prerequisite: CE441

CE447 Airports Planning and Design

Importance and classification of airports; Airports and shipping technology; Site selection; Air traffic control; Economical analysis; Optimum capacity; Aircraft characteristics related to airport design; Airport planning; Airport layout; Geometric design of the landing area; Planning and design of the terminal area; Lighting; Marking and signing; Computer applications.

Prerequisite: CE442

CE448 Railway Engineering

Importance of railways engineering; Train resistance and attractive forces; Train trip- time estimation by graphical method; Elements of geometric alignment of railway lines; Design of different elements of railway track; Renewal and maintenance of railway lines; Geometric design of different types of turnouts & crossings; Design of railway stations and yards; Safety and types of railway signals.

Prerequisite: CE441

CE 449 Special Topics in Transportation and Highway Engineering

This course covers emerging and advanced topics in the field of transportation engineering. The course contents and prerequisite will vary depending on the topics.

Prerequisite: CE442

CE474 Hydrology and Groundwater

Review of fundamentals of hydrology and advanced elements of the hydrologic cycle; hydrologic flood routing; probability concepts in hydrology, flood frequency analysis; hydrologic principles in engineering design; computer applications in hydrology and introduction to minor structure design. Introduction and definitions of ground water storage and supply, Darcy's Law and its limitation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

Prerequisite: CE331- CE472

CE473 Hydraulic Structures

Rainwater Harvesting Structures and Dam design concepts. Design of flood-way, overflow and outlet structures; frontal overflow, side channel, morning glory over fall, siphon, free fall, chute, cascade spillway. Design of dissipation structures; hydraulic jump and stilling basin, drop structures and plunge pools, trajectory basins. Design of bottom outlets; gate types, hydraulics of high head gates, air entrainment, cavation. Design of intake structures; hydraulic losses, vortex formation, hydraulic loadings, control gates and valves, penstock.

Prerequisite: CE472 - CE452

CE463 Water resources

Principles water resources engineering. Objectives of water resources planning, management and

development. Water demand. Hydrologic cycle. Measurement and analysis of precipitation, evaporation, infiltration and stream flows. Water balance. Reservoirs, Dams and Spillways. Conjunctive use of surface and groundwater. Planning for water resources development. Economical and formulation analysis of water resources projects. Planning for multipurpose projects. Systems analysis and design. Mathematical modeling and optimization. Risk analysis.

Prerequisite: CE472

CE464 Environmental Engineering II

Examines natural environmental processes and their relevance to engineering. Soil and water chemistry, equilibrium and organic chemistry, microbiology, biochemistry and biological processes will be examined, focusing on the application of these in engineering design, practice and management. Industrial waste sources, impacts, characteristics and management measures; environmental impact assessment; design of sampling and methods of risk assessment; cost-benefit analysis.

Prerequisite: CE461

CE465 Wastewater Reclamation and Reuse

Wastewater reuse as an essential part of water resources management. Biology of wastewater. Characteristics of municipal secondary effluents and quality standards for reuse. Reclaimed wastewater uses in agricultural, landscaping, recreational and industrial developments. Industrial wastes: characteristics, reclamation and recycling. Combining of treatment units to achieve the required water quality standards. Design of advanced wastewater treatment systems for reuse. Land treatment systems and groundwater recharge. Design of non-potable water distribution networks. Potential reuse alternatives. Water reuse economics.

Prerequisite: CE462

CE466 Solid and Hazard Wastes

Investigation of the regulatory and technical issues affecting solid and hazardous waste management, with an emphasis on the principles governing the transport, fate, and remediation of solid and hazardous waste in the subsurface. Evolution of solid waste sources, composition and properties. Biology of solid waste composition. Engineering principles. Separation, transformation and recycling of waste, materials. Disposal methods and regulations. Site selection, site investigations and design for landfills. Construction problems in waste disposal sites. Hazard wastes disposal, Environmental assessments.

Prerequisite: CE462

CE475 Special topics in Water Resources and Environmental Engineering

This course covers emerging and advanced topics in the field of Water Resources and Environmental Engineering and prerequisite will depend on the topics.

Prerequisite: CE462

Electrical Engineering Courses

ELEN200 Electric Circuits I

Introduction to electric circuits theory; Ohm›s law; KVL; KCL; Circuit analysis using Mesh and Nodal methods; Circuit theorems: Thevenin's, Norton's, and superposition theorems; Inductance and capacitance; transient response of first order circuits.

Prerequisite: PHYS205+MATH101

ELEN202 Electric Circuits II

Operational Amplifiers, Sinusoids and Phasors, Sinusoidal Steady-State Analysis, AC Power Analysis, Three-Phase Circuits, Magnetically Coupled Circuits, Frequency Response, Two-port Networks.

Prerequisite: ELEN200

ELEN203 Electric Circuits Lab

This laboratory introduces the students to the Laboratory Safety and lab regulations, Electric components; Electric equipment: sources, multimeters, oscilloscopes; Measuring electric circuit parameters. In addition, students get to Verify basic laws and theorems of DC circuits; Record, evaluate, and analyze experimental data; Measure waveform parameters; Measure reactance and phase angle in RC and RL circuit; Use op-amp as Inverting amplifier, Non-inverting amplifier, Voltage follower, Differential amplifier, Integrator and differentiators.

Prerequisite: Pre ELEN200, Co ELEN202

ELEN 204 Measurements and Instrumentation

Fundamentals of measurements, types of errors, types of commonly used sensors, displacement transducers, temperature transducers; digital to analog and analog to digital converters; electromechanical instruments; oscilloscopes.

Prerequisite: ELEN310

ELEN210 Electronics I

Band structure, bonding in molecules and solids, energy bands; electrical properties of materials used in electrical engineering, doped semiconductors in thermal equilibrium, charge neutrality, mass action law, recombination and transport mechanisms, Boltzmann relations, derivation of p-n junction, dc and ac characteristics, charge storage effects. The junction field effect transistor (JFET) and metal oxide semiconductor FET, derivation of dc characteristics.

Prerequisite: ELEN200

ELEN220 Complex analysis and discrete math

This course is composed of the topics from discrete mathematics and complex analysis. Discrete math: Propositional logic, their equivalence, proofs, quantifiers and their instantiation, set, function, growth of function, basic algorithm, prime numbers, gcd, relation, counting, basic counting. Complex analysis: Complex Numbers, single and multiple functions, limits and continuity, analytic functions, complex differentiation, Cauchy-Riemann formula, contour integrals, Cauchy›s residue theorem, infinite series Taylor›s and Laurent›s series.

Prerequisite: Math101

ELEN224 Probabilistic Methods in Electrical Eng.

Fundamentals of probability theory, continuous and discrete random variables, distribution functions, Gaussian and other distributions, function of random variables, joint and conditional probabilities, moments and statistical averages, introduction to random process.

Prerequisite: ELEN 230

ELEN326 Engineering Programming

Overview of computer hardware and software; Programming in C with emphasis on modular and structured programming technique; Problem solving and algorithm development; numeric 1-D and 2-D arrays, strings and pointers, applications in electrical engineering.

Prerequisite: CSC001

ELEN230 Signals and Systems

Elementary signals and discrete and time continuous signals. Signal and system properties. Discrete and Continuous Convolution. Discrete and Continuous Fourier series. Continuous Fourier transform. Fourier transform properties. Continuous Laplace transform and properties.

Prerequisite: ELEN200, MATH241

ELEN232 Control Systems

Principles of control systems, modeling of physical systems: electrical/mechanical systems, system representations using block diagrams, feedback control system characteristics, performance of feedback control systems, Routh-Hurwitz stability, steady state error, root locus method, PID control, and introduction to frequency response.

Prerequisite: MATH383, ELEN230

ELEN233 Control Systems Lab

This laboratory introduces the students to the practical implementation of modeling and various PID control combinations. In addition, students get to understand the impact of closed-loop control on system performance. Applications include process and DC motor systems.

