University of Basra

College of Engineering/ Computer Engineering Department

Self-Assessment Report

Computer Engineering Department
College of Engineering,
University of Basra,
Basra, Iraq

2016-2017

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Chapter0: Background

The computer engineering department was established in 1997-1998 to meet the emerging need for skilled computer engineers and to keep abreast of the scientific and technical progress in the world.

Since its inauguration, CoE department adopted a well academic program equal to the computer engineering departments worldwide by focusing on both theoretical and practical integrated aspects of the computer engineering field of study. The practical side of the program equals one third the total teaching process and the curriculums are kept updated.

The undergraduate study at the department is four years in length; from the moment of receiving the freshman year students whose average grades qualify them to join it up till to the graduation of the senior year students where they get their Bachelor of Science degree in computer engineering.

In 2001-2002, the department has established a graduate studies section where admissible graduates have to complete two years of study to get their Master of Science degree in computer engineering.

The computer engineering departments constitutes of:

1. The **chairman** of the department who manages the department's academic and administrative affairs, the **chairman administrative support staff** (chairman's reservist, assistant, and secretary).
2. The **department panel** which includes all of the faculty members of the department whose names is listed in **Table0.1**.

Table0.1: CoE Department Faculty Members

Rank	Full Name
Assist. Professor, PhD	Abbas Abdulameer Jasim Alsankor
Professor, PhD	Abduladhem Abdulkareem Ali
Professor, PhD	Turki Younis Abdullah
Assist. Professor, PhD	Ghaida A. Al-Suhail
Assist. Professor, PhD	Haroutuon Intranik Hairik
Assist. Professor, PhD	Ali Ahmed Abed
Lecturer, PhD	Majid Abdulnabi Alwan Altameemi
Lecturer, PhD	Fatima Kadhum Hasan
Lecturer, PhD	Mohammed Abedali Jodah
Lecturer, PhD	Wasan Abdulrazaq Wali
Lecturer, PhD	Loai Talib Alubaich
Lecturer, PhD	Mus'aab Adel Ali
Lecturer, PhD	Imad Abdulrazzaq Jassim
Lecturer	Abdulkareem Khamees Hasan
Assist. Lecturer	Alaa' Falah Abdulhasan Alibadi
Assist. Lecturer	Ali Esam Hameed Alhadad

Assist. Lecturer	Atheel Kadhum Abdulzahraa
Assist. Lecturer	Dunia Sattar Tahir Aljubori
Assist. Lecturer	Ghasaq Chasib Almayahi
Assist. Lecturer	Intisar Tua'ess Huaidi
Assist. Lecturer	Hasaneen Shakir Hussain
Assist. Lecturer	Ali Mohammed Ahmed
Assist. Lecturer	Hiba Hakim Abdulzahraa
Assist. Lecturer	Israa' Sabri Abdulameer
Assist. Lecturer	Mohaned Hamid Khalaf
Assist. Lecturer	Ali Nabeel Ibraheem
Assist. Lecturer	Mohammed Kati' Audah
Assist. Lecturer	Amjed Ahmed Majeed
Assist. Lecturer	Shafaa Mahdi salih

3. The engineers, technicians, and administrators employees are mentioned in **Table0.2**.

Table0.2: Engineers, Technicians, and administrators in CoE department

Name	Position and Specialty
Hanadi Salah Ahmed	Engineer – Computer Engineering
Fatima Ghanam	Engineer – Computer Engineering
Khalid Ali Abbas Alwan	Engineer – Electrical Engineering
Hanna' Abdulsaid Alwan	Laboratory Assistant
Wafaa' Abdulwahab Hamza	Library Admin.
Ibtisam Mohammed Nimr	Secretary
Nahidah Kadhum Haddal	Service
	Service

4. The department also has several committees, see **Table0.3**.

Table0.3: Departmental Committees

Committee Name
Scientific and Graduate Affairs Committee
Examination Committee
Quality Assurance Committee
Inventory Committee
Gratis Books Committee
Summer Industrial Training Committee
Laboratories Maintenance Committee
Importation Committee

The overall department structure is shown in **Fig.0.1**:

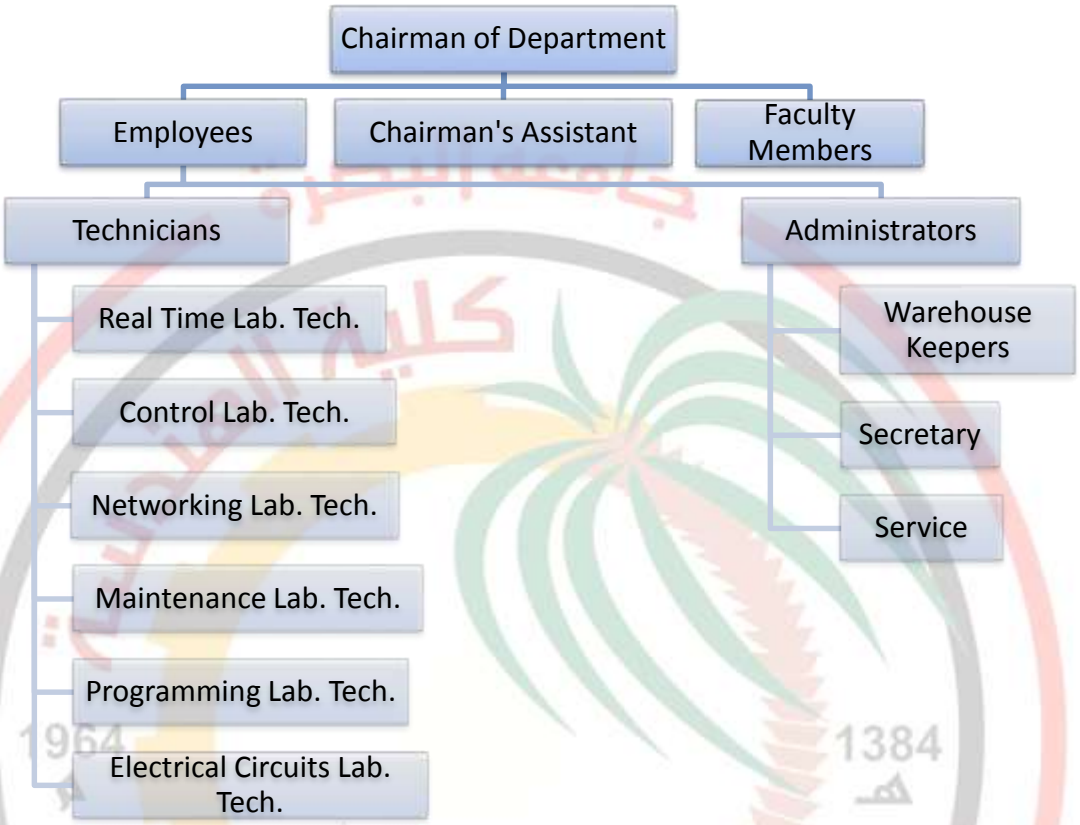


Fig.0.1: Department Structure

Chapter1: Criterion1 (Students)

1.1 Admission Process and Enrollment

Students are admissible to the college of engineering according to a central admission process called (grades comparison) managed by the Iraqi Ministry of Higher Education and Scientific Research / Studies, Planning, and Prosecution Office / Central Admission Department. The accepted students are coming from:

1. High school graduates (scientific disciplines only).
2. Institutions graduates (only who are in top 25% rank).
3. Industrial technical secondary schools (only who are in top 5% rank).
4. Distinguished employees in governmental offices who are originally institutions graduates.

After the names of the accepted students are announced, the registration committee which contains at least ten members including the dean's assistant has only ten days to meet the accepted students and to register them at the college. They are distributed again according to their high school grades on the eight departments in the college (petroleum engineering, architecture engineering, computer engineering, civil engineering, electrical engineering, chemical engineering, mechanical engineering, and materials engineering).

For the computer engineering department, the number of the newly enrolled students has changed through the past six years from 40 to 68 students as seen in **Table1.1**.

Table 1.1: Records of Admissions Standards Applied over the Past 11 Years

Academic Year	Number of New Enrolled Students
2016-2017	68
2015-2016	60
2014-2015	55
2013-2014	50
2012-2013	90
2011-2012	70
2010-2011	61
2009-2010	57
2008-2009	42
2007-2008	43
2006-2007	40

1.2 Evaluating Students' Performance

The students of college of engineering are evaluated using the following means:

1. Daily, monthly, semester, and final exams.
2. Their laboratories reports.
3. Assignments.
4. Senior year project.
5. Summer industrial training reports.

1.3 Advising and Guidance

During the past years, the CoE department as well as the college of engineering had an educational advising scheme where one or two advisors were assigned to give advice to one level of study (1st, 2nd, 3rd, or 4th) year.

Starting from the year 2010-2011, the department and the college has the intention to apply a new scheme of advising with the following steps:

1. In each department, an advising and guidance committee (Chief Departmental Advisor "**CDA**") is formed to be responsible of arranging the work of the advisors, delivering its reports to the chairman of the department, and its recommendations of solving any problems that may face both the advisors and the students.
2. The chairman of the department distributes the students on the selected faculty members (advisors) such as each advisor is assigned a number of advisees. Each month the advisor meets her/his assigned advisees according to a pre-scheduled appointments.
3. Each advisor delivers her/his monthly report (**Appendix A** contains the proposed advisor report form) to the advising and supervision committee which in turn sends it to the chairman.
4. These appointments can be classified as:
    a. Evaluation meeting: assess the student's readiness and abilities and accordingly determine the best advising approach to follow.
    b. Diagnostic meeting: usually is used to make tests and answering questions to reach an accurate diagnosis in order to lay out the work plan of advising.
    c. Guidance/Treatment meeting: where the treatment is applied according to the plan set in the previous meeting. This treatment depends a lot on the skills and abilities of the advisor.

1.4 Graduation Requirements

In the CoE department, the student has to complete 160 credit hours in order to get his Bachelor of Science degree; these credit hours are divided through her/his four years of study as:

For the 1st year:
1. 21/37 credits (56.75%) are of Computer Engineering courses requirements.
2. 12/37 credits (32.43%) are of College courses requirements.
3. 4/37 credits (10.82%) are of university courses requirements.

For the 2nd year:
1. 30/40 credits (75%) are of Computer Engineering courses requirements.
2. 6/40 credits (15%) are of College courses requirements.
3. 4/40 credits (10%) are of university courses requirements.

For the 3rd year:
1. 36/40 credits (90%) are of Computer Engineering courses requirements.
2. 4/40 credits (10%) are of College courses requirements.
3. 0/40 credits (0%) are of university courses requirements.

For the 4th year:
1. 39/43 credits (90.69%) are of Computer Engineering courses requirements.
2. 2/43 credits (9.31%) are of College courses requirements.
3. 0/43 credits (0%) are of university courses requirements.

Overall percentile during four years:
1. 128/160 credits (80%) are of Computer Engineering courses requirements.
2. 24/160 credits (15%) are of College courses requirements.
3. 8/160 credits (5%) are of university courses requirements.

Table1.2 shows the records, over the past five academic years, of the total number of full time students enrolled in the program and the corresponding number of graduates each year.

Table 1.4: Total enrollment and graduates trends for the past six years

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Full-time students	230	250	230	203	176	186
Graduates	37	45	42	45	37	21

1.5 Transfer Students

Each year, the Iraqi Ministry of Higher Education and Scientific Research issues the regulations of transferring succeeded students from/to all colleges and universities in Iraq. It also issues the nomination's modifications for the deferred and failed students. The college of engineering carries out the ministry instructions using a form given by the ministry plus other needed documents. The Students Affairs Department at the University of Basrah keeps following the transferring process that happens during summer holidays, i.e., July – August.

Each transferred student undergoes what is called the scientific reprise executed by the department if the curriculum and credit hours of the two colleges are similar in more than 80%. **Table1.5** shows the numbers of the transferred students from/to the department over the past five years.

Table1.2: The number of students transferred from/to the department over the last five years

Academic Year	Number of Transferred Students	
	From the department	To the department
2016-2017	0	0
2015-2016	0	1
2014-2015	0	1
2013-2014	0	0
2012-2013	0	4
2011-2012	0	4
2010-2011	4	1
2009-2010	3	0
2008-2009	2	2
2007-2008	0	0
2006-2007	0	3

Chapter2: Criterion2 (Program Educational Objectives)

Program educational objectives (PEOs) are defined by ABET as "broad statements that describe the career and professional accomplishments that the Program is preparing graduates to achieve." Current ABET Engineering Criteria requires that: "Each program for which an institution seeks accreditation must have in place:

A. Published educational objectives that are consistent with the mission of the institution.
B. A process that periodically documents and demonstrates that the objectives are based on the needs of the program's various constituencies.
C. An assessment and evaluation process that periodically documents and demonstrates the degree to which these objectives are attained.