Prerequisite: ELEN 232, ELEN 203

ELEN240 Electromagnetics I

Review to vector analysis, coordinate systems and transformation; Electrostatic fields; Coulomb›s law and electric field intensity; Gauss›s law and electric flux density; Maxwell›s first equation; Energy, electric potential and potential gradient; Dielectrics and capacitance; Current density and conductors; Charge images; Poisson›s and Laplace's equations; Magnetostatics fields; Bio–Savart and Ampere›s laws; Curl and Stokes's theorem; Magnetic materials; Self and mutual inductances; Energy in static Fields.

Prerequisite: MATH284, PHYS205

ELEN250 Logic Design

Number systems; Boolean algebra; Logic gates, Boolean functions; Design of combinational logic circuits: comparators, decoders, code conversions, BCD to seven segment decoders; Flip flops; Shift registers; Design of sequential logic circuits; Types of memories; Design of ROMs.

Prerequisite: ELEN200

ELEN250 Logic Design Lab

Design of combinational logic circuits: comparators, decoders, code conversions, BCD to seven segment decoders; Flip flops; Shift registers

Prerequisite: ELEN203, ELEN250

ELEN260 Communication Engineering I

Amplitude modulations, Angle Modulation, Pulse Modulation, Signal spectrum, FDM, Representation of band-pass signals and systems, Signal-to-noise ratio. Noise equivalent bandwidth.

Prerequisite: ELEN224, ELEN230

ELEN310 Electronics II

Derivation of dc and ac terminal characteristics, equivalent circuits, BJT and FET amplifier biasing networks; small-signal equivalent circuits; single and multi-stage small-signal amplifiers; high and low frequency response; negative feedback amplifiers; introduction to large-signal amplifiers. Introduction to MOSFET.

Prerequisite: ELEN202, ELEN210

ELEN311 Electronics Lab

Get the dc and ac terminal characteristics of Silicon Diode LED and Zener, build a half wave and full wave rectification circuits, and design a BJT and FET amplifier biasing networks;

Prerequisite: Pre ELEN203, Pre ELEN210, Co ELEN310

ELEN322 Numerical Methods

Mathematical preliminaries, numerical errors, loss of significance and error propagation. Finite difference method, Numerical solution of nonlinear algebraic equations. Numerical solutions of linear and non-linear algebraic equations. Interpolation and approximation and curve fitting. Numerical differentiation and integration. Numerical solution of differential equations. Eigenvalue problems. Introduction to numerical solution of partial differential equation. Engineering applications.

Prerequisite: MATH241

ELEN330 Digital Signal Processing

Revision of discrete time signals and their properties. Revision of Discrete Time Fourier transform. A/D and D/A conversions. The concept of frequency in continuous and discrete time signals. Z Transform and its applications. Implementation of discrete time systems (FIR, IIR and state-space system analysis). Introduction to digital filters. Discrete Fourier transform and its applications. FFT algorithms.

Prerequisite: ELEN230

ELEN331 Scientific Computing

Introduction to MATLAB. MATLAB Environment. Built-In MATLAB Functions. Using the help feature. Random numbers. Complex numbers. Matrices and vectors. User defined functions. Loops. User controlled input and outputs. Logical functions. Symbolic math and integrals. Plotting in 2D and 3D. Numerical techniques: solve functions, curve fitting, interpolation.

Prerequisite: MATH241, ELEN200

ELEN340 Electromagnetics II

Time varying fields; Faraday›s law: Transformer and motional emfs; Displacement current; Maxwell›s equations and time harmonic fields; Transmission lines; Standing waves and reflection coefficient; Impedance matching; Wave equation; Power transfer and Pointing vector; Plane wave propagation: in free space, in lossy dielectrics and in good conductors; Reflection of plane wave; Introduction to radiation

and antennas.

Prerequisite: MATH383, ELEN240

ELEN341 Electromagnetics Lab

Practical Experiments to demonstrate electromagnetics laws including Coulomb›s law, Ampere›s laws, Faraday›s law, standing waves, impedance matching, wave propagation, antenna measurements

Prerequisite: Pre ELEN203, Pre ELEN240, Co ELEN340

ELEN352 Embedded Systems

Embedded system design and applications, synthesis of microcontroller systems, including hardware, programming, and interfacing. It also covers microcontroller architecture and peripherals basics, microcontroller parallel interfacing and serial communication, I/O techniques requirements, A/D conversion, timing and interrupts. Principles of instruction set, assembly and high languages programming. In this course, the C compiler is used for programming. The 8-bit PIC microcontroller will be used as well to get the particularization of all theoretical concepts.

Prerequisite: ELEN226, ELEN250

ELEN361 Communications Engineering Lab

This laboratory introduces the students to the practical implementation of communications transceivers for various techniques like DSB, SSB, AM and FM and introduce sampling and multiplexing techniques

Prerequisite: ELEN260, ELEN 203

ELEN370 Electric Machines

Basic principles of electrical machines and energy conversion, magnetic circuits, principles and operation of single phase and three-phase transformers, principles, operation, key characteristics and applications of three phase induction motors, introduction to DC machines and synchronous generators.

Prerequisite: ELEN 202+ ELEN340

ELEN372 Electric Energy Engineering

Power system components: generation, transmission, and distribution; Energy sources: fossil, nuclear, and renewable; Energy conversion; Power calculations; Per- phase analysis; Transformers; Overhead transmission line parameters: resistance, inductance, and capacitance calculations; Overhead transmission line equivalent circuits; Voltage regulation and efficiency of overhead transmission line; Underground cables: construction and types; Power factor correction in three-phase circuits.

Prerequisite: ELEN 370

ELEN373 Electric Machines and Energy Lab

The aim of this course is to introduce the students to three-phase circuits and power measurements, single phase transformer, three-phase transformers, DC machines, parameters of three-phase synchronous generator, three-phase induction motor.

Prerequisite: Pre ELEN203, Pre ELEN370, Co ELEN372

ELEN410 Power Electronics

Single phase controlled and uncontrolled rectifier circuits, three phases controlled and uncontrolled rectifier circuits, Power semiconductor devices, such as: Power Diode, Thyristor, Power BJT, and Power MOSFET, Base drive and firing circuits of power devices.

Prerequisite: ELEN310

ELEN495 Graduation Project I

The goal of graduation projects is to prepare the students to participate in engineering projects related to an appropriate industry. Thus, all project teams are to follow standard industrial practices, methods and processes. Teams must carry the engineering project to completion, examining real world and multiple design constraints, following applicable industrial and business standards. Such constraints may include but are not limited to: economic, environmental, and industrial regulations, time and resource management, and cross-disciplinary/departmental result integration. Students are required to work collaboratively in multidisciplinary teams whenever possible. Graduation Project I is the first of two sequential semesters devoted to a team project that engages students in the full engineering design process. Project proposals will be written, reviewed and approved by advisors. Initial designs will be completed and corresponding constraints will be determined. All students will participate in a public oral and poster presentation following departmental guidelines. Teams are required to submit weekly written progress reports adhering to established guidelines.

Prerequisite: ENG213, ELEN370, ELEN311

ELEN496 Graduation Project II

Continuation of the Graduation Design project begun in the previous semester. In Graduation Design II, projects based on approved project proposals will be completed. All limitations of the design will be determined and addressed. All students will participate in a public oral presentation following faculty-approved guidelines at a faculty-approved time and location. Teams will also submit a written final report and documented team communication (complete sets of weekly reports and/or log books) following faculty-approved guidelines.

Prerequisite: ELEN495

ELEN399 Summer Training

All students must participate in training program in the electrical engineering field where they are expected to gain practical experience. At the completion of 8 weeks of supervised training each student must submit a formal report and oral presentation. Prerequisite: Successfully passing 120 credit hours

ELEN360 Communications Engineering II

Signal-to-noise ratio and probability of error. Mutual information and entropy. Optimum receivers. Pulse detection and matched filters. Signal distortion in transmission and equalization. Classic digital modulation schemes M-PSK and M-QAM modulations. Baseband-bandpass conversion, Performance evaluation in the presence of additive white Gaussian noise.

Prerequisite: ELEN260

ELEN412 Power Electronics Applications

Review of single phase and three phase controlled and uncontrolled power rectification. DC choppers and voltage regulators such as Buck, Boost, Buck-Boost, and Bulk converters. Switched Mode

Power Supplies. AC voltage controllers. DC-AC converters (Inverters). Power electronics for motor drives.

Prerequisite: ELEN410

ELEN432 Industrial Automation

Components and characteristics of industrial processes, process development, integration of components, introduction to process automation, industrial controllers, process automation using PLCs, introduction to computer control and SCADA systems.

Prerequisite: ELEN202, ELEN352

ELEN436 Industrial Motor Control

This course aims to introduce the students to the principles of motor control; motor starting methods, soft starters, sensing and operation of motor control systems, motor protection and safety, motor installation, motor braking methods, types of mechanical loads, variable speed motor controls, sequencing and switching, maintenance, and troubleshooting techniques.

Prerequisite: ELEN310, ELEN370

ELEN440 Antennas

Introduction, antenna characteristics, radiation resistance, gain and directivity, efficiency, beam width and bandwidth, mathematical analysis of antennas, dipole and monopole antennas, ground effect, loop antennas, waveguides and aperture antennas, antenna arrays, beam steering.

Prerequisite: ELEN340

ELEN462 Wireless Communications

Overview of Wireless systems. Cellular Concept. Cell splitting and sectoring. Trucking and queuing Theory. Large Scale fading. Two ray model. Fresnel zones. Okumura and Hata channel models. Small scale fading. Delay spread, coherence time and bandwidth and Doppler spread. Overview of 2G, 3G, OFDM, MIMO and future wireless standards Prerequisite: ELEN260

ELEN464 Optical Communications

Introduction to optical waveguides and fibers, propagation characteristics of fibers, characterization methods, LEDs, laser diodes, optical receivers, optical amplifiers, all- optical switching and fiber optic communication systems.

Prerequisite: ELEN260, PHYS205

ELEN466 Satellite Communications

History of satellite communications. Satellite systems: orbits and constellations, satellite space segment, propagation and satellite links. Satellite communications techniques: modulation and coding techniques, multiple access, on-board processing techniques. Systems and applications: INTELSAT systems, SAT networks, GPS, GEO, MEO and LEO mobile communications,

Prerequisite: ELEN340, ELEN260

ELEN468 Data Networks

OSI and TCP/IP network layers; types of physical channels; data transmission; link layer operation: error

control and reliable transmission; circuit and packet switching; local and wide area networks; routing algorithms; IP protocol; operation of TCP and UDP; higher layers and quality of service.

Prerequisite: ELEN260

ELEN470 Power System Operation and Control

Overview of Energy Management Systems (EMS) and their functions; Economic Dispatch; Automatic Generation control; Unit Commitment; State Estimation; Stability; Security. Application: the Saudi Power System.

Prerequisite: ELEN372, ELEN232

ELEN472 Protection of Power Systems

Power System Faults, System Protection Components, Instrument Transformers, Protective Relay Technologies, Overcurrent Relays, Radial System Protection, Reclosers and Fuses, Directional Relays, Protection of Two-Source System with Directional Relays, Zones of Protection, Line Protection with Impedance (Distance) Relays, Differential Relays, Bus Protection with Differential Relays, Transformer Protection with Differential Relays, Buchholz Relay, Surge Arrestors, Pilot Relaying, Digital Relaying. Demos using PSCAD. Prerequisite: ELEN372

ELEN474 Power System Analysis

Generation, transmission, and distribution of power (the voltage levels); Single line representation of power system; Per-unit system; Load flow; Fault calculations; Optimal Load Flow. The Saudi Power Network. Applications: Test Case – the IELENE 30 bus system. Prerequisite: ELEN372

ELEN476 Renewable Energy and Smart Grids

Energy Resources, Energy Conversion, Energy Conservation, Cogeneration of Heat and Power, Fossil Fuel, Carbon Emissions, Basics of Solar energy systems, Photovoltaic Systems, Solar Thermal Systems, Other Renewable Energy Sources (Wind, Bio Fuel, Geothermal, and Fuel Cells), Electric Energy Storage Systems, Smart Grid Technologies, Smart Grid components, Smart Grid Control , Smart Grids Impacts.

Prerequisite: ELEN372

ELEN478 Special Electric Motors

Introduction to special types of electric machinery with all their internal structure, operations, characteristics, and applications. These types include single phase motors, universal motors, hysteresis motors, reluctance motors, stepper motors, brushless motors, and servo motors. Prerequisite: ELEN370

ELEN480 Fundamentals of Energy Efficiency

The main objective of the course is to provide students with the basic principles of energy efficiency. It presents energy consumption reduction measures in buildings, the industrial sector, and transportation. It also introduces energy efficiency standards, energy policies, and the economics of energy.

Prerequisite: ELEN372

ELEN482 High Voltage Engineering

Electrical breakdown in gases: Streamer-Kanal mechanism, breakdown in non-uniform field and corona. Electrical break-down of liquids, Electrical breakdown of solids, Insulating materials, Factors affecting performance of insulators, Testing of insulators, Destructive and non-destructive insulation tests, dielectric gases. Generation and measurement of high AC, DC and impulse voltages and impulse currents. Testing transformers and series resonant circuits. Impulse voltage generator circuits. Impulse current generator circuits. Sphere and uniform field gaps. Electrostatic, generating and peak voltage measuring voltmeters. Voltage dividers. Measurement of impulse voltages and currents.

Prerequisite: ELEN372

ELEN490 Selected topics in Electrical Engineering

The aim of this course is to introduce the students to recent developments or advancements in Electrical Engineering and related fields.

Prerequisite: ELENxxx

Mechanical Engineering Courses

ME201 Engineering Materials

Introduction and classification of materials, Modern Material needs, Mechanical behaviors and testing of materials, Atomic structure, Atomic Bonding in solids; the structure of crystalline solids, properties and performance, Crystalline and non- crystalline materials, Imperfections in solids; Reaction rates and diffusion. Phase transformations in metals; Phase diagrams; Carbon-iron phase diagrams; Mechanical properties of metals, Heat treatment, Deformation and fracture, Metal alloys, Materials selection, Metals, Ceramics and Polymers. Introduction to failure analysis. Case studies. Use of computers in materials science.

Prerequisite: CHEM101

ME202 Manufacturing Processes

Engineering Materials, Manufacturing properties of materials, Testing, Metal and Alloys, Non-

metal materials - Elements of Manufacturing Processes, material flow, energy flow and information flow- Forming in the liquid state, Casting and molding processes- forming in the solid state, metal forming, forming of plastics and powder metallurgy- Sheet metal processes (formability of sheets and sheet forming processes, processing of polymers). Material Joining processes, welding processes, soldering and brazing, riveting, Testing of weldability, joining by mechanical elements, assembly processes- Material removal processes, metal cutting and finishing processes, Gear cutting. Basic machining processes and machine tools - Turning, Drilling, Shaping-and planning, Milling, Grinding, Machining time, Measurements, Basics of CNC machining and programming. Machinability and cuttingfluids.

Prerequisite: ME201-ENG202

ME211 Mechanical Drawing and Graphics

Auxiliary views; Skew and inclined planes; Surface intersections; Developed views; Fits and tolerances; surface finish notations; Fasteners; rivets, welds, pins, keys, bolts, nuts. Standard representation and drawing of common mechanical elements; Machine components; Structural drawings; Assembly and working drawings; Fundamentals of computer graphics and the use of Auto CAD computer drafting software.

Prerequisite: ENG201

ME212 Mechanics of Machines

Kinematics Fundamentals : Geometry of Motion and Mechanism Topology, Linkage Mechanisms and Planar Robots : Position; Displacement; Velocity; and Acceleration (Graphical, Analytical and Computers Assisted Methods), Cam - Follower Mechanisms : Design and Analysis (Graphical, Analytical and Computers Assisted Methods); standard Cams and Equivalent Mechanisms, Kinematics of Gear Trains: Gears Terminology; Simple, Compound, and planetary Gear Trains, Dynamics Fundamentals; Force Analysis of Mechanisms; Basics of rotating and reciprocating Balancing; Machines(gyroscope, governor, belt, brake, clutch, etc.), Applications and Use of Computers for Mechanism Simulation and Animation, Course project.