Vision of the Department

CoE Department will be ranked in top of CoE departments in Iraq and worldwide in teaching, scientific research, and community service.

Mission of the Department

Within the context of the college of engineering goals and to keep abreast of the computer engineering field progress, the CoE department wants to meet the emerging need to the specialized computer engineers who are capable of doing researches in scientific sciences related to computers in a way that enables the government and private section agencies to solve the problems they face.

2.1 Strategic Objectives of the Department

The Program Educational Objectives (**PEOs**) clearly reflect the professional expectations from the graduates of the computer engineering department and prepare them to meet that challenge. Table2.1 shows the CoE department PEOs.

Table2.1: Program Education Objectives

PEO1	Graduates will be engaged in computer engineering related careers that could serve the needs of both industry and academia, in private and public sectors, as well. They will adapt to the rapidly changing work environment and attain leadership positions in their business, profession, and community.
PEO2	Graduates must have the pursuit of knowledge and active, continuous and lifelong professional development through the continuous reading of up to date scientific researches, the engagement in the further/continual education courses, and admission to graduate studies.
PEO3	Graduates will contribute to the welfare of society and the development of their profession, through responsible practice of engineering.

2.2 Consistency of the PEOs with the College Educational Objectives (CEOs)

The PEOs of the computer engineering department are coherent and in flow with those of the college of engineering. They are stated in accordance with the College Educational Objectives (**CEOs**), mentioned in **Table2.2**, while preserving the unique characteristics of the department of computer engineering.

Table2.2: College Education Objectives

CEO1	Prepare globally competent and socially responsible graduates who are specialists in engineering sciences and their applications by providing quality education.
CEO2	Encourage and support the higher degree graduate studies (master and doctorate) in all college departments.
CEO3	Foster research and scholarly endeavors that advance knowledge and help in solving the industrial and social problems.
CEO4	Contribute to the welfare of the country by establishing effective partnerships that can add value and contribute to college programs.
CEO5	Create an enriching supportive working environment for the college community to ensure the achievements of the college objectives.

Table2.3 establishes the links between the PEOs of the department and the major components of the CEOs of both the college of engineering.

Table2.3: Links between the PEOs of the Department and the CEOs of the College

		Program Educational Objectives (PEOs)		
		PEO1	**PEO2**	**PEO3**
College of Engineering Objectives (CEOs)	**CEO1**	**X**	**X**	**X**
	CEO2		**X**	
	CEO3	**X**	**X**	**X**
	CEO4	**X**	**X**	**X**
	CEO5	**X**	**X**	

Chapter3: Criterion3 (Program Outcomes)

The main objective of the program outcomes, POs, and program Educational Objectives, PEOs, is to measure the level of achievement of the curricular requirement of the department in preparing the graduates to meet the challenges presented to them by the fascinating computer industry. In other words, computer engineering Program outcomes, POs, and Program Educational Objectives, PEOs, are two different, but interrelated mechanisms that were developed in order to measure the level of achievement and success of the program.

3.1 ABET Program Outcomes

Program outcomes are defined by ABET as:

"Narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program."

The CoE department has developed ten Program Outcomes (POs) as an initial set of POs. These outcomes are, in effect, what the students expected to know and achieve post graduation. **Table3.1** shows these program outcomes.

Table3.1: Computer Engineering Program Outcomes

Symbol	Description
a	**PO1:** ability to apply knowledge of mathematics, science, and engineering fundamentals.
b	**PO2:** ability to outline and conduct experiments as well as analyze and interpret data.
c	**PO3:** ability to design an integrated system and its various components and processes, within realistic economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
d	**PO4:** ability to function on multi-disciplinary teams to analyze and solve problems.
e	**PO5:** ability to identify, evaluate and solve engineering problems.
f	**PO6:** understanding of the responsibility of engineers to practice in a professional and ethical manner at all times.
g	**PO7:** ability to communicate effectively using oral, written, and graphic forms.
h	**PO8:** the broad education necessary to understand the potential impact of engineering solutions on society and the environment.
i	**PO9:** understanding of the need for up-to-date engineering tools and other knowledge acquired through life-long learning.
j	**PO10:** knowledge of contemporary issues related to engineering.
k	**PO11:** ability to use modern engineering tools, skills and design techniques necessary for the practice of engineering.

3.2 Relationship of the Program Outcomes to the PEOs

Mapping between the Program Outcomes and the Program Educational Objectives is shown in **Table3.2**.

Table3.2: Mapping of Program Outcomes to PEOs

	PEOs		
POs	**PEO1**	**PEO2**	**PEO3**
PO-a	X		
PO-b	X		
PO-c	X	X	X
PO-d	X	X	X
PO-e	X	X	
PO-f	X		X
PO-g	X	X	
PO-h	X	X	X
PO-i	X	X	
PO-j	X	X	
PO-k	X	X	X

Chapter4: Criterion4 (Continuous Improvement)

The college of engineering has created the Accreditation and Quality Assurance Office **(AQAO)** to monitor and qualify the college educational system in accordance with ABET requirements. The main responsibilities of this office are:

1. Introducing technical and academic support to all of the college departments.
2. Preparing time tables for departments to complete their needed actions in accordance with ABET requirements.
3. Establishing and executing training programs and workshops about the process of assessing and designing the curriculum in predetermined dates during the academic year.
4. Receiving the curriculum folders from the departments; after revision the section sends a feedback to the college dean and departments' chairmen with the strengths and weaknesses of their educational process.
5. This section is the active communicating mean which connects the college with the quality assurance department at the University of Basrah.

The programs at the college of engineering have been carefully designed to provide the graduates with the important tools they need in their future industrial and governmental careers. To measure the level of success in achieving any of the program outcomes, six assessment methods are to be used. It has decided to adopt a uniform metric goal of 3.50(70%), in a scale of (1-5) to be used, in all the program assessment tools. The program will be a success, if a program outcome meets the criteria in five assessment tools out of six assessment tools, and no correcting measure will be taken. Corrective measures will be taken if any of the outcomes failed to meet its metric goal in two or more assessment tools. **Table4.1** summarizes the used assessment tools.

Table4.1: Assessment Tools, Indices, and Assessment Benchmark

Assessment Method	Indices	Assessment Benchmark
Senior Exit Survey (POs)	Scale of 1 to 5	A score of 3.5
Faculty Assessment (POs)	Scale of 1 to 5	A score of 3.5
Alumni Survey (PEOs)	Scale of 1 to 5	A score of 3.5
Employer Survey (PEOs)	Scale of 1 to 5	A score of 3.5
Evaluation of Senior Project by faculty (POs)	Scale of 1 to 5	A score of 3.5
Evaluation of Senior project by Industry expert (POs)	Scale of 1 to 5	A score of 3.5
Evaluation of Students' Industrial Training by Industry Supervisor (POs)	Scale of 1 to 5	A score of 3.5

It is worth noting that the alumni and employer surveys are only used in improving the PEOs while the other mentioned tools are used in the continuous improvement of the POs. **Table4.2** shows the consistency between POs and assessment tools. **Appendices B-G** contains survey forms for these assessment tools.

Tabe4.2: Mapping of POs to Assessment Tools

Program Outcomes	Assessment Tools					
	Direct Assessment by Faculty	Senior Exit Survey	Alumni Survey	Evaluation of Senior Project by Industry Expert	Faculty Assessment of Senior Project	Industrial Training Assessment
PO-a	X	X	X	X	X	
PO-b	X	X	X	X	X	
PO-c	X	X	X	X	X	
PO-d	X	X	X	X	X	
PO-e	X	X	X	X	X	X
PO-f	X	X	X	X	X	X
PO-g	X	X	X			X
PO-h	X	X	X		X	X
PO-i	X	X	X	X	X	X
PO-j	X	X	X	X	X	X
PO-k	X	X	X	X	X	X

4.1 Planning for Development and Review of the PEOs & POs

One of the main processes, which are used to establish the various Programs' Education Objectives and Program Outcomes in the college, is to seek inputs from key constituencies through questionnaire form distributed on them at specific time tables. The objectives of the surveys are:

- To assess the quality of graduating students.
- To obtain feedback on the Program outcomes.
- To obtain feedback on the Program Educational Objectives.
- To assess the work environment.
- To assess the overall institutional quality.
- To establish baseline data.

Key constituencies that participate in reviewing the program PEOs and POs are:

- Faculty.
- Alumni.
- Employers.
- Senior Exit Students.

The following steps summarize the input to be obtained from these key constituencies. The Accreditation and Quality Assurance office schedules the process as in **Table4.3**.

Table4.3: Assessment Process and Timeline

No.	Constituency	Assessment Tools	Timeline
1,2	**Faculty**	Faculty Survey Class Evaluation	every year every semester
3	**Alumni**	Alumni Survey	every year
4	**Employers**	Employer Survey	every year
5	**Students**	Senior Exit Survey	every year

1. Faculty Survey

The survey form contains three parts covering different aspects that the College of Engineering consider important for faculty members to assess.

PART I

It has four sections that seek the faculty members' evaluation of students regarding the Program Outcomes, Program Educational Objectives, their opinions about the three most

important skills that need more emphasis, and finally an open ended question about what should be done to improve engineering education at Basrah University.

PART II

Also, it has four parts; the first three sections assess the level of satisfaction and the quality of services, facilities, and work environment/benefits at the department, college, and university Levels. The fourth section assesses the time management of activities of the faculty members.

PART III

It is about the assessment of overall institutional quality.

2. Class Evaluation Survey

All instructors at the college should carry out course assessment and submit a course assessment file to their departmental assessment coordinators at the end of the term.

3. Alumni Survey

Alumni are important constituent group and should be involved in the evaluation process. Survey of the graduates who are pursuing graduate study locally or abroad can be obtained by inviting them to an annual meeting at the college and/or e-mailing them the survey. Selected alumni from the industry could also be consulted;

4. Employers Survey

A survey form could be sent to selective employers for their comments. The results of the employer survey which is distributed every year will be used by including questions about the PEOs and POs for each engineering program at the college. Also, many of our capstone design courses involve student presentations before a panel of professionals who also represent employers. We can plan to survey these professionals when they visit the department.

5. Senior Exit Survey

They are our most important constituent group. The response from students will formally be discussed and addressed with the faculty during their evaluation process. In general, the students' input is considered during the annual departmental assessment meeting and at regular faculty meeting:

- Seminar will be offered on September to inform all students about ABET process and importance of the evaluation of PEOs.
- Survey of student forms consists of at least 6 junior and senior students, who maintained a reasonable GPA, selected by faculty advisors, student committee or other means. This could be an initiation of student council for each program.
- Survey of graduating students who are taking senior project course.

The Program Educational Objectives (PEOs) documents that will be provided to ABET evaluators are:

Short-term outcomes

To be prepared by the end of second semester

1. "Program Educational Objectives"

The purpose of this document is to state the objectives and then to explain them. It should include:

a. A list of the PEOs.
b. A detailed discussion of the objectives, showing how each one is consistent, where it is appropriate, with the mission of the institution, the needs of key constituencies, and with the spirit of continual improvement desired in the EC 2000 criteria.
c. A description of the relationship between the objectives and the program's curriculum and other relevant EC 2000 criteria.

2."Establishing Program Educational Objectives"

The purpose of this document is to describe the process created for establishing the PEOs. It should emphasize the degree of involvement of the key constituencies and the role of the institutional mission in the process. It may include appropriate portions of the process log as an appendix. This document must include:

a. A list of the key program constituencies.
b. A discussion of how and why those constituencies were identified as key to the process of establishing objectives.
c. A delineation of the way individuals or groups were chosen to represent the key constituencies, how and why they were selected.
d. A description of the initial plan for establishing the objectives and how you arrived at that plan.
e. A detailed outline of the process you followed.