Prerequisite: ENG 204- ME211

ME213 Mechanics of Materials

Types of loads, Axial loads (centric for tension and compression), Definition of stress and strain. Stress and strain relation (Hook›s Law), Types of stresses, Normal stress due to axial load, Stress-Strain Diagram, statically determinate problems, statically indeterminate problems, Thermal stresses, Shear force, Bending moment diagrams, Normal stress due to bending, Shear stresses, Direct shear, Torsion, Combined stresses, (Eccentric Loading), Principle stresses, and Mohr›s circle. Deflection of beams, Buckling, Thin and thick cylinders, Yield criteria, Lab work. (Tension, Bending, hardness, Fatigue).

Prerequisite: ENG203

ME221 Thermodynamics I

Basic Concepts and Definitions of Thermodynamics: Thermodynamic systems, property, state, process, cycle and equilibrium. Energy and the first law of thermodynamics: Energy balance for closed systems, energy analysis for cycles. Properties of pure substances, Control volume energy analysis. Second

law of thermodynamics: statements of second law, Carnot cycle. Maximum performance measures for power, refrigeration and heat pump cycles operating between two reservoirs.

Prerequisite: MATH284-PHYS205

ME231 Fluid Mechanics I

Introduction to fluid mechanics and units, properties of fluids, Fluid statics; Pressure measurements; Buoyancy and stability, Fluid flow kinematics, Conservation of mass, energy, and momentum, Differential form of equations, Stream and potential functions, Euler›s equations, Bernoulli›s equation, Dimensional analysis and similitude. Boundary layer Concepts, pipe flows. Pipe network and water hammer analysis.

Prerequisite: MATH383-ENG204

ME243 Electrical Engineering Fundamentals

Fundamentals and concepts of electric circuits, Resistive circuits, Thevenin and Norton›s equivalent circuits, Active and reactive power, AC circuits and three phase circuit analysis, Transformers, Semiconductor materials. Diodes and Transistors circuits. Introduction to ideal Operational Amplifiers and its applications. Concepts of electrical motors.

Prerequisite: PHYS205-MATH284

ME291 Summer Training I

All students must participate in training program in the relevant industry where they are expected to gain practical experience. At the completion of 8 week of supervised training each student must submit a formal report and oral presentation.

Prerequisite:

ME314 Mechanical Vibrations

Elements of vibration, Classification of vibration, Free and damped vibration of single degree of freedom systems, Viscous damping, Forced vibration, Resonance, Harmonic excitation, Rotating unbalance, Base motion, Vibration isolation, Vibration measuring, Critical speed of shaft. Two degrees of freedom systems, Undamped vibration absorber. Vehicle Suspension. Multi-degree of freedom systems for free, damed, Undamped, and forced vibration. Tensional vibration: Two rotor system, Three rotor system, Tensional vibration of gear systems. Introduction to Continuous systems, Application with computer programs.

Prerequisite: ME212-MATH383

ME315 Mechanical Design I

Fundamentals of mechanical Design, Codes and standards, Factor of safety, and Professional ethics. Review of stress analysis (combined stress, bending), Buckling, theories of failure, Fatigue failure. Materials selection in mechanical design and safety factors, Design of fasteners and connections: riveted, welded, bolted and bonded joints. Shafts and axles, Power screws, Keys, Clutches, springs, Couplings, Bolts, Chains, and ropes, Belts, and other elements. Applications and term design projects.

Prerequisite: ME212-ME213

ME316 Systems and Automatic Control

Introduction to control systems in the real world. Feedback Concept. Modeling of Electromechanical

Systems. Block Diagrams. Signal Flow Graph. Sensitivity and Disturbance Analysis. Steady State Error Analysis. Stability Analysis. Analysis of Control Systems, Root Locus, Frequency Domain Analysis of Control Systems, Control System Design in the Frequency Domain. State Variable Modeling. State space representation. Controllability and Observability. State and Output Feedback Controller Design, Observer Design, Introduction to modern control; Introduction to PLC controllers, applications; Control design projects.

Prerequisite: ME314-ME341

ME 317 Mechanical Design II

Power transmission elements, Design of variable speed drives, Theory of hydrodynamic lubrication, Systems of lubrication and greasing, Rubbing and non-rubbing seals. Design of bearings(sliding-rolling), Gear design(spur-bevel-helical-worm), Optimum design, Design of brakes. Design, analysis and selection of mechanical systems. Introduction to the use of computers in mechanical design. Design project using computer facilities.

Prerequisite: ME315

ME322 Heat Transfer

Basic modes of heat transfer. Thermal circuits, surface energy balance. Steady one- dimensional heat conduction, conduction across flat plate, cylindrical and spherical shells. Fins. Convection fundamentals and correlations, external flow, internal flow, tube banks, impinging jets, packed beds. Types of heat exchangers, overall heat transfer coefficient, design of heat exchanger. Radiation, black body and gray radiation, view factor, radiation exchange between surfaces.

Prerequisite: ME221-ME231

ME 323 Thermodynamics II

Second law of thermodynamics. Irreversibility and availability: second law efficiency, non-flow exergy and flow exergy. Exergy destruction. Vapor power cycles and exergy analysis: basic Rankine cycle, Otto cycle, Diesel cycle, Brayton cycle. Refrigeration: vapor-compression refrigeration, refrigerant properties, absorption refrigeration. Heat pump systems. Nonreacting ideal gas mixtures and Psychometrics. Dry–bulb and wet- bulb temperatures. Psychometric charts and psychometric applications.

Prerequisite: ME221

ME332 Turbomachinery I

Classifications of fluid machinery. Momentum and energy transfer between fluid and rotor. Principles and practice of scaling laws. Performance characteristics of centrifugal and axial flow fans, compressors and pumps. Positive displacement pumps. Cavitation's and water-hammer problems. Valves, types and characteristics. Performance characteristics of axial and radial flow turbines. Fluid machinery noise.

Prerequisite: ME231

ME333 Instrumentation and Measurements

Introduction to instrumentation and measurements techniques in engineering, Fundamentals of measurement systems; fundamental measurement theory, Statistical analysis of experimental data;

uncertainty analysis, various statistical distributions and test of goodness of fit; correlation coefficient and multivariable regression. Time dependent characteristics Analog input; Response of measuring systems, Sensors and transducers, electronics for instrumentation; analogue and digital instrumentation fundamentals, computer-based data acquisition; Introduction to applied mechanical measurements; Displacement and dimensional measurements; Measurement and analysis of stress and strain; Pressure; velocity; flowrate and temperature measurements, extensive technical report writing.

Prerequisite: ME243-ME314

ME341 Numerical Methods

Modeling, Computers and error analysis, Introduction to programming concepts including variable types, data structures, flow control, Root of equations, Linear algebraic equations, Optimization; Curve fitting; Numerical methods to interpolation and statistical regression, Numerical differential and integration; solution of linear and nonlinear equations, Eigen problems, Numerical methods for ordinary differential equations, Numerical methods for partial differential equations. Deterministic and probabilistic methods; Fundamentals of MATLAB programming and basic commands. Examples from Mechanical Engineering including lumped and continuum models from solid and fluid mechanics; heat transfer; dynamics and control; design and manufacturing. Assignments use MATLAB programming.

Prerequisite: MATH383-MATH241

ME342 Computer Aided Design

Introduction. Basics of computer graphics: Mathematical formulation, two- and three-dimensional transformations, plane and space curves, curve fitting and surface generation, modeling, hidden line removal. Introduction to Finite Element Method and optimization techniques. Kinematic analysis, and animation of mechanical systems. Tools for CAD: hardware and software. CAD packages. Static linear analysis in one, two and three dimensions. Introduction to nonlinear analysis. Optimum design. Computer applications in mechanical design. Incorporates projects in solid modelling, stress analysis of machine parts and structures, and mechanism response animation.

Prerequisite: ME315-ME341

ME392 Summer Training II

In this second industrial training course, all students must participate in an approved training program in the relevant industry, developing a multidisciplinary and teamwork experience. At the completion of 8 week of supervised training each student must submit a formal report and oral presentation.

Prerequisite: ME291

ME424 Refrigeration and Air Conditioning

Application of Refrigeration and Air Conditioning: Major uses. Air-conditioning processes and cycles. Refrigerant and refrigeration cycles. Outdoor design conditions and indoor design criteria. Load calculation. Refrigeration components and evaporative coolers. Air system basics: fan and duct systems, fan combinations in air-handling units and packaged units. Absorption systems: the absorption cycle. Air conditioning systems and selection. Students will use computer-based AC packages for homework and team projects.

Prerequisite: ME323- ME333

ME425 Power and Desalination plants

Power stations classifications, steam power plant, feed water heaters, performance. Steam generators, fuels and combustion processes, turbine, water systems. Gas power stations and diesel power plant, characteristics and performance. Combined power cycles. Co-generation concepts and systems. Power generation and environmental impact. Water desalination, reverse osmosis, multiple flash evaporator.

Prerequisite: ME323- ME444

ME434 Basic Hydraulic and Pneumatic Systems

The basics of hydraulic and pneumatic systems, Hydraulic Circuits, Main pneumatic circuits, Control of several hydraulic and pneumatic cylinders, Hydraulic and pneumatic control valves, Characteristics and selection of positive and non-positive displacement pumps, Characteristics and standards of filters, Linear and rotary hydraulic Actuators, Characteristics and design of hydraulic and pneumatic distribution systems; Design; sizing and analysis of hydraulic and pneumatic circuits, Design and application of hydraulic and pneumatic systems.

Prerequisite: ME332-ME333

ME444 Mechatronics I

Introduction to AC circuits, Introduction to semiconductor, Introduction to ideal diodes, introduction to NPN and FET transistors, D/A and A/D convertors, Introduction to Digital Circuits, Introduction to electrical motors, introduction to robotics.

Prerequisite: ME243-ME316

ME493 Graduation Project I

Choosing the topic, establishing the project, literature review, preparing for/or preliminary conducting the experiments, collecting the field data and developing the mathematical/ computer model if applicable, writing the first two chapters along with any preliminary findings.

Prerequisite: ME315-ME392

ME494 Graduation Project II

Continuation of Part-I of the project including: running and finalizing the experimental program or the mathematical/computer model, analyzing the results and findings and drawing the conclusion, writing the complete project report, presenting and defending the project.

ME451 Heating Ventilation and Air-conditioning Systems

HVAC systems; introduction to meteorological data and design conditions; solar angles and solar radiations; heat and moisture transfer in building envelope; Infiltration; heating and cooling load calculations; analysis and understanding of different processes that moist air undergoes in most common HVAC systems; psychometric, indoor air quality (IAQ); and thermal comfort.

Prerequisite: ME493

ME452 Pipelines Engineering

Introduction and Basic Concepts, Types of pipelines, Incompressible flow in pipelines and pipe networks, Flow in a pipeline with uniform Draw-off, Inertia Pressure in pipelines, Power

Transmission by pipelines, Pipeline Materials, Stresses in pipelines, Economical Study of Pipelines, Pipe Line Design, Codes and Standards relating to Design, Pipe Lines Inspection and Testing, Compressible flow in pipelines. Study Cases.

Prerequisite: ME231

ME453 Renewable Energy Systems

Introduction to types of renewable energy. Energy efficiency issues and energy storage; Potential of using renewable energy resources as supplement of conventional energy resources. Solar radiation energy and location; Basic concepts of solar thermal process; collectors; Application of water heating, active and passive building heating and cooling, industrial processes. Wind energy fundamentals. Aerodynamic theory of propellers and windmills, optimal blade design and economics.

Prerequisite: ME322-ME332

ME454 Aircraft Propulsion Systems

Design principles and performance analysis of atmospheric and space propulsion engines and systems. Application of thermodynamics, compressible fluid flow and combustion fundamentals to the design of gas turbine and rocket engines and components, including inlets, turbo machines, combustors, and nozzles, matching of propulsion system to vehicle requirements.

Prerequisite: ME323-ME332

ME455 Fluid Mechanics II

Dynamics of fluid flow and Naiver-Stokes equations, Flow in pipes, Boundary layer equations, Blasius flow, Momentum integral equation, Potential flow, Complex potential of elementary flow, superposition, Introduction to one dimensional compressible flow, one-dimensional isentropic flow in variable-area Passage, Shock waves.

Prerequisite: ME322-ME341

ME456 Computational Fluid Dynamics

Review of MATLAB; review of numerical methods: number representation and errors, interpolation, differentiation, integration, systems of linear equations, Fourier interpola¬tion and transforms; Fluid flow modeling, the Navier-Stokes equations and its approximations. Differential equations: partial and ordinary differential equations, elliptic, parabolic and hyperbolic differential equations, Solution of fluid differential equations by finite difference methods and finite volume methods; Stability and time marching methods; Grid generation; Finite element and spectral methods, boundary element methods and panel methods; Boundary layers. Turbulent flows: models and numerical simulations.

Prerequisite: ME322-ME342

ME457 Turbomachinery II

Introduction: overview and Turbomachinery classification. Thermodynamics of fluid flow and thermodynamics analysis of compression and expansion processes; Centrifugal Fans, Blowers, and Compressors; Axial Flow Compressors; Axial Flow Turbines; Kinematic relations and efficiencies of turbomachines; two dimensional cascades; Turbine and Compressor cascade correlations and performance. Axial Turbines (two-dimensional analysis), Axial Flow Compressors and Fans (two-dimensional analysis), Centrifugal Compressors and Fans, Radial Flow Turbines, and preliminary design

fundamentals of turbomachines and three-dimensional considerations.

Prerequisite: ME322-ME332

ME 458 Internal Combustion Engines

Basic engine operation, introduction to engine cycles. Air standard cycles, fuel-air and actual cycles, volumetric efficiency. Performance and the effects of operating variables on it. Two stroke engine air capacity and scavenging. Ideal combustion of S.I engines, real combustion of S.I engines, abnormal combustion of S.I engines, diesel combustion. Emission sources, exhaust after treatment, emission reduction systems and diesel emissions.

Prerequisite: ME322-ME323

ME 459 Design of Thermal-fluid Systems

Application of principles of fluid mechanics, heat transfer, and thermodynamics in the component design of thermal systems. Heat transmission and fluid flow, Thermal analysis of heat exchangers, Examples are drawn from power generations, Applications of heat exchangers, and industrial processes. Students work on group projects for integration of these components in the design of thermal systems.

Prerequisite: ME317-ME322

ME445 Computer Programming and Applications

Introduction to computer languages and computer hardware, Fundamental of MATLAB programming and basic commands, 2D and 3D graphics. Data manipulation and presentation, model building, application of linear and nonlinear algebraic and differential equations in mechanical engineering systems, numerical solution of optimization problem, virtual prototyping, finite element applications, Computer applications in mechanical engineering fields, case studies.

Prerequisite: CSC001-ME341

ME461 Material Selection for Mechanical Design

Effects of materials and manufacturing processes on design; The rule of materials and design in industry; Design process; Methodology for materials selection in mechanical design processes; Engineering materials and properties; Materials selection chart; Shape and processing; Multiple constraints and data source; Design issues; Case studies in mechanical design, taking materials selections, shape and process into account; Projects on materials selection at the design concept and the design embodiment stages.

Prerequisite: ME201-ME317

ME462 Numerical control machines

Components of CNC machines (mechanical parts, sensors, transducers, limit switch, encoder, speed drives and control, hot electrical panel), Basics of machine tools, Describing the operation panel of CNC machine tool, Control of machine tools, Constructing of machine tools, Manufacturing modes, Programming of CNC machines, Manual programming for complex work pieces, Machine programming(lathe, milling, drill and others).