Long Term Outcomes

To be prepared at the end and before the ABET visit

1. "A Process for Periodic Review of Educational Program Objectives"

The purpose of this document is to show that a thorough and realistic procedure is in place and allows to review, in consultation with key constituencies, the extent to which the programs are achieving the objectives and also to review the objectives themselves, all of which leads to a more effective and responsive program. This document should include:

a. A formal outline for the review procedure: assessment cycles, kinds of information to be used for evaluation, how key constituencies will be involved in the review, how the results of the review will be used to improve the effectiveness of the program and/or revise the objectives.
b. Reports for each of the review cycles detailing the particular process undertaken, the results of the review, the recommendations for any changes in the program or changes in the PEOs, and the process of implementing the changes.

2. "A System for Continual Improvement"

The purpose of this document is to demonstrate that the various parts of any program contribute to the goal of continual improvement of the whole program. the whole system should be describe, the parts of it that influence the PEOs, the parts that work together to attain those objectives, and the processes by which various reviews and assessments drive the system toward continual improvement. This document should include:

a. A description of the program as a system. Using the PEOs as the core of the description, showing how all the parts of the system are related to them. Some parts, such as the institutional mission and the needs of the key constituents, serve to influence the creation of the objectives. Other parts, such as the curricular outcomes and the faculty and the facilities, serve as the instruments by which the objectives will be achieved. What is important to note, though, is that the objectives provide the crucial link between, say, the mission of the institution and the mission of the department. The description, then, will consist of a graphical and verbal rendering of this system, showing how its parts are strategically and integrally related to its whole.
b. A description of the system as a means of leading toward continual improvement of the program. The part will focus on the way the various reports and assessments have been used to unite all the parts of the system in the general improvement of the whole. It will summarize the reviews in place, the results of these reviews, and the role that the results have played in making the program better, particularly in terms of the PEOs.

Chapter5: Criterion5(Curriculum & Syllabus Description)

1. Introduction

1.1 Overview of Department of Computer Engineering

The computer engineering department was established in 1997-1998 to meet the emerging need for skilled computer engineers and to keep abreast of the scientific and technical progress in the world.

Since its inauguration, CoE department adopted a well academic program equal to the computer engineering departments worldwide by focusing on both theoretical and practical integrated aspects of the computer engineering field of study. The practical side of the program equals one third the total teaching process and the curriculums are kept updated.

The undergraduate study at the department is four years in length; from the moment of receiving the freshman year students whose average grades qualify them to join it up till to the graduation of the senior year students where they get their Bachelor of Science degree in computer engineering.

1.2 Program Educational Objective

The curriculum requirements specify subject areas appropriate to Computer Engineering (CoE). The professional component must include:

1. A combination of mathematics and basic sciences general education component (some with experimental experience) appropriate to the discipline.
2. Computer Engineering topics, consisting of Computer Engineering sciences and engineering design appropriate to the computer utilization study.
3. A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.
4. These **requirements** are reporting in "The Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering. A report of Computing Curricula IEEE Computer Society CE-2004 and its updates (2010, 2012, 2014)". The Computer Engineering Task Force has sought to assemble a modern curriculum by first defining the primary disciplines that make up the body of knowledge for computer engineering. Some of these discipline areas contain material that should be part of all computer engineering

curricula. These are the 18 knowledge areas, including two covering related mathematics topics, listed in Table 1.1

Table 1.1 The Computer Engineering Body of Knowledge

Computer Engineering Knowledge Areas and Units	
CE-ALG Algorithms [30 core hours] CE-ALG0 History and overview [1] *CE-ALG1 Basic algorithmic analysis [4] *CE-ALG2 Algorithmic strategies [8] *CE-ALG3 Computing algorithms [12] *CE-ALG4 Distributed algorithms [3] *CE-ALG5 Algorithmic complexity [2] *CE-ALG6 Basic computability theory	**CE-CAO Computer Architecture and Organization** [63 core hours] CE-CAO0 History and overview [1] CE-CAO1 Fundamentals of computer architecture [10] CE-CAO2 Computer arithmetic [3] CE-CAO3 Memory system organization and architecture [8] CE-CAO4 Interfacing and communication [10] CE-CAO5 Device subsystems [5] CE-CAO6 Processor systems design [10] CE-CAO7 Organization of the CPU [10] CE-CAO8 Performance [3] CE-CAO9 Distributed system models [3] CE-CAO10 Performance enhancements
CE-CSE Computer Systems Engineering [18 core hours] CE-CSE0 History and overview [1] CE-CSE1 Life cycle [2] CE-CSE2 Requirements analysis and elicitation [2] CE-CSE3 Specification [2] CE-CSE4 Architectural design [3] CE-CSE5 Testing [2] CE-CSE6 Maintenance [2] CE-CSE7 Project management [2] CE-CSE8 Concurrent (hardware/software) design [2] CE-CSE9 Implementation CE-CSE10 Specialized systems CE-CSE11 Reliability and fault tolerance	**CE-CSG Circuits and Signals** [43 core hours] CE-CSG0 History and overview [1] CE-CSG1 Electrical Quantities [3] CE-CSG2 Resistive Circuits and Networks [9] CE-CSG3 Reactive Circuits and Networks [12] CE-CSG4 Frequency Response [9] CE-CSG5 Sinusoidal Analysis [6] CE-CSG6 Convolution [3] CE-CSG7 Fourier Analysis CE-CSG8 Filters CE-CSG9 Laplace Transforms
CE-DBS Database Systems [5 core hours] CE-DBS0 History and overview [1] *CE-DBS1 Database systems [2] *CE-DBS2 Data modeling [2] *CE-DBS3 Relational databases *CE-DBS4 Database query languages *CE-DBS5 Relational database design *CE-DBS6 Transaction processing *CE-DBS7 Distributed databases *CE-DBS8 Physical database design	**CE-DIG Digital Logic** [57 core hours] CE-DIG0 History and overview [1] CE-DIG1 Switching theory [6] CE-DIG2 Combinational logic circuits [4] CE-DIG3 Modular design of combinational circuits [6] CE-DIG4 Memory elements [3] CE-DIG5 Sequential logic circuits [10] CE-DIG6 Digital systems design [12] CE-DIG7 Modeling and simulation [5] CE-DIG8 Formal verification [5] CE-DIG9 Fault models and testing [5] CE-DIG10 Design for testability
CE-DSP Digital Signal Processing [17 core hours] CE-DSP0 History and overview [1] CE-DSP1 Theories and concepts [3] CE-DSP2 Digital spectra analysis [1] CE-DSP3 Discrete Fourier transform [7] CE-DSP4 Sampling [2] CE-DSP5 Transforms [2] CE-DSP6 Digital filters [1] CE-DSP7 Discrete time signals CE-DSP8 Window functions	**CE-ELE Electronics** [40 core hours] CE-ELE0 History and overview [1] CE-ELE1 Electronic properties of materials [3] CE-ELE2 Diodes and diode circuits [5] CE-ELE3 MOS transistors and biasing [3] CE-ELE4 MOS logic families [7] CE-ELE5 Bipolar transistors and logic families [4] CE-ELE6 Design parameters and issues [4] CE-ELE7 Storage elements [3] CE-ELE8 Interfacing logic families and standard buses [3]

CE-DSP9 Convolution CE-DSP10 Audio processing CE-DSP11 Image processing	CE-ELE9 Operational amplifiers [4] CE-ELE10 Circuit modeling and simulation [3] CE-ELE11 Data conversion circuits CE-ELE12 Electronic voltage and current sources CE-ELE13 Amplifier design CE-ELE14 Integrated circuit building blocks
CE-ESY Embedded Systems [20 core hours] CE-ESY0 History and overview [1] CE-ESY1 Embedded microcontrollers [6] CE-ESY2 Embedded programs [3] CE-ESY3 Real-time operating systems [3] CE-ESY4 Low-power computing [2] CE-ESY5 Reliable system design [2] CE-ESY6 Design methodologies [3] CE-ESY7 Tool support CE-ESY8 Embedded multiprocessors CE-ESY9 Networked embedded systems CE-ESY10 Interfacing and mixed-signal systems	**CE-HCI Human-Computer Interaction** [8 core hours] CE-HCI0 History and overview [1] *CE-HCI1 Foundations of human-computer interaction [2] *CE-HCI2 Graphical user interface [2] *CE-HCI3 I/O technologies [1] *CE-HCI4 Intelligent systems [2] *CE-HCI5 Human-centered software evaluation *CE-HCI6 Human-centered software development *CE-HCI7 Interactive graphical user-interface design *CE-HCI8 Graphical user-interface programming *CE-HCI9 Graphics and visualization *CE-HCI10 Multimedia systems
CE-NWK Computer Networks [21 core hours] CE-NWK0 History and overview [1] CE-NWK1 Communications network architecture [3] CE-NWK2 Communications network protocols [4] CE-NWK3 Local and wide area networks [4] CE-NWK4 Client-server computing [3] CE-NWK5 Data security and integrity [4] CE-NWK6 Wireless and mobile computing [2] CE-NWK7 Performance evaluation CE-NWK8 Data communications CE-NWK9 Network management CE-NWK10 Compression and decompression	**CE-OPS Operating Systems** [20 core hours] CE-OPS0 History and overview [1] *CE-OPS1 Design principles [5] *CE-OPS2 Concurrency [6] *CE-OPS3 Scheduling and dispatch [3] *CE-OPS4 Memory management [5] *CE-OPS5 Device management *CE-OPS6 Security and protection *CE-OPS7 File systems *CE-OPS8 System performance evaluation
CE-PRF Programming Fundamentals [39 core hours] CE-PRF0 History and overview [1] *CE-PRF1 Programming Paradigms [5] *CE-PRF2 Programming constructs [7] *CE-PRF3 Algorithms and problem-solving [8] *CE-PRF4 Data structures [13] *CE-PRF5 Recursion [5] *CE-PRF6 Object-oriented programming *CE-PRF7 Event-driven and concurrent programming *CE-PRF8 Using APIs	**CE-SPR Social and Professional Issues** [16 core hours] CE-SPR0 History and overview [1] *CE-SPR1 Public policy [2] *CE-SPR2 Methods and tools of analysis [2] *CE-SPR3 Professional and ethical responsibilities [2] *CE-SPR4 Risks and liabilities [2] *CE-SPR5 Intellectual property [2] *CE-SPR6 Privacy and civil liberties [2] *CE-SPR7 Computer crime [1] *CE-SPR8 Economic issues in computing [2] *CE-SPR9 Philosophical frameworks
CE-SWE Software Engineering [13 core hours] CE-SWE0 History and overview [1] *CE-SWE1 Software processes [2] *CE-SWE2 Software requirements and specifications [2] *CE-SWE3 Software design [2] *CE-SWE4 Software testing and validation [2] *CE-SWE5 Software evolution [2] *CE-SWE6 Software tools and environments [2] *CE-SWE7 Language translation *CE-SWE8 Software project management *CE-SWE9 Software fault tolerance	**CE-VLS VLSI Design and Fabrication** [10 core hours] CE-VLS0 History and overview [1] CE-VLS1 Electronic properties of materials [2] CE-VLS2 Function of the basic inverter structure [3] CE-VLS3 Combinational logic structures [1] CE-VLS4 Sequential logic structures [1] CE-VLS5 Semiconductor memories and array structures [2] CE-VLS6 Chip input/output circuits CE-VLS7 Processing and layout CE-VLS8 Circuit characterization and performance CE-VLS9 Alternative circuit structures/low power design CE-VLS10 Semi-custom design technologies CE-VLS11 ASIC design methodology

Mathematics Knowledge Areas and Units	
CE-DSC Discrete Structures [33 core hours] CE-DSC0 History and overview [1]	**CE-PRS Probability and Statistics** [33 core hours] CE-PRS0 History and overview [1]

*CE-DSC1 Functions, relations, and sets [6] *CE-DSC2 Basic logic [10] *CE-DSC3 Proof techniques [6] *CE-DSC4 Basics of counting [4] *CE-DSC5 Graphs and trees [4] *CE-DSC6 Recursion [2]	CE-PRS1 Discrete probability [6] CE-PRS2 Continuous probability [6] CE-PRS3 Expectation [4] CE-PRS4 Stochastic Processes [6] CE-PRS5 Sampling distributions [4] CE-PRS6 Estimation [4] CE-PRS7 Hypothesis tests [2] CE-PRS8 Correlation and regression

* Consult the CC2001 Report [ACM/IEEECS, 2001] for more detail on these knowledge

1.3 ABET Program Outcomes

Program outcomes are defined by ABET as:

"Narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program."