Prerequisite: ME202-ME316

ME463 Pressure Vessels and Piping System

Introduction to ASME boilers, Pressure vessels, Piping codes, Materials selection, Basic principles in design, Types of loads, Failure theories, Design for internal and external pressure, Design of end closures with various geometries, Design of openings and nozzles, Fabrication requirements, Non-destructive testing, piping stress and flexibility analysis, Design and selection of piping supports. Course project. Prerequisite: ME213-ME231

ME464 Tools Design and Production Facilities

Design of cutting tools, Basics of design of jigs and fixtures, Die design (blanking dies- bending dies- deep drawing dies), Molds for injection of plastics, Computer aided design.

Prerequisite: ME342-ME202

ME465 Automotive Engineering

Automotive dynamics; Automotive systems; Mechanisms; power transmission; Braking; steering; suspensions; Electrical systems; Frame and body; Nonconventional engines and environmental aspects; Heating and Air conditioning Systems, Safety Systems. Problems of performance and economy.

Prerequisite: ME317-ME314

ME466 Finite Elements Methods and Applications in Design

Introduction to finite element methods; Basic concepts of finite element methods; one, two and three dimensional analysis; General steps in the finite element method; Direct stiffness (equilibrium) method to solve finite element problems; Formulation and application of spring, bar, truss and beam elements; Types of analyses: statics and dynamics model, linear, nonlinear, static, modal, vibration, buckling, thermal; Finite Element Analysis (FEA) modeling techniques, common modeling errors; Implementation and management of FEA used as a design tool; Mechanical engineering applications using FE software.

Prerequisite: ME342-ME317

ME467 Robotics Engineering

Overview of robot mechanisms, dynamics, and intelligent controls, Planar and spatial kinematics, motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3-D graphic simulation; control design, actuators, sensors; wireless networking, task modeling, human-machine interface, and imbedded software, real-time control, and embedded software. Group term projectrequires design and fabrication of roboticsystems.

Prerequisite: ME316-ME444

ME468 Tribology

Surface properties and surface contact stress; Friction, measurement of friction, theories of friction, thermal effects in sliding friction; Types of wear, wear of lubricated surfaces. Tribological properties of solid materials, solid lubricants, polymers and composites, the PV factor, lubricant properties, fluid lubricated thrust bearings. Fluid- lubricated journal bearings, oil supply grooves, Wear failure analysis, and industrial preventive maintenance: case studies.

Prerequisite: ME315- ME317

ME469 Fault Diagnoses and Failure Analysis in Mechanical Systems

Function of failure analysis; Techniques of failure analysis; Testing used in failure analysis; Types of failure; Designing against failure; Laboratory experiments; Review of vibration, Instruments: Transducers, FFT Analyzer, Sampling and Aliasing. Vibration problems: Imbalance, Misalignment, Bearings, Gears, Fans, Belts; Techniques and Maintenance Management; Sound; Basic Properties of Waves, Intensity, Power Level; Balancing: Static Unbalance, Dynamic Unbalance and Field Balancing.

Prerequisite: ME213-ME333

ME445 Computer Programming and Applications

Introduction to computer languages and computer hardware, Fundamental of MATLAB programming and basic commands, 2D and 3D graphics. Data manipulation and presentation, model building, application of linear and nonlinear algebraic and differential equations in mechanical engineering systems, numerical solution of optimization problem, virtual prototyping, finite element applications, Computer applications in mechanical engineering fields, case studies.

Prerequisite: CSC001-ME341

ME471 Materials and Process Selection

Introduction and motivation for selection; Interrelation between materials processing and design; Design process; Review of engineering materials and their properties; Materials and process selection charts. Principles of materials and process selection: translation, screening, ranking, and supporting information. Materials selection based on: shape, property, and process; Economics of materials and process selection; Material selection case studies for various engineering applications.

Prerequisite: ME213-ME202

ME472 Advanced Manufacturing Technology

Non-conventional machining: Principles, Ultrasonic machining, Electromechanical Machining, Electro-discharge Machining, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining. Numerical Control of Machine Tools: Automation of Manufacturing Processes, Numerical Control, Coordinate systems, Types and components of CNC systems, Programming for CNC, Adaptive control, Computer Integrated Manufacturing.

Prerequisite: ME202-ME444

ME473 Composite Materials

Classification; Applications; Processing and fabrication of composites (polymer matrix, metal-matrix, ceramic-matrix); resin systems; reinforced systems; fibers and matrices; fibers architecture; elastic deformation; properties; Design Considerations; Laminate structures; honeycomb materials; Stress-strain characteristics of fiber- reinforced materials; Lamination theory; Failure theories of fiber-reinforced materials; environmentally induced stresses in laminates.

Prerequisite: ME213-ME202

ME474 Automation and Production Systems

Introduction to industrial automation; Manufacturing operations; material handling and identification technologies (Material handling, material transport systems, storage systems, and automatic data capture); Manufacturing systems include: single station manufacturing cells, group technology and cellular manufacturing, flexible manufacturing systems, manual assembly lines, transfer lines and similar

automated manufacturing systems, and automated assembly systems.

Prerequisite: ME444-ME202

ME475 Theory of Metal Cutting

Basic concepts and definitions, Tool geometry (definitions, reference planes, geometry of single point tools, twist drills and milling cutters), Tool materials (types and applications), Chip formation (types of chips, built up edge BUE, chip compression ratio, determination of shear angle and shear strain), Mechanics of metal cutting (merchant›s analysis, factors affecting cutting forces), Measurement of the cutting forces, Heat in metal cutting, Tool failure (types and causes), Tool wear and its measurement, Tool life, Taylor›s relationship, Factors affecting tool life, Cutting fluids, Surface roughness and measurements Machining economy (machining cost equation, optimum tool life, optimum machining variables), Machinability (definitions, criteria and indices).

Prerequisite: ME317-ME202

ME476 Engineering Polymers and Ceramics

Introduction to the types of engineering, metals, polymers, ceramics, and composites, engineering polymers, polymer molecules, weight, shape, structure, configurations, polymer crystallinity, types of polymers, thermoplastics , thermoses, elastomers, Polymer Additives, polymer processing methods and properties; Introduction to ceramics and glasses being used as important materials of engineering; Types of ceramics: traditional and engineering ceramics, manufacturing of ceramic components, Structures and properties of ceramics, ceramic structures, crystal structures, imperfection in ceramic, ceramic phase diagrams, heat treating of glass, application and processing in ceramics.

Prerequisite: ME201-ME202

ME477 Plasticity and Metal Forming

3-D state of stress and strain for elastic behavior, Yield criteria, Plastic stress-strain relation. Plane stress and plane strain problems. Determination the flow equation from experiments results, Theory of plasticity. Applications: Instability in thin vessel, thick vessel subjected to internal pressure, and beam under pure bending. Analysis of metal forming process and its techniques of analysis; energy method; slab method, upper bound method. Classification of metal forming processes. Bulk deformation processes. Forging, rolling, extrusion, and rod and wire drawing.

Prerequisite: ME213-ME202

ME478 Corrosion Engineering

Cost of corrosion, Electrochemical principles of corrosion, How to predict the corrosion in industry, Mechanical and metallurgical factors affecting corrosion, Corrosion rate measurements, Polarization, Passivity, Uniform corrosion, Bi-metallic corrosion, Crevice and Pitting corrosion, Inter-granular corrosion, De-alloying, Erosion-corrosion, Stress corrosion cracking and Hydrogen damage, Corrosion-fatigue. Modern electrochemical principles of corrosion: Cathodic protection, Coating; Designing against corrosion.

Prerequisite: ME201-ME213

ME479 Welding Technology

Fusion welding; Weld ability; Selection of welding electrodes; Hot cracking; Cold cracking; Welding

metallurgy; heat affected zone; Welding of heat-treatable alloys. Welding of dissimilar alloys; Destructive and nondestructive testing of welds; Weld thermal cycles and residual stresses; welding in manufacturing: pressure vessels, boilers and ship building industries; welding in automotive maintenance; welding codes.