The Computer Engineering department has developed eleven Program Outcomes (POs). These outcomes are, in effect, what the students expected to know and achieve post-graduation. **Table1.2** shows these program outcomes.

Table 1.2: Computer Engineering Program Outcomes

Symbol	Description
a	**PO1:** ability to apply knowledge of mathematics, science, and engineering fundamentals.
b	**PO2:** ability to outline and conduct experiments as well as analyze and interpret data.
c	**PO3:** ability to design an integrated system and its various components and processes, within realistic economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
d	**PO4:** ability to function on multi-disciplinary teams to analyze and solve problems.
e	**PO5:** ability to identify, evaluate and solve engineering problems.
f	**PO6:** understanding of the responsibility of engineers to practice in a professional and ethical manner at all times.
g	**PO7:** ability to communicate effectively using oral, written, and graphic forms.
h	**PO8:** the broad education necessary to understand the potential impact of engineering solutions on society and the environment.
i	**PO9:** understanding of the need for up-to-date engineering tools and other knowledge acquired through life-long learning.
j	**PO10:** knowledge of contemporary issues related to engineering.
k	**PO11:** ability to use modern engineering tools, skills and design techniques necessary for the practice of engineering.

1.4 University Linkage Program "Oklahoma State University"

The Computer Engineering Department had linkage program with Oklahoma State University OSU 2010-2013. The proposed curricula have some disappointed:-

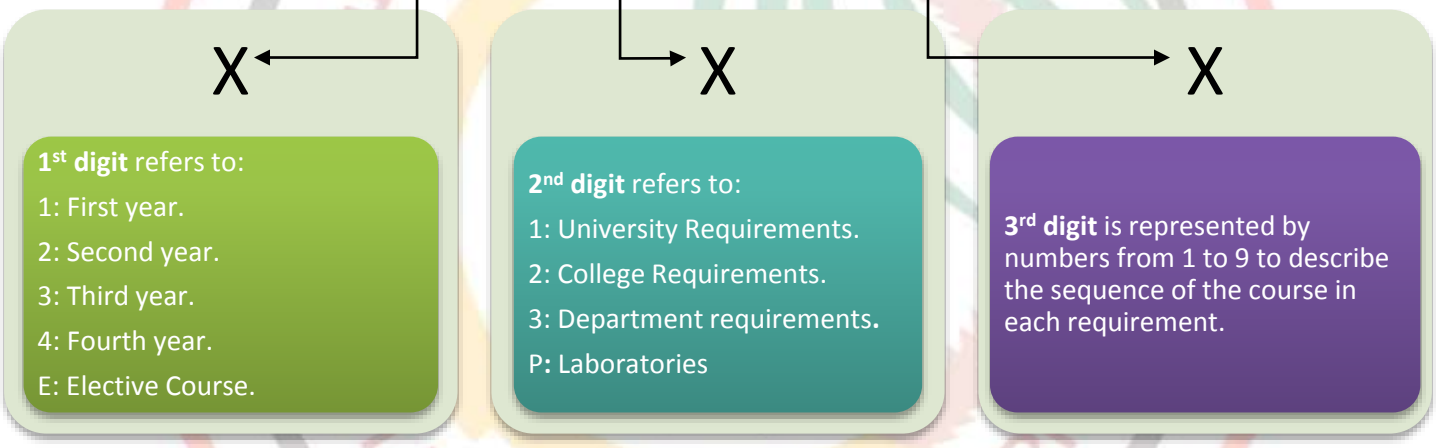
1. Redundancy in some curriculum titles.
2. The lack of an accurate description of some of the vocabulary curriculum.
3. OSU suggested curriculum do not cover the requirements for granting a Iraqi B.Sc. degree; like number of courses per semester, number of units and hours per week, and the ratio of practical hours to theoretical hours.

2. The Proposed Curricular/Course Description

In computer engineering department, each curricular is described by:

1. Curricular/Course Number and Title: each course is coded as:

Course Number = CoE + X X X (3 Digits Number)



For example: **CoE432 Computer Network** means that this is a computer engineering department course that is given to the **fourth year**; it is the **second course** within the **department requirement** courses.

2. Required or elective: whether it is required course for the program or an elective one.
3. Course description: defines what the course is designed for and why it is given to the students.
4. Prerequisites (if any): these have been established to assure an adequate and uniform background for students in advanced classes.
5. Course Topics: detailed syllabi of the course.

3. Graduation Requirements

To graduate, students have to complete 157 credit hours during her/his four years study

Table 3.1: Summary of Requirements "Iraqi description"

Total CoE Requirements: 157 credit hours / 56 courses		
Requirements	**Credit-hours "Units"**	**Total hours**
University Requirements	15	225
College Requirements	29	555
Department Requirements	113	2340
Total	**157**	**3120**

Table 3.2: Summary of Requirements "Iraqi description as sciences"

Total CoE Requirements: 157credit hours / 56 courses	
Requirements	**Credit-hours "Units"**
Humanities and Social Sciences CoE 112, CoE 114, CoE 212, CoE 422	8
Mathematics and Basic Sciences CoE 121, CoE 122, CoE 221, CoE 222, CoE 223, CoE 231, CoE 321, CoE 111, CoE 113, CoE 211	28
Computer Engineering Other courses	121
Total	**157**

Table 3.3: Summary of Requirements "IEEE CE2004 description"

Total CoE Requirements: 157credit hours / 56 courses	
Topics	**Credit-hours**
Mathematics	19
Basic Science (Physics, Chemistry)	9
English, humanities and social sciences	8
Required computer science	9
Required computer engineering	94
Elective computer engineering	9
Other engineering courses	9
Total **Credit Hours for Computer Engineering Program**	**157**

3.1 University Requirements:

Subject Code	*Subject*	*Units Credit-hours*	*Weekly hours*		
			Th.	*Prac.*	*Tut.*
CoE 111	General Chemistry	3	3		
CoE 112	English Language I	2	2		
CoE 114	English Language II/ Technical Writing	2	2		
CoE 113	Basic Physics	3	3		
CoE 211	Electronic Device Physics	3	3		
CoE 212	Human Rights, Democracy & Freedom	2	2		
Total		*15*	*15*	*0*	*0*
			15		

3.2 College Requirements:

Subject Code	*Subject*	*Units*	*Weekly hours*		
			Th.	*Prac.*	*Tut.*
CoE 121	Calculus I	3	3		1
CoE 122	Calculus II	3	3		1
CoE 123	Engineering Design / Auto CAD	3	2	2	
CoE 221	Calculus III	3	3		1
CoE 222	Differential Equations	3	3		1
CoE 223	Probability and Statistics	2	2		1
CoE 321	Linear Algebra	3	3		
CoE 322	Engineering Economics	2	2		
CoE 323	Random Signals & Systems	3	3		1
CoE 421	Ethics, Society, Profession	2	2		
CoE 422	Project management	2	2		1
Total		*29*	*28*	*2*	*7*
			37		

3.3 Department Requirements:

Subject Code	*Subject Title*	*Units*	*Weekly hours*		
			Th.	*Prac.*	*Tut.*
CoE 131	Electric Circuits	3	3		1
CoE 132	Programming & Prob. Solving	3	3		1
CoE 133	Fundamentals of Logic systems	2	2		1
CoE 1P1	Lab1(Programming+ Electrical Circuits)	3		6	
CoE 134	Digital Logic Circuits	2	2		1
CoE 135	Object Oriented Programming and Data Structure	3	3		1
CoE 1P2	Lab2(OOP + Digital Logic)	3		6	
CoE 231	Discrete Structures	2	2		1
CoE 232	Signals & Systems	3	3		1
CoE 233	Digital System Design	3	3		1
CoE 2P1	Lab3(Digital System Design+ Device Physics)	3		6	
CoE 234	Computer Organization	3	3		
CoE 235	Algorithms	3	3		
CoE 236	Digital Electronics	3	3		1
CoE 237	Instrumentation	3	3		
CoE 2P2	Lab4(Computer Organization+ Algorithms)	3		6	
CoE 331	Computer Architecture	3	3		
CoE 332	Operating Systems	3	3		
CoE 333	Digital Signal Processing	3	3		1
CoE 334	Analog Electronics	3	3		
CoE 3P1	Lab5(OS + DSP + Electronics)	4		8	
CoE 335	Microprocessor Interface	3	3		
CoE 336	Operating system Programming	2	2		
CoE 337	Digital Communication	2	2		1
CoE 338	Computer Maintenance	2	1	2	
CoE E3x	CoE Elective I (x= 1,2,3, ……..,9)	3	3		
CoE 3P2	Lab6(Microprocessor+ OSP + Matlab)	4		8	
CoE 431	Software Design	3	3		
CoE 432	Computer Network	3	3		
CoE 433	Control System	3	3		1
CoE 434	Engineering Project (Two semesters)	6	1*2	4*2	
CoE E3x	CoE Elective II (x= 1,2,3, ……..,9)	3	3		
CoE 4P1	Lab7(Software Design+ Control system)	3		6	
CoE 435	Embedded Computing Systems	3	3		
CoE 436	Network Technology	3	3		
CoE 437	Parallel Processing Architecture	3	3		
CoE E3x	CoE Elective III (x= 1,2,3, ……..,9)	3	3		
CoE 4P2	Lab8(Embedded Computing+ Networks)	3		6	
TOTAL		***113***	**82**	**62**	**12**
			156		

4. The Proposed Computer Engineering CoE Program: Curriculum

Typical degree program is shown in the following Tables for Computer Engineering, where recommended CoE course plan by semester is presented

First year

Semester 1

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 121	Calculus I	3		1	3
CoE 131	Electric Circuits	3		1	3
CoE 132	Programming & Prob. Solving	3		1	3
CoE 133	Fundamentals of Logic systems	2		1	2
CoE 111	General Chemistry	3			3
CoE 112	English Language I	2			2
CoE 1P1	Lab1(Programming+ Electrical Circuits)		6		3
Total		16	6	4	19
		26			

Semester 2

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 122	Calculus II	3		1	3
CoE 134	Digital Logic Circuits	2		1	2
CoE 135	Object Oriented Programming and Data Structure	3		1	3
CoE 123	Engineering Design / Auto CAD	2	2		3
CoE 113	Basic Physics	3			3
CoE 114	English language II/ Technical Writing	2			2
CoE 1P2	Lab2(OOP + Digital Logic)		6		3
Total		15	8	3	19
		26			

Second year

Semester 3

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 221	Calculus III	3		1	3
CoE 231	Discrete Structures	2		1	2
CoE 232	Signals & Systems	3		1	3
CoE 233	Digital System Design	3		1	3
CoE 211	Electronic Device Physics	3			3
CoE 212	Human Rights, Democracy & Freedom	2			2
CoE 2P1	Lab3(Digital Design + Device Physics)		6		3
Total		16	6	4	19
		26			

Semester 4

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 222	Differential Equations	3		1	3
CoE 223	Probability and Statistics	2		1	2
CoE 234	Computer Organization	3			3
CoE 235	Algorithms	3			3
CoE 236	Digital Electronics	3		1	3
CoE 237	Instrumentation	3			3
CoE 2P2	Lab4(Computer Organization+ Algorithms)		6		3
Total		17	6	3	20
		26			

Third year

Semester 5

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 321	Linear Algebra	3			3
CoE 331	Computer Architecture	3			3
CoE 332	Operating Systems	3			3
CoE 333	Digital Signal Processing	3		1	3
CoE 334	Analog Electronics	3			3
CoE 322	Engineering Economics	2			2
CoE 3P1	Lab5(OS + DSP + Electronics)		8		4
Total		17	8	1	21
		26			

Semester 6

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 323	Random Signals & Systems	3		1	3
CoE 335	Microprocessor Interface	3			3
CoE 336	Operating system Programming	2			2
CoE 337	Digital Communication	2		1	2
CoE 338	Computer Maintenance	1	2		2
CoE E3x	CoE Elective I (x= 1,2,3, ……..,9)	3			3
CoE 3P2	Lab6(Microprocessor+ OSP + Matlab)		8		4
Total		14	10	2	19
		26			

Fourth year

Semester 7

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 431	Software Design	3			3
CoE 432	Computer Network	3			3
CoE 433	Control System	3		1	3
CoE 434	Engineering Project (continued)	1	4		continued
CoE 421	Ethics, Society, Profession	2			2
CoE E3x	CoE Elective II (x= 1,2,3, …….,9)	3			3
CoE 4P1	Lab7(Software Design+ Control system)		6		3
Total		15	10	1	17
		26			

Semester 8

Code	Subject	Number of Hours Per Week			Credit Units
		Theoretical	Practical	Tutorial	
CoE 422	Project management	2		1	2
CoE 435	Embedded Computing Systems	3			3
CoE 436	Network Technology	3			3
CoE 437	Parallel Processing Architecture	3			3
CoE 434	Engineering Project	1	4		6
CoE E3x	CoE Elective III (x= 1,2,3, …….,9)	3			3
CoE 4P2	Lab8(Embedded Computing+ Networks)		6		3
Total		15	10	1	23
		26			

Summer Training

The **Computer Engineering (CoE)** curriculum requires students to complete one month of summer training at private industries or governmental firms. This training is a compulsory component of graduation requirements. It is supervised by the Summer Training Committee of the department.

5. Courses Syllabi

Subject : **CoE 121 Calculus I** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: None **Practical :**

Tutorial : 1 Hr/wk

==========

Course Description:

This course reviews the basic ideas you need to start calculus for computer science and engineering, also for students intending to continue to more advanced courses in calculus and mathematics in general Topics include a brief review of functions, followed by discussion of limits, derivatives, and applications of differential calculus to real-world problem areas. An introduction to integration concludes the course, with a brief description of vectors and complex geometry.

Course Topics:

1- **Preliminaries:**
Real numbers and the real line, lines, circles, and parabolas, functions and their graphs, Absolute value function, greatest integer function, signum function, domain and range algebraic functions, combining functions, shifting and scaling function graphs, even and odd functions, trigonometric functions

2- **Differentiation:**
Limits, continuity and differentiability. Rules of Differentiation, chain rule, implicit differentiation, higher order differentiation, application, time rate, maxima and minima, concave, curve plotting, inverse functions, the limit sinx/x , trigonometric functions and their inverse.

3- **Integration:**
Finite integration, rules of integration, applications, area, volume, arc-length, integration methods, special integrals, rotating and shifting of axes, conical sections.

4- **Vectors:**
Vectors in the plane, in the space, scalar and vector products, triple products. Equations of lines and planes in the space.

5- **Complex Geometry:**
Complex numbers: z = x +jy as an affix on the real point.(x y), modulus, argument, conjugate, addition, subtraction, products of such numbers, (Cartesian, trigonometric, polar and exponential) forms, transformations: translation, rotation by an angle .

Subject : **CoE 131 Electrical Circuits** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: None **Practical : -** Hr/wk

Tutorial : 1 Hr/wk

==========

Course Description:

This course is designed to give the students an introduction to electrical currents, voltages, and the different elements of AC and DC circuits. Also, it teaches them how to analyze DC and AC circuits in steady and transient states.

Course Topics:

1. **Introduction**: Units, atomic structure, conductor, semiconductor and isolator. Electrical current, potential and potential difference. Electromotive force (EMF). Resistance and conductance, temperature effect, resistor types, color code resistance, ohm's law, linear and nonlinear resistance, electrical energy and power, efficiency.
2. **DC Circuit analysis:** Serial and parallel circuits, Kirchhoff's law, internal resistance of source, dependent sources, source transformation. Methods of analysis, Branch current, Mesh analysis, node analysis, examples, delta/ star transformation.
3. **Network Theory:** Superposition, Thevenin, Norton, reciprocity theorem, maximum power transfer.
4. **DC Transient:** The capacitor, capacitor current and voltage, the inductor, inductor current and voltage, exponential response, source free RC and RL circuit, unit step input, steady stale and transient terms in RC and RL circuit.
5. **AC Circuit:** AC quantities (resistance, reactance, and impedance, conductance, susceptance, and admittance, peak values, maximum, average, and r.m.s values, phasor quantities). AC circuit analysis (equivalent impedance, power in AC circuit, power factor, power factor correction, AC circuit's analysis with network theorem). Single phase, and three phase circuits, star/delta transformation.
6. **Resonance:** Series resonance, parallel resonance, quality factor, selectivity, half power frequencies and bandwidth. Serial- parallel resonance circuit, locus diagram.

Subject : **CoE 132 Programming and Problem Solving** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: None **Practical :** - Hr/wk
Tutorial : **1** Hr/wk

==========

Course Description:

The course Indicate some reasons for studying programming fundamentals, covers the basics of programming and the "C++" programming language, including syntax, fundamental data structures, algorithms and basic problem-solving, control structures, string manipulation and list processing, concepts of executive programs.

Course Topics:

1. **An introduction to programming fundamentals**: topics, variables, data types, and operations. Programming paradigms (Functional, Procedural, Object-oriented, and Event-Driven).
2. **Problem-solving Algorithms:** Problem-solving strategies and process, Implementation strategies for algorithms, Debugging strategies, the concept and properties of algorithms, structured decomposition
3. **Programming in C++:** Basic syntax and semantics, Variables, types, expressions, assignment, Mathematical functions, logical and bitwise and arithmetic operations, Simple I/O, Functions and parameter passing, procedural programming, Encapsulation and information-hiding Separation of behavior and implementation.
4. **Control structures**: Conditional and iterative control structures, loops, sequencing, selection, and iteration functions.
5. **Basic Data Structures:** Primitive types, Arrays, Strings and string processing, Records, stack, and heap allocation.
6. **Structure programming**: static and dynamic structure programming.
7. **Recursion:** Recursive mathematical functions, Divide-and-conquer strategies, Recursive backtracking, Implementation of recursion in C++.

Subject : **CoE 133 Fundamental of Logic Systems** **Units "Credit Hours":** **2**

Theoretical : **2** Hr/wk

Pre-requisite: None **Practical :**

Tutorial : **1** Hr/wk

==========

Course Description:

This course gives overview of digital systems and their applications. Understand how signed numbers, unsigned numbers, and alphanumeric characters are represented in binary different numbering systems. Highlight the importance of Boolean logic to the knowledge area. Contrast the meanings of gates, circuits, combinational circuits, and modules. Be able to manipulate and simplify Boolean algebraic expressions and functions of different forms. The basic logic operations and gates.

Course Topics:

1. **Introduction and overview:** introduction of logic systems, variables, and relations.
2. **Number systems:** binary systems, base conversion, representation of numbers and characters using binary codes, octal number system, Decimal number System, Hexadecimal number system, number system conversion, and other Radix (r) system to Decimal conversion.
3. **Arithmetic Operations**: Binary arithmetic (addition, subtraction, multiplication, division). Octal and Hexadecimal arithmetic (addition, subtraction, multiplication, division).
4. **Boolean algebra**: Boolean algebra symbols, axioms, switching algebra and functions, theorems (Generalized De Morgan, Shannon, expansion theory), and operations.
5. **Manipulation and simplification**: Boolean algebraic expressions and functions are simplified using Boolean theorems and K-map(plotting, cell grouping,)
6. **Analysis and design of combinational circuits**: Logic operators, Analysis using basic gates and/or combinational devices.

Subject :	**CoE 122 Calculus II**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 121	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

This is the second course in calculus, intended for students who have already completed a Calculus I course in limits, differential and integral calculus, and need to extend their skills in this subject.

Course Topics:

1- **Coordinates:**

Polar coordinates: areas and lengths in polar coordinates equivalent points and equivalent equations, the relation between the Cartesian and the polar systems, areas, other applications. Three dimensional coordinates: Cartesian, cylindrical, and spherical.

2- Determinants and Matrices:

Matrix basics, add and subtract matrices, multiply a matrix by a scalar, multiply matrices, take the transpose of a matrix, special types of matrices, matrix properties, some properties of determinants, system of linear equations, Gramer's rule ,matrices, some and product of matrices, the inverse of matrix, solution of linear equations by matrices.

3- Functions of two or more variables:

Partial differentiation, total differential, multiple integrals.

4- Multiple Integrals:

Double integrals over rectangles, double integrals over general regions, double integrals in polar coordinates, applications of double integrals, triple integrals, triple integrals in cylindrical coordinates, triple integrals in spherical coordinate's, change of variables in multiple integrals.

Subject : **CoE 134 Digital Logic** **Units "Credit Hours":** **2**

Theoretical : **2** Hr/wk

Pre-requisite: CoE 133 **Practical :** **-** Hr/wk

Tutorial : **1** Hr/wk

==========

Course Description:

Identify some contributors to digital logic and relate their achievements to the knowledge area. Explain why Boolean logic is important to this subject. Articulate why gates are the fundamental elements of a digital system. Work with binary number systems and arithmetic. Derive and manipulate switching functions that form the basis of digital circuits. Reduce switching functions to simplify circuits used to realize them. Analyze and explain uses of small- and medium-scale logic functions as building blocks. Design and describe the operation of basic memory elements. Analyze circuits containing basic memory elements. Apply the concepts of basic timing issues, including clocking, timing constraints.

Course Topics:

1. **Introduction and overview**: Indicate some reasons for studying digital logic. Highlight some people that influenced or contributed to the area of digital logic. Indicate some important topic areas such as logic circuits, switching, memory, registers, and digital systems. Mention how systems result from modules and circuits. Explore some additional resources associated with digital logic. Explain the purpose and role of digital logic in computer engineering.

2. **Combinational Logic:** Code conversions (BCD, Gray, excess-3, and weighted codes). MSI circuits: Adders/ Subtractors (Half and Full adders, Half and Full subtractor). Comparators, Multiplexers, Demultiplexers, Decoders, and Encoders.
3. **Sequential Logic:** Flip- Flops (S-R, J-K, D, T), master/slave FF, Timing diagrams of clocked FF.
4. Analysis and design of synchronous sequential logic circuits: Latches and flip-flops (SR, JK, D, and T).

5. **Registers and Counters:** Registers (SISO, SIPO, PISO, PIPO) , timing sequence of registers. Synchronous versus asynchronous counters.

Subject : **CoE 135 Object Oriented Programming and Data Structure** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 132 **Practical :** **-** Hr/wk

Tutorial : **1** Hr/wk

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Course Description:

The course gives the fundamentals of object-oriented programming, Identify data structures useful to represent specific types of information, and also gives an introduction to database systems and data modeling, architectures, and Fundamental concepts of structured query language.

Course Topics:

1. **Object-oriented programming in C++:** Class hierarchies, object, Encapsulation, Abstraction, Polymorphism, Dynamic binding, Message passing, Messages Association, Interfaces, inheritance, and Operator overloading.
2. **Data Structures:** Pointers and references, Linked structures, Implementation strategies for stacks, queues, and hash tables, Implementation strategies for graphs and trees, Strategies for choosing the right data structure.
3. **Database systems:** definition and role in computer engineering, Components, Database management system (DBMS), Database architectures (possibilities, concept, data independence), and query.
4. **Data modeling:** Concepts (key, foreign key, record, relation), Conceptual models (possibilities, entity-relationship model and UML; strengths and weaknesses), and object oriented models.
5. **Structured query language (SQL)**: Fundamental concepts including data definition, query formulation, update sub-language, constraints, and integrity.

Subject :	**CoE 123 Engineering Design/ Auto CAD**	**Units "Credit Hours":**	**3**
		Theoretical :	**2** Hr/wk
Pre-requisite:	None	**Practical :**	**2** Hr/wk
		Tutorial :	

==========

Course Description:

This course is designed to give the students an introduction to the engineering drawing and its tools. It also gives them a course in AutoCad 2000 software.

Course Topics:

1. ACAD: hardware requirements, running AutoCAD.
2. Types of Coordinates: description of drawing areas, limits, grid, snap.
3. Drawing commands: line, arc, and circles.
4. Display Commands: zoom, region.
5. Editing Commands: erase, move, copy, break, trim, rotate, scale, fillet, mirror, scale.
6. Selection Objects: object- snap. Array, text, dimensions.
7. Orthogonal Projection, Viewing and Dimensions, ISO drawing.

Subject :	**CoE 221 Calculus III**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 121, CoE 122	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

This mathematics course covers and vector calculus, sequences and series, Laplace transform and partial differentiation it depends on the main topics of Calculus I and Calculus II courses. And can be as an introduction to study the topics of engineering analysis.

Course Topics:

1- **Vector Analysis:** Scalars and vectors, components of a vector, addition of vectors, multiplication by scalars, vector in space, ·dot product, cross product, forms of equation of a curve in space, parametric representation, tangential and normal vectors, curvature, radius of curvature, forms of equation of a surface in space, gradient and normal vectors, vector function in Cartesian cylindrical and spherical coordinates, speed, and acceleration, line, surface, and volume integrals Grean's theorem, Stock's .theorem, and Divergence theorem.