Prerequisite: ME 202

ME445 Computer Programming and Applications

Introduction to computer languages and computer hardware, Fundamental of MATLAB programming and basic commands, 2D and 3D graphics. Data manipulation and presentation, model building, application of linear and nonlinear algebraic and differential equations in mechanical engineering systems, numerical solution of optimization problem, virtual prototyping, finite element applications, Computer applications in mechanical engineering fields, case studies.

Prerequisite: CSC001-ME341

ME481 Electronic Fundamentals

Introduction to Semiconductors. Diffusion process in semiconductors. Semiconductor doping, electron and hole transportation physics of PN junction. Construction and operation of PN Junction Diode. Open-circuited junction. Forward and reverse biased junction. VI static characteristics. Temperature effects. Small and large-signal models. Junction capacitance and switching times. Diode types and applications. Rectification. Rectifier filters. LED and Photodiode applications. Bipolar Junction Transistors. Transistor ratings. Field-effect Transistor, FET, as a switch and amplifier. Small-signal models. Band theory of semiconductors. Device modeling, analysis of linear single-stage amplifiers.

Prerequisite: ME243-MATH284

ME482 Programmable Logic Controller

The programmable logic controller (PLC) and industrial control, PLC architectures, PLC programming, ladder diagrams, Timers, Counters, Arithmetic functions, Data manipulation, Data communication, Numerical control, Safety measures, Maintenance and fault finding, Applications of PLC in speed control of electrical machines, Applications of PLC in reactive power control of power systems.

Prerequisite: ME316-ME342

ME483 Mechatronics (2)

Foundational concepts in mechatronics including analog and digital electronics, basic concepts of major sensors, applications of microprocessors and microcontrollers for process control. Introduction to sequential logic circuits. Term project on designing an integrated mechatronics system using a combination of hardware and software.

Prerequisite: ME444-ME434

ME484 Engineering Programming

Introduction to computer architecture. Concepts of memory. Input-output units. Introduction to CPU. Introduction to C. Structure of C program. Symbolic Constants. Arrays and Functions. Operators and expressions. Control Flow. Functions and program structure. Pointers; Data structures. Managing memory

in C. Manipulating files, Microprocessor architecture and assembly language, Applications of C and assembly language.

Prerequisite: CSC001-ME341

ME485 Image Sensors and Processing

Overview of imaging sensors and principles including various imaging devices. Measures of imaging quality through point spread function, resolution and spatial sampling. Storage requirements, including image representation, coding and compression techniques, lossy versus lossless. Techniques for reducing noise in images, feature enhancement and recognition. Image enhancement including contrast manipulation, histogram equalization and derivative based operators. Segmentation and thresholding techniques Applications of morphology to image processing including erosion and dilation operations for binary and grey scale images. Filtering and transform techniques for image processing including two dimensional Fourier transforms, wavelets and convolution. Extension topics may include image registration, super-resolution techniques for video processing and object classification using features extracted from images.

Prerequisite: ME434

ME486 Modeling and Simulation in Mechatronics

Modeling of mechanical systems (springs, dampers, rotational or geared systems), Modeling of Electrical systems (RLC and major analog electronic components and devices), Modeling of hydraulic and pneumatic systems, Mathematical modeling and analysis of electro mechanical systems, Introduction to recent simulation software, simulation with real life applications.

Prerequisite: ME316-ME434

ME487 Machine Design Applications in Mechatronics

Introduction to designing mechatronics systems, under static and dynamic loads, Mobility and Gruber Criterion, Kinetics and Kinematics Design, kinematics Inversions, Factors of safety allowances for stress concentration and fatigue. Overview of various systems: Clutches, Brakes, Gear train, welded and riveted joints, balancing of rotating shafts, belt drives.

Prerequisite: ME317-ME444

ME488 Robotics and Industrial Automation

Robotic manipulator includes: classification of robotic systems; transformation of coordinates; kinematics and inverse kinematics; Jacobians and robot dynamics; trajectory generation; modeling; control. Robot programming languages, Topics of Advanced robotics includes wheeled mobile robot; machine vision basics; introduction to air, space and underwater robots; robot plume tracing, mobile robot trajectory generation; robotics in mining; other new robotic developments.

Prerequisite: ME444-ME 341

ME489 Introduction to Intelligent Building Systems

Introduction to intelligent building and building automation, communication, safety and security systems; modeling and control of noise, illumination, mechanical transportation, electrical, electronic, Design of fire protection systems, fire safety subsystems; system integration and optimization with the building envelope; code of practice in design, operational characteristics and

performance specifications.

Prerequisite: ME231-ME444

Industrial Engineering Courses

INEN210 Introduction to Industrial Engineering

An introduction to and overview of the profession, including career planning, professionalism, ethics and teamwork Nature of the Industrial Engineer job, Selected areas of IE such as quality, optimization, productivity, process improvement. Industry site visits, industrial speakers, Case studies from IE applications.

Prerequisite: None

INEN221 Operations Research I

Introducing to Operations Research (OR), Linear programming (LP) model formulation, LP Graphical solution method, Transition from Graphical to Algebraic solution, LP Simplex Method, Artificial starting solution M- method, Artificial starting solution Two- phase method, Dual Simplex Algorithm, Transportation model, Assignment model.

Prerequisite: MATH241

INEN231 Fundamentals of Computer Systems

Fundamentals of computers; hardware, software and computer systems concepts. Introduction to operating systems and data processing. Overview of programming languages. Internet and computer security. Introduction to software packages for Industrial Engineering applications.

Prerequisite: CSC001

INEN214 Fundamentals of Electrical Engineering

Basic electrical concepts: Electrical symbols, Ohm›s Law, Kirchhoff's Law, DC and AC, resistance, inductance, capacitance and three-phase system. Power computation of DC and AC, circuit theorems, Diode & Transistor and its applications, Ohms, concepts of AC and DC machines.

Prerequisite: PHYS205

INEN216 Thermo-Fluid Engineering

Introduction to thermo-fluid sciences: Introduction to modes of heat transfer. One- dimensional heat conduction. Heat transfer from surfaces. Introduction to fluid mechanics. Fluid properties. Fluid statics. Use of control volumes. Internal flows.

Prerequisite: CHEM101 - ENG204

INEN261 Project Management

Principles of industrial management, Principles of industrial system and industrial institutions management, Principles of scientific management and Management functions, Management of Engineering professions, personnel›s management, and industrial organization, Energy and water resource management and raw materials management, Time management and work analysis, Industrial project management, Computer applications in management.

Prerequisite: ENG 214

INEN212 Manufacturing Processes I

Casting technology, sand casting methods, and mold materials and properties, Casting equipment and alloy solidification, Castings defects, inspection methods, and die casting technology, Welding technology, hot and cold forming, Forging processes, Sheet forming and calculations, Rolling and drawing processes, Deep drawing and wire drawing, Hot and cold extrusion, and applications on force and power calculations.

Prerequisite: ENG202 - ME201

INEN301 Production Planning and Control

Basic concepts of Production and Operations Management (POM). Design of products and services. Processes and technologies. Inventory management. Forecasting. Material Requirements Planning (MRP). Introduction to Enterprise Requirement Planning (ERP). Capacity and Aggregate planning. Scheduling.

Prerequisite: INEN221 - INEN261

INEN305 Work Study

History of Methods Design & Work Measurement Methods design. Process analysis. Operation analysis. Introduction to human engineering. Standardization. Work measurement Predetermined motion-time systems. Standard data. Work sampling. Term project.

Prerequisite: MATH383 - INEN210

INEN311 Control Systems

Introduction to dynamic and modeling control systems (open loop and closed control of system). Block diagram and Transformation function, SFG. Time response of systems. System stability. Design and analysis of closed- loop control systems using locus techniques. Control by microprocessors. System characteristics. ID controllers.

Prerequisite: INEN214 - INEN216

INEN320 Engineering Statistics

Review for estimation. Test of hypothesis for single and two samples. Applications of test of hypothesis in engineering. Simple and multiple linear regression, and their applications. Design and analysis of single-factor experiments: analysis of variance. Design of experiments with several factors. Case studies in engineering statistics.

Prerequisite: MATH325

INEN445 Operations Research II

Integer programming – Branch and Bound Algorithm, Integer programming – Cutting Plane Algorithm, Travelling Salesman Problem, Dynamic Programming (DP) –Forward and backward recursion methods, Selected DP applications, Applications in industrial, service and public sector.

Prerequisite: INEN221

INEN302 Computer Applications in Industrial Engineering

Basics of Industrial Engineering and computers, Database environment and data modeling, IDEF0 modeling, IDEF3 modeling, Object oriented modeling, Microsoft Excel, Python programming language

Prerequisite: INEN231

INEN444 Statistical Quality Control

Introduction to quality control and process improvement. Cost of quality and the effects of quality on productivity. Concepts of variation. Statistical process control (SPC tools). Control charts for variables, attributes and their applications in process control. Process capability studies. Acceptance sampling. Introduction to reliability. Case studies in applied quality control.

Prerequisite: INEN320

INEN321 Human Factors Engineering

Study of human response into man-machine systems. Study of visual displays as a medium of input. Auditory and tactual displays. Human control of systems. Control tools and related devices. Applied

anthropometry and workplace design. Physical space arrangement, Environment, Illumination, Atmospheric conditions and noise.

Prerequisite: INEN305

INEN331 Manufacturing Processes II

Introduction to metal cutting and forming principles. Metal cutting processes, metal cutting theories, and chip removal process. Cutting tools and tool geometry, the effect of cutting variables and forces in machining processes, machines classification. Metal turning, drilling, shaping, grinding, milling and gear manufacturing, surface and cylindrical grinding, Conventional machining processes (turning, drilling, shaping, milling, surface and cylindrical grinding, and shaping), Nonconventional machining processes, design and selection of machining processes, Case studies (turning, drilling, milling, shaping, grinding).

Prerequisite: INEN212 - ME213

INEN400 Safety Engineering

Importance of safety, Fundamental concepts and terms related to accidents and safety, Accident investigation, Occupational Safety and Health Act (OSHA), Record Keeping and Reporting, Hazards and their control, System Safety.

Prerequisite: INEN212

INEN350 Summer Training

10 weeks of supervised hands-on work experience at a recognized firm in a capacity, which ensures that the student applies his engineering knowledge and acquires professional experience in his field of study at KAU. The student is required to communicate, clearly and concisely, training details and gained experience both orally and in writing. The student is evaluating based on his abilities to perform professionally, demonstrate technical competence, work efficiently, and to remain business focused, quality oriented, and committed to personal professional development.

Prerequisite: Dep. Approval

INEN522 Facilities Planning and Material Handling

Introduction to Facilities Planning and design. Product, process, and schedule Design. Flow systems, activity relationships, and space requirements. Material handling and storage equipment. Layout Planning Models and design algorithms. Warehousing, and warehouse Operations. Personnel Requirements. Evaluating and selecting the facilities plan.

Prerequisite: INEN301

INEN546 Design and Analysis of Experiments

Introduction to design of experiments and its application in industrial engineering, Hypothesis tests, Fixed effect models, Random effect models, Hybrid models, Block designs, Error analysis, Model building and practical applications.

Prerequisite: INEN320

INEN547 Systems Simulation

Basic principles for building simulation models, Introduction to probability distributions, Simulation systems and software, Random numbers generators and varieties, Data analysis, Simulation models in service and industrial systems, Queuing systems, Queuing systems design and analysis, Steady state equations, performance measures, and service rates, Simulation and analysis techniques, Using Statistica SLAMII, GPSS, AWESIM, Pro-Model.

Prerequisite: INEN445

INEN592 Senior Design Project (1)

Choosing the topic, establishing the project, literature review, preparing for/or preliminary conducting the experiments, collecting the field data and developing the mathematical/ computer model if applicable, writing the first two chapters along with any preliminary findings.

Prerequisite: Dep. Approval

INEN535 Industrial Automation

Basic production concepts, analysis of serial production lines, assembly line balancing, computer numerical control, industrial robots, Piece position (forward and inverse kinematics, sensors and actuators, automated material handling, CNC systems, automated storage and retrieval systems, PLC.

Prerequisite: INEN311

INEN593 Senior Design Project (2)

Continuation of Part-I of the project including: running and finalizing the experimental program or the mathematical/computer model, analyzing the results and findings and drawing the conclusion, writing the complete project report, presenting and defending the project.

Prerequisite: INEN592

INEN523 Supply Chain Management

The course covers the design, planning, and operational control of manufacturing supply chain systems. Models of the supply chain at the strategic, tactical and operational levels examined as well as the incorporation of these models in a variety of decision support systems. Understand the role of transportation and evaluate the different types of transportation. The role of information technology is study in the supply chain context.

Prerequisite: INEN301

INEN527 Maintenance Engineering

Maintenance systems. Maintenance operation and control. Preventive Maintenance: concepts, modeling, and analysis. Maintenance planning and scheduling. Maintenance material control. Computerized Maintenance Management Systems. Replacement studies. Case studies.

Prerequisite: INEN261

INEN548 Total Quality Management

Introduction to TQM, Leadership, Customer satisfaction, Continuous process improvement,

Benchmarking, Quality function deployment, Management Tools, Statistical process control.

Prerequisite: INEN444

INEN526 Lean and Agile Manufacturing

Introduction, Lean manufacturing through waste elimination, Value stream mapping, Concepts, Kaizen in lean manufacturing paradigm, Single minute exchange of die, Pull production through Kanban card systems, One-piece flow production system, Visual management, The fundamental structure of Agile manufacturing paradigm, Implementation of Agile paradigm in moderate and smart organizations.

Prerequisite: INEN301

INEN549 Decision Making and Analysis

Basic theory and methods on individual or group decision making, problem analysis, problem solving and decision making method, decision making meaning, decision problem, decision tree, sensitivity analysis, the information role on decision making, utility concept, preference, group decision making, Borda method, Delphi, NGT, AHP, decision making techniques which can be used to assist the design, improvement and operation of integrated system.

Prerequisite: INEN221

INEN594 Special Topics in Industrial Engineering

In-depth study of relevant Industrial Engineering topics not covered in other courses of the program in order to enhance student's knowledge in the field of Industrial Engineering.

Prerequisite: INEN301 - INEN210

INEN595 Special Topics in Engineering Management

In-depth study of relevant Engineering Management topics not covered in other courses of the program in order to enhance student's knowledge in the field of Engineering Management.

Prerequisite: INEN261

INEN524 Design and Analysis of Production Systems

This course deals with the analysis, planning and control of production system for the optimum design of production system. This course provides the student with an introduction to issues in planning and control of production systems and scheduling techniques used in production environments. Topics include assembly line balancing models, performance measurement, materials requirements planning (MRP), production lot-size, just-in-time (JIT) models and other push v pull control systems, and job shop/flow shop scheduling and sequencing. Other set of programs currently practiced in industry to improve production systems, such as Lean Manufacturing and Six-Sigma, are also covered.

Prerequisite: INEN301

INEN525 Production Economics and Cost Analysis

Importance of cost analysis in engineering. Cost terms and concepts. Cost estimation for decision-making: cost volume-profit analysis, measuring relevant costs and revenues, cost assignment, and activity-based costing. Cost evaluation of engineering alternatives. Case studies.

Prerequisite: ENG214

INEN536 Computer Integrated Manufacturing

Introduction to production systems. Introduction to Material Handling. Storage Systems, Automatic Data Capture, Introduction to Manufacturing Systems, Single Station Manufacturing Cells, Group Technology and Cellular Manufacturing, Manual Assembly Lines, Automated Assembly Lines, Product Design and CAD/CAM in production systems, Process Planning and Concurrent Engineering.

Prerequisite: INEN331