2- Sequences and series: Sequences and subsequences, limits, uniqueness of limits, series convergence and divergence, comparison test, comparison of ratios, integral test, test of alternating series, absolute and conditional convergence, Infinite series test for convergence, power series for functions, Taylor 's theorem, Mclaurian series, and convergence of power series, differentiation and integration, solution of differential equations by series, Legender and Bessel equations.

3- Laplace Transform: Definition of the Laplace transform, transforms and properties, inverse transform, partial fraction, application, D.E. solutions using Laplace transform, convolution theorem.

4- Partial Differentiation: Functions of two or more variables, tangent plane and normal line, the directional derivative, the gradient, the chain rule for partial derivatives, the total differential, maximum and minimum of two independent variables.

Subject :	**CoE 231 Discrete Structures**	**Units "Credit Hours":**	**2**
		Theoretical :	**2** Hr/wk
Pre-requisite:	Pre-calculus or equivalent	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

The purpose of this course is to understand and use discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions, with an emphasis on applications in computer science.

Course Topics:

1-Logic: propositional logic, logical equivalence, predicates & quantifiers, and logical reasoning.
2- Sets: basics, set operations
3- Functions: one-to-one, onto, inverse, composition, graphs
4- Integers: greatest common divisor, Euclidean algorithm.
5- Sequences and Summations
6- Mathematical reasoning: Proof strategies, Mathematical Induction, Recursive definitions, Structural Induction
7- Counting: basic rules, Pigeon hall principle, Permutations and combinations, Binomial coefficients and Pascal triangle.
8- Relations: properties, Combining relations, Closures, Equivalence, partial ordering
9- Graphs, directed, undirected graphs.

Subject :	**CoE 232 Signals & Systems**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 131	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

This course introduces the necessary tools for continuous-time signal analysis and linear time-invariant (LTI) systems analysis to the student. It also covers the essential concepts of time and frequency domain representation of a signal, as well as, the time and frequency response of an LTI system.

Course Topics:

1. **Signals and Spectra**: Phasors and Line Spectra, one-sided and two-sided spectra, Classification of Signals, Signal Energy and Signal Power.
2. **Fourier Series and Transform:** Fourier Series; Trigonometric, and Exponential, Parseval's Theorem, Fourier Transform, Fourier Transform properties.
3. **Convolution:** Convolution Integral, Convolution Relationships, Convolution with Unit Impulse Function, Graphical Representation of Convolution.
4. **LTI Systems**: LTI Systems; Basics and Concepts, LTI System Response, Time Response, Frequency Response, Block Diagram Analysis of Systems, Energy and Power Spectral Densities, Correlation Functions, Signal Distortion and Distortionless Transmission.
5. **Applications of Systems:** Amplitude Modulation (AM), Types, Generation and Detection, Angle Modulation, Types, Generation, and Detection.

Subject : **CoE 233 Digital System Design** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 133, CoE 134 **Practical : -** Hr/wk

Tutorial : 1 Hr/wk

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Course Description:

Introduction to logic circuits design, sequential circuits, and shift registers design. Analysis and design of synchronous and asynchronous networks using FSM charts. Minimization of hazards and glitches. Hierarchical, modular design of digital systems, Synthesis of digital circuits from HDL models, RTL, modeling and simulation using HDL and FPGA.

Course Topics:

1. **Introduction and Overview:** combinational versus sequential circuits, Hierarchical design of combinational circuits using logic modules, PLA, Random-access memory (RAM), realization of logic functions using PLA and/ or RAM.
2. **Analysis of Sequential logic circuits:** Finite state machines (FSMs), clocked and unclocked, Mealy vs. Moore models of FSMs, Modeling FSM behavior: State diagrams and state tables, timing diagrams, algorithmic state machine charts, Analysis of synchronous and asynchronous circuits.
3. **Design of Sequential logic circuits** Design of synchronous sequential circuits: State minimization, state assignment, next state and output equation realization. Sequential functional units: Data registers, shift registers, counters, sequence detectors, synchronizers, controllers.
4. **Digital systems design:** Hierarchical, modular design of digital systems. Synthesis of digital circuits from HDL models. Design principles and techniques: Bridging conceptual levels – top down/bottom up, iteration, satisfying a behavior with a digital structure. Functional units, building blocks and LSI components: Adder, shifter, register, and control circuits, tri-state devices and buses.
5. **Realization using field-programmable gate arrays (FPGAs):** Control concepts: Register transfer notation, major control state, sequences of micro-operations, conditional execution of micro-operations. Timing concepts: System timing dependencies, sequencing, clock generation, distribution, and skew. Programmable logic devices (PLDs) and field-programmable gate arrays (FPGAs), PLAs, ROMs, PALs, complex PLDs.
6. **System Modeling:** Schematic capture. Hierarchical schematic modeling for complex systems. Digital system modeling with hardware description languages HDL. Other modeling techniques (timing diagrams, register transfer languages, state diagrams, algorithmic state machines).
7. **System Simulation:** Functional simulation of combinational and sequential circuits. Timing models of digital circuit elements: Propagation delay, rise/fall time, setup and hold times, pulse widths. Timing simulation to measure delays and study signals subject to timing constraints.
8. **Formal verification:** Relationship of good design practice to formal verification. Comparison and contrast of formal verification, validation, testing. Verification by model checking. Verification by proofs. Verification by equivalence checking. Verification by assertions and verification languages. Verification by testing.

Subject : **CoE 211 Electronic Device Physics** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 113, CoE 131 **Practical : -** Hr/wk

Tutorial :

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Course Description: This course is an introduction to the crystal structure of solids, the physics of semiconductors, and the pn junction, with an emphasis on types and applications to semiconductor devices.

Course Topics:

1- **The crystal structure of solids**: Semiconductor Materials, Types of Solids, Space Lattices, Atomic Bonding, Imperfections and Impurities in Solids, Growth of Semiconductor Materials.

2- **Wave-particle duality, physical meaning of the wave function, potential barrier**: Principles of Quantum Mechanics, Schrodinger's Wave Equation, Physical Meaning of the Wave Function, Boundary Conditions, Applications of Schrodinger's Wave Equation.

3- **Energy bands, k-space diagrams, statistical laws**: Introduction to the Quantum Theory of Solids, Allowed and Forbidden Energy Bands; Formation of Energy Bands, The Kronig-Penney Model, Electrical Conduction in Solids, Extension to Three Dimensions ; The k-Space Diagrams of Si and GaAs, Additional Effective Mass Concepts, Density of States Function, Statistical Mechanics; Statistical Laws, The Fermi-Dirac Probability Function, The Distribution Function and the Fermi Energy.

4- **Electrons and holes, doped semiconductors, extrinsic semiconductors, donors and acceptors** Charge Carriers in Semiconductors, The Intrinsic Carrier Concentration, The Intrinsic Fermi-Level Position, Dopant Atoms and Energy Levels, The Extrinsic Semiconductor, Statistics of Donors and Acceptors, Charge Neutrality, Position of Fermi Energy Level. Variation of E_f with Doping Concentration and Temperature, Relevance of the Fermi Energy.

5- **Carrier drift and carrier diffusion:** Carrier Drift, Drift Current Density, Mobility Effects, Conductivity, Velocity Saturation, Carrier Diffusion, Graded Impurity Distribution, The Hall Effect.

6- **The pn junction: basic structure and bias**: Basic Structure of the pn Junction, Zero Applied Bias, Forward Applied Bias, Reverse Applied Bias, Nonuniformly Doped Junctions.

7- **The pn junction diode:** DC models, AC models for low frequency small signal, AC models for high frequency small signal, AC models for low frequency large signal. Clipping, clamping, rectifiers.

8- **The Bipolar Transistor:** normal operation, PNP and NPN. Characteristics and operation of common emitter, common base and common collector, width of depletion layers.

9- **Fundamentals of the Metal-Oxide-Semiconductor Field-Effect Transistor:** The Two-Terminal MOS Structure, Capacitance-Voltage Characteristics, The Basic MOSFET Operation, Frequency Limitations. The CMOS Technology.

Subject :	**CoE 212 Human Right, Democracy, and Freedom**	**Units "Credit Hours":**	**2**
		Theoretical :	**2** Hr/wk
Pre-requisite:	None	**Practical :**	
		Tutorial :	

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Course Description:

This course is designed to give the student the definition of human rights, the concepts of human rights, international human rights laws, human rights in Islam, and human rights in Iraq and their relationship to the Iraqi laws. This course is also designed to give the student the definition of freedom and democracy. It explains the history of democracy, democracy and freedom properties, and ancient democracy & its comparison to modern one.

Course Topics:

1. Human rights definition and history.
2. Human rights and Islam.
3. Iraq constitution and its role in human rights.
4. Child rights.
5. International human rights guarantee laws.
6. The concept of democracy.
7. The concept of freedom.
8. History of democracy and freedom.
9. The properties and principles of democracy and freedom.
10. The relationship between freedom and democracy.

Subject : **CoE 222 Differential Equations** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 221 **Practical :**

Tutorial : **1** Hr/wk

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Course Description:

The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of science. It is often the case that these mathematical models are formulated in terms of equations involving functions as well as their derivatives. Such equations are called differential equations. If only one independent variable is involved, often time, the equations are called ordinary differential equations. The course will demonstrate the usefulness of ordinary differential equations for modeling physical and other phenomena. Complementary mathematical approaches for their solution will be presented, including analytical methods, graphical analysis and numerical techniques.

Course Topics:

1- Introduction to Differential Equations: Definitions and terminology. Initial-value problems. Differential equations as mathematical models

2- First-Order Differential Equations: Solution curves without a solution; direction fields, autonomous first-order differential equations. Separation of variables . Linear equations . Exact equations . Solutions by substitutions.

3- Modeling with First-Order Differential Equations: Linear models; exponential growth and decay, Newton's law of cooling, mixture problems, series circuits Non-linear models; logistic growth, chemical reactions. Systems of differential equations; radioactive series, mixtures, predator-prey models, competition models, networks.

4- Higher-Order Differential Equations: Linear differential equations; initial-value and boundary-value problems, homogenous equations, non-homogeneous equations. Reduction of order. Homogenous linear equations with constant coefficients. Undetermined coefficients; superposition approach, annihilator approach.

5- Modeling with Higher-Order Differential Equations: Linear models with initial value problems; spring/mass systems with free undamped motion, free damped motion, and driven motion; series circuit analogue. Linear models with boundary value problems. Nonlinear models.

Subject :	**CoE 223 Probability and Statistics**	**Units "Credit Hours":**	**2**
		Theoretical :	**2** Hr/wk
Pre-requisite:	Pre-calculus or equivalent	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

Randomness, finite probability space, probability measure, events; conditional probability, independence, Bayes' theorem; discrete random variables; binomial and Poisson distributions; concepts of mean and variance; continuous random variables; exponential and normal distribution, probability density functions, calculation of mean and variance; central limit theorem and the implications for the normal distribution.

Course Topics:

1- **Exploring Univariate Data:** Types of data. Mean and Median. Standard Deviation and Variance. Range, IQR and Finding Outliers Graphs and Describing Distributions.
2- **Introduction to Probability:** Counting Techniques, Combinations and Permutations. Sets and Venn Diagrams. Basic Probability Models. General Probability Rules.
3- **Discrete and Continuous Distributions:** Random Variables. Binomial Distributions. Geometric Distributions. Density Curves. The Normal Distribution. Standard Normal Calculations.
4- **Samples and Experiments:** Sampling. Designing Experiments. Simulating Experiments.
5- **Estimation:** Margins of Error and Estimates. Confidence Interval for a Proportion. Confidence Interval for the Difference of Two Proportions. Confidence Interval for a Mean. Confidence Interval for the Difference of Two Means.

Subject : **CoE 234 Computer Organization** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 233 **Practical : -** Hr/wk

Tutorial :

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Course Description:

This course introduces the general microcomputer organization. The topics include the components of a computing system and interactions among them, overview of the memory and memory segmentation and the data exchange between CPU and memory unit. Also, the course includes the fetch and execute cycles, instruction decoding and execution, and addressing modes. The instruction set and assembly language are explained during this course. Memory fundamentals, basic element of the memory, memory interfacing, and address decoding are also studied in this course.

Course Topics:

1- **Introduction to computer organization**: Indicate some important topic areas such as system organization and architecture, history of computer systems and its development, general model of computer organization (CPU, Memory, I/O).

2- The software Architecture of the microprocessor unit: Bus interface unit BIU, execution units EU, instruction queue, pipelined and non-pipelined architecture, the software model of 8088/86286/386/Pentium microprocessors, instruction pointer, segment registers, general purpose registers, pointer and index registers, and status register. Memory address space, segmentation and data organization.

3- Data type: Representation of integers and real numbers, signed and unsigned numbers, packed and unpacked BCD numbers, and ASCII codes.

4- Instruction set and assembly programming: Introduce the instruction format, instruction fetching, decoding, and executing operations, addressing modes, instruction types (data movement, arithmetic, logic, strings, branching, subroutine call and return mechanisms, and interrupt instructions). The course introduces the programming in assembly language for Intel x86-based microcomputers.

5- Real Mode and Protected mode of x86 Microprocessors: Explain the difference between real and protected modes of microcomputer system operations and their memory management and organization.

6- Memory Interface: Clock system, bus cycle and time states, hardware organization of the memory address space, memory control signals, read and write bus cycles, buses buffering and demultiplexing, memory technologies such as SRAM, DRAM, ROM, PROM, EPROM, and

FLASH, error detecting and error correcting system, design a complete memory subsystem and its interface. Example Intel processors memory interface.

Subject :	**CoE 235 Algorithms**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 135, CoE 231	**Practical :**	**-** Hr/wk
		Tutorial :	

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Course Description:

Studying the general topics of algorithms Design and the analysis techniques for solving domain specific problems, algorithm design strategies, distributed algorithms, sorting and searching algorithms, graph searching algorithms, algorithm evaluation and complexity, non-algorithmic solution, and incompatibility.

Course Topics:

1. **Introduction**: Basic algorithms, algorithm using, complexity, the purpose and role of algorithms in computer engineering.
2. **Algorithmic analysis**: behavior (best, average, and worst case), Big "O," little "o," omega, and theta notation, measurements, Time and space tradeoffs, recursive algorithms. Distributed algorithms Concurrency and Scheduling.
3. **Algorithmic strategies:** Brute-force/exhaustive algorithms, Greedy algorithms, Divide-and-conquer, Backtracking, and heuristics algorithms.
4. **Sorting and searching algorithms:** Sequential and binary search algorithms, Binary search trees, Hash tables , Topological sort, Depth- and breadth-first traversals, spanning tree, graphs adjacency matrix and Shortest-path algorithms (Dijkstra's and Floyd's algorithms), and Transitive closure (Floyd's algorithm).
5. **Algorithmic complexity:** Tractable and intractable problem, P and NP problems, Standard NP-complete problems, halting problem, incomputable functions and its Implications.
6. **Basic computability theory:** Deterministic finite Automata (DFA), Non-deterministic finite Automata (NFA), Equivalence, Context-free grammars, and Pushdown automata (PDA).

Subject : **CoE 236 Digital Electronics** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 131, CoE 211 **Practical :**

Tutorial : **1** Hr/wk

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Course Description:

This course covers the main aspects required in digital electronic circuits.

Course Topics:

1. **MOS logic families:** Logic level definitions, NMOS logic design: Inverter, NOR, NAND, SOP, POS, complex gates, PMOS logic, CMOS logic: Inverter, NOR, NAND, SOP, POS, complex gates, Dynamic logic, CVS logic, Cascade buffers, NMOS and CMOS power/delay scaling.
2. **Design parameters and issues:** Switching energy, power-delay product comparison, Propagation delay, rise time, fall time, Fan-in and fan-out, Power dissipation, noise margin, Power supply distribution, Sources of signal coupling and degradation, Transmission line effects; passive, active, dc and ac termination, Element tolerances, Worst-case analysis of circuits, Monte Carlo analysis, Monte Carlo analysis in SPICE, Six-sigma design.
3. **Storage elements:** Latches, Flip-flops, Static RAM cells, Dynamic RAM cells, Sense amplifiers.
4. **Interfacing logic families and standard buses:** Terminal characteristics of various logic families, Standard interface characteristics, Level translations: TTL/CMOS, TTL/ECL, CMOS/ECL, Single-ended to differential and differential to single-ended conversion, Transmission line characteristics, reflections, Bus termination: Passive, active, dc, ac, 4-20 mA current interfaces, RS-XXX buses, IEEE-XXXX buses, Low-level differential signaling, RAMBUS, DDR.
5. **Data conversion circuits:** D/A Converters: Definitions such as for codes, A/D Converters, Definitions such as for codes, Sample-and-hold circuits.
6. **Introduction to VLSI and ASIC design:** Explain the purpose and role of VLSI and ASIC design in computer engineering.
7. **Functions of basic inverter structure:** Connectivity, layout and basic functionality of a CMOS inverter.
8. **Combinational logic circuits:** Basic CMOS gate design, Layout techniques for combinational logic structures, Transistor sizing for complex CMOS logic devices, Transmission gates, Architectural building blocks (multiplexers, decoders, adders, counters, multipliers).
9. **Sequential logic structures:** Storage mechanisms in CMOS logic, Dynamic latch circuits, Static latch and flip-flop circuits, Sequential circuit design, Single and multiphase clocking, Clock distribution, clock skew.
10. **Chip input-output circuits:** General I/O pad issues, Bonding pads, ESD Protection circuits, Input, Output, Bidirectional, and analog pads, VDD and VSS pads.
11. **Processing and Layout:** Processing steps for patterning SiO2 on a silicon wafer , CMOS processing technology steps and their results, Layout design rules and their objectives, Scalable (-based) design rules, Design-rule checking.

Subject : **CoE 237 Instrumentation** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 131, CoE 211 **Practical :**

Tutorial :

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Course Description

Principle of measurement, measuring electrical quantities, analogue and digital transducers, measurement of level, pressure, flow, temperature and other industrial measurements.

Course Topics

1. **Introduction:** Instrumentation applications, SI Units, Fundamental and derived units , Elements of measuring instrument, Feedback system. Types of instruments , precision and accuracy. Primary measurement and secondary measurement.

2. **Electrical Measurements:** Galvanometer, Voltage measurement, Current measurement, Resistance measurements. Electronic measurement devices. D.C. and A.C. Bridges.

3. **Electrical Transducers:** Resistive, Inductive and Capacitive transducers, measurement of transducer output, modulation and demodulation in transducers.

4. **Industrial measurements:** Level measurement, Pressure measurement: Burden tube, Bellows, Diaphragms, Differential pressure measurement, Flow measurement, Temperature measurement, Force, Load cell.

5. **Digital Transducers:** Opt couplers and OID, optical detection, magnetic pickups, Speed measurement, Position measurement, principle of mouse. Other digital transducers.

Subject : **CoE 321 Linear Algebra** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: Pre-calculus or equivalent **Practical :**

Tutorial :

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Course Description:

At its root, linear algebra is the study of systems of linear equations. Systems of linear equations are ubiquitous in the natural and social sciences. One major contribution to the topic was made by Gauss (1777–1855), who was confronted with large systems of linear equations in his work on astronomy and developed the famous method of least squares to cope with measurement errors. Later in the nineteenth century Cauchy, Sylvester, Cayley and others developed the concept of a matrix, which provides the most convenient language for the theory and practice of linear equations. Matrices are intricate algebraic objects with many fascinating properties, but they also provide a bridge between linear equations and vectors, so infusing the subject of linear algebra with a strong geometric flavor. We will delve into all these topics, as well as the notions of determinant and eigenvalues, which are important numbers associated with any square matrix.

Course Topics:

1. **Linear Equations in Linear Algebra:** Systems of Linear Equations. Row Reduction and Echelon Forms. Vector Equations. The Matrix Equation Ax = b. Solution Sets of Linear Systems. Applications of Linear Systems. Linear Independence. Introduction to Linear Transformations. The Matrix of a Linear Transformation. Linear Models in Business, Science, and Engineering.

2-**Matrix Operations:** The Inverse of a Matrix. Characterizations of Invertible Matrices. Partitioned Matrices Matrix Factorizations. The Leontief Input-Output Model. Applications to Computer Graphics. Subspaces of R^n. Dimension and Rank. Introduction to Determinants. Properties of Determinant. Cramer's Rule, Volume, and Linear Transformations.

3-**Vector Spaces**: Vector Spaces and Subspaces. Null Spaces, Column Spaces, and Linear Transformations. Linearly Independent Sets; Bases. Coordinate Systems. The Dimension of a Vector Space. Rank. Change of Basis . Applications to Difference Equations. Applications to Markov Chains.

4-**Eigenvalues and Eigenvectors:** Eigenvectors and Eigenvalues. The Characteristic Equation. Diagonalization. Eigenvectors and Linear Transformations. Complex Eigenvalues. Discrete Dynamical Systems. Applications to Differential Equations. Iterative Estimates for Eigenvalues.

5- **Orthogonality and Least Squares:** Inner Product, Length, and Orthogonality. Orthogonal Sets. Orthogonal Projections. The Gram-Schmidt Process. Least-Squares Problems. Applications to Linear Models.

Subject : **CoE 331 Computer Architecture** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 234 **Practical :** **-** Hr/wk

Tutorial :

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Course Description:

Introduction to the design and performance analysis of Digital Arithmetics,, the trade-off analysis in designing various components of computer architecture, which includes , arithmetic (fixed and floating point) units design, ALU design, memory hierarchy, control unit design.

Course Topics:

1. **Introduction and Overview:** General definition, purpose of Digital Arithmetic and Introduction to computer architecture, CPU organization and its parts, sketch CPU organization, definition of the performance factors, reasons for binary arithmetic with computers. Review of basic fixed- point number representation systems (non-negative and signed integers), sign detection.
2. **Algorithms and design of the common Fixed- Point arithmetic operations:** design of two operand addition/ subtraction: (CRA, CLA), data compression, multi-operand addition (carry save adder CSA), sequential multiplier, recoding (coding), Booth recoding multiplier, division algorithms: (restoring and non-restoring) division.
3. **Design of High speed CPU components**: design of combinational shifters (barrel shifters), general- purpose registers (GPR), Timers, Tri- state buffers, arithmetic and logic unit (ALU).
4. **Real number representations:** IEEE754 FP representation and format (sign , exponent, and magnitude) of floating point numbers, exceptions, special values, single- precision and double- precision format, dynamic range, integer to real numbers conversion.
5. **Floating- point Algorithms and Implementation:** FP addition/ subtraction, multiplication, multiply- add fused (MAF) unit, division.
6. **Memory system hierarchy: role of memory system,** High-Speed Memories: locality of reference, Cache Memory: (Organization and Mapping Techniques, Replacement Algorithms, write policies) . Main memory systems: Types of main memories: (SRAM, DRAM), main memory characteristics and performance: (latency, cycle time, and bandwidth).
7. **Virtual Memory System:** (Paging, Segmentation, and hybrid), fault trap, Address Translation Virtual to physical, translation look-aside buffer TLB.

8. **Control Unit Design:** Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer. Hardwired Control: Design methods – State table and classical method, Design Examples - Multiplier CU. Micro-programmed Control: Basic concepts, Microinstructions and micro- program sequencing.
9. **Processor Design:** Datapath and control; single cycle design and implementation; simplifying control design; multicycle implementation of datapath and control.

Subject : **CoE 332 Operating Systems** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 135, CoE 234 **Practical :**

Tutorial :

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Course Description:

Introduction to operating systems. Types of operating systems, Process management, Scheduling, memory management, File management, Protection and security.

Course Topics

1- **History and overview:** Introduction, Hardware: CPU, memories, Memory hierarchy, I/O devices, I/O interrupts, DMA, Firmware: BOIS, Software, Operating systems review and its roles, Types of operating systems, Time sharing, Concurrency, System programs, Operating system structures, Operating system components, Microkernel, System calls and APIs, Interrupts, General definitions: Buffering, resources, device management, device driver, caching, crash…etc.
2- **Process Management:** Processes, Process state diagram, Process control block (PCB), Context switch, Process scheduling, Queuing diagram, Schedulers, Types and operation of processes., Bounded-buffer problem.
3- **Threads:** Definition, Benefits, Types of threads, Multithreading models, Java threads, Java thread management, Java thread states, Producer-consumer problem.
4- **Scheduling and dispatch :** CPU-I/O burst cycle, Preemptive and non-preemptive scheduling, Dispatcher, Scheduling criteria, Multi-processor and multiple core scheduling.
5- **Process Synchronization:** Define the problem, Race condition, Critical section problem, Mutual exclusion, Semaphore, Starvation, Producer-consumer problem, Monitors.
6- **Deadlock:** Definition, Deadlock characterization, Necessary conditions, Resource allocation graph, Deadlock prevention, avoidance, and recovery. Process termination.
7- **Memory Management:** Address binding, Logical vs. physical address space, Static and dynamic loading and linking, Overlaying and swapping, paging, segmentation, fragmentation, Memory hierarchy.
8- **File systems:** Definition, attribute, types, access methods, Directory, Allocation methods, Consistency checking, Backup and restore, Disk management.
9- **Protection and Security:** Goals of protection, Domain of protection, Access matrix, Access control and rights, Cryptography, User authentication, Firewall.

Subject : **CoE 333 Digital Signals Processing** **Units "Credit Hours":** **3**

Theoretical : **3** Hr/wk

Pre-requisite: CoE 232 **Practical :** **-** Hr/wk

Tutorial : **1** Hr/wk

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Course Description:

Digital processing of signals, sampling, z-transforms, difference equations, discrete-time Fourier transforms, discrete and fast Fourier transforms, digital filter design.

Course Topics:

1. **Fundamentals of discrete time systems:** introduction, basic definitions, important Discrete Time (DT) signals, DT systems, and Fourier transform of sequences.

2. **The Z transform:** definition of Z-transform, inverse Z-transforms, relationships between system representations, computation of frequency response.

3. **Realizations of digital filters:** direct form realizations of IIR filters, cascade realizations of IIR filters, parallel realizations of IIR filters, and realizations of FIR filters.

4. **Sampling**: Sampling of continuous time signals, changing the sampling rate, multirate signal processing, interpolation, and decimation.

5. **Digital filter design:** design of IIR and FIR filters.

6. **Discrete Fourier transform:** properties, circular convolution, and Fast Fourier Transform "FFT"

Subject : **CoE 334 Analog Electronics** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 211 **Practical : -** Hr/wk

Tutorial :

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Course Description:

This course give a detail information on different types of amplifiers, multipliers, oscillators, voltage and current regulators, and filters.

Course Topics:

1. **Circuit modeling and simulation:** DC analysis, AC analysis, Transient analysis, Simulation control options, Built-in solid-state device models, Device parameter control, Libraries, Mixed-mode simulation.
2. **Feedback Amplifiers:** Voltage amplifiers, Current amplifiers, Trans impedance amplifiers, Trans conductance amplifiers.
3. **Voltage and current regulators:** Series voltage regulators, Current limiting regulators, Fold back limiting regulators, Shunt voltage regulators, Switching regulators, Current regulators with floating load, Current regulators with grounded load.
4. **Oscillators:** Barkhausen Criterion, Low frequency oscillators, RC-phase shift oscillators, Wien-bridge oscillators, High frequency oscillators, Hartley oscillators, Colpitts oscillators, Clapp and Meissner oscillators, Negative resistance oscillators, Crystal oscillators.
5. **Power amplifiers:** Class-A amplifier, Class-B amplifier, Class-AB amplifier, Class-C amplifier, Class-D amplifier, and Class-E amplifier.
2. **Operational amplifiers:** Ideal op-amps and circuit analysis, Ideal op-amp circuits: Inverting and non-inverting amplifiers, summing amplifier, difference amplifier, and integrator, low pass filter, Non-ideal op-amps: dc errors, CMRR, input and output resistances, frequency response, output voltage and current limitations, Circuits with non-ideal amplifiers, Multi-stage op-amp circuits, Nonlinear applications.
3. **Analog multipliers:** Techniques used in design of analog multipliers, Squaring, square root, and division circuits utilizing analog multipliers.
4. **Active filters:** Types of filters, direct simulation of active filters, Single loop and multiple loop filters, VCVS filters, MLFB filters.

Subject : **CoE 322 Engineering Economics** **Units "Credit Hours":** **2**

Theoretical : **2** Hr/wk

Pre-requisite: Junior Standing "3rd Year Standing" **Practical :**

Tutorial :

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Course Description:

Time value of money, economic analysis of engineering projects, planning and capital budgeting, rate-of-return analysis, depreciation, cash-flow analysis, organizational behavior, business organization forms, design of organizational structures, financial analysis and management. Prerequisite: Junior standing.

Course Topics:

1. Making Economic Decision
2. Engineering Cost and Cost Estimating
3. Engineering Economic Concepts
4. Time Value of Money & Cash Flow Diagrams
5. Simple and Compound Interest Calculations
6. Equivalence for Repeated Cash Flows
7. Present Worth Analysis
8. Annual Cash Flow Analysis
9. Rate of Return Analysis
10. Choosing the Best Alternative
11. Future Worth
12. Benefit-Cost Ratio, Payback Period
13. Sensitivity and Breakeven Analysis
14. Sustainability Issues
15. Renewable Energy Projects
16. Key Players, Project Delivery, Phases
17. Financial Sources, Instruments & Applications
18. Obtaining Financing and Approaches
19. Financing Risks & Requirements
20. Overcoming Key Barriers
21. Energy Efficiency Projects

22. Energy Programs

Subject :	**CoE 323 Random Signals & Systems**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 223, CoE 232	**Practical :**	
		Tutorial :	**1** Hr/wk

==========

Course Description:

Purpose and the nature of sampling; nature of estimates, point estimates, interval estimates; maximum likelihood principle approach, least squares approach; confidence intervals; estimates for one or two samples; development of models and associated hypotheses; nature of hypothesis formulation, null and alternate hypotheses, testing hypotheses; criteria for acceptance of hypothesis t-test, chi-squared test; correlation and regression; Markov processes, discrete time systems and continuous time systems; queuing theory including system simulation and modeling, queuing methods; use of appropriate statistical packages..

Course Topics:

1- **Introduction & Mathematical Review:** Sample Spaces and Events, Probability Laws. Conditioning on Events, The Total Probability Theorem, Bayes' Rule, Independence. The Counting Principle, Permutations, Combinations, Partitions, Combinatorial Examples

2- **Discrete Random Variables:** Probability Mass Functions, Important Discrete Random Variables, Functions of Random Variables

3- **Discrete Expectations and Discrete Random Vectors:** Expected Value, Functions and Expectations, Moments, Ordinary Generating Functions. Joint Probability Mass Functions, Functions and Expectations, Conditional Random Variables, Conditional Expectation, Independence, Multiple Random Variables

4- **Continuous Random Variables:** Cumulative Distribution Functions, Probability Density Functions, Important Distributions, Additional Distributions

5- **General Expectations, Bounds and Empirical Distributions:** Expectations, Moment Generating Functions, Inequalities. Convergence of Random Sequences, The Law of Large Numbers, The Central Limit Theorem

Subject : **CoE 335 Microprocessor Interface** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 331 **Practical :**

Tutorial :

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Course Description:

This course introduces input/ output interface, memory mapped input/output, design of input/output ports with specific addresses, programmable input/output, programmable timers, interrupt address pointer, masking of interrupt, software interrupt, non-mask able interrupt, reset, programmable interrupt controller, and direct memory access DMA.

Course Topics:

1- I/O fundamentals: Handshaking, buffering, I/O read and write bus cycles.

2- Design of I/O ports: Design of isolated and memory-mapped I/O with a specific decoded port address.

3- Programmable I/O: Programmable peripheral interface (8255 PPI) internal architecture, port description, programming and modes of operation, interfacing with microprocessor. Programmable communication interface (8251 PCI) internal architecture, programming and modes of operation, interfacing with microprocessor. Keyboard and display controllers., and I/O Performance.

4- Programmable Timers: Programmable interval timer (8254 PIT) internal architecture, counters, programming and modes of operation, interfacing with microprocessor.

5- Interrupt structures: Vectored and prioritized interrupts, interrupt handling, interrupts service routines structure, software interrupt, BIOS and DOS interrupts, key board, display, mouse,…etc, internal interrupt, non-maskable interrupt, reset, external hardware interrupt. Programmable interrupt controller (8259 PIC) internal architecture and programming, multiple cascaded (master/slave) PICs configuration, and interfacing with microprocessor.

6- Direct memory access DMA: DMA operation in microcomputer system, programmable direct memory access controller (8237 DMA controller), programming and interfacing.

7- Buses: Bus protocols, local and global buses, bus arbitration.

8- Mass storage Devices: Floppy, Optical disk, Hard disk, RAID.

Subject : **CoE 336 Operating Systems Programming** **Units "Credit Hours":** **2**

Theoretical : **2** Hr/wk

Pre-requisite: CoE 332 **Practical :** **-** Hr/wk

Tutorial :

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Course Description

Execution of common UNIX user/administrator commands. Writing, compiling, and executing example Java programs which examine and display internal system data structures on a live UNIX system. The course is enhanced with a short introduction of some up-to-date computing techniques such as: Mobile computing, Cloud computing, android programming.

Course Topics

1- **UNIX System Overview:** Introduction, UNIX Architecture, Logging In, Files and Directories, Input and Output, Programs and Processes, UNIX Standardization, Feature Test Macros, Primitive System Data Types, Conflicts Between Standards.
2- **File and directories:** File Descriptors, function file functions, I/O functions , file traction, Link, Unlink, directory and its functions.
3- **Standard I/O Library:** Streams and FILE Objects, Standard Input, Standard Output, and Standard Error, Buffering, Opening , reading , writing a Stream, Formatted I/O stream, Temporary Files, Alternatives to Standard I/O.
4- **Process Control:** Process Identifiers, fork and vfork Functions, wait functions, Race Conditions, exec Functions, User ID and group ID functions, Interpreter and system functions, Process Accounting, User Identification, Process time.
5- **Threads:** Thread Concepts, Identification, Creation, Termination, Synchronization, Thread Limits, Attributes, Cancel Options. Threads and Signals, Threads and fork, Threads and I/O.
6- **Inter-process Communication:** Pipes, popen and pclose Functions, Coprocesses, FIFOs, XSI IPC, Message Queues, Semaphores, Shared Memory, Client–Server Properties.
7- **Network IPC: Sockets:** Socket Descriptors, Addressing, Connection Establishment, Data Transfer, Socket Options, Out-of-Band Data, Nonblocking and Asynchronous I/O, STREAMS-Based Pipes, UNIX Domain Sockets, Passing File Descriptors, An Open Server.
8- **Mobile computing:** Introduction, Types of wireless devices, Mobile objects , Moving object databases (MOD), Query language for MOD, Applications and challenges, future.
9- **Cloud Computing:** Introduction, architecture, characteristics, service models, SaaS maturity model, Layers, virtualization and virtual machines, sourcing,, taxonomy, storage, Modular datacenter, platforms.
10- **Android programming:** Introduction, Making and testing android projects, Basic program structure, Java-based layout, XML-based layout, Android studio, Eclipse ADT visual layout editor, Hybrid layout, Project structure, Accessing sensors on android devices, Database connections.

Subject : **CoE 337 Digital Communication** **Units "Credit Hours": 2**

Theoretical : 2 Hr/wk

Pre-requisite: CoE 232 **Practical :**

Tutorial : 1 Hr/wk

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Course Description:

This course reviews the ideas of Digital communication systems including different types of encoding and multiplexing techniques. It also demonstrates the performance of digital systems and the guided and unguided transmission media. Cellular networks are also included.

Course Topics:

1. **Introduction to Digital Communication**: Communication model, OSI introduction, Sampling theory, channel capacity, Shannon theorem.
2. **Data Encoding, Transmission, and Multiplexing**: Pulse modulation (PWM, PAM, PPM, PCM, DPCM, delta modulation), line coding, FDM, TDM, ASK, FSK, BPSK, QPSK, and QAM,
3. **Performance of digital receiver**: transmission impairments: noise (Gaussian, impulsive and shot noise) and losses (optical, coaxial, radio), BER (Bit- error-ratio) and S/N ratio,.
4. **Transmission Media:** Guided transmission media (coaxial, optical fiber), wireless transmission, and wireless propagation.
5. **Spread spectrum**: Direct sequence, Frequency hopping and time hopping, CDMA.
6. **Cellular Wireless Networks**: Cellular network organization, operation, mobile radio propagation effect, and cellular network generations.
7. **Error control techniques**: checksum, summation code, Hamming code, CRC and Block codes.
8. **Switching techniques**: Store and forward packet and message switching, circuit switching, datagram and virtual circuit packet switching.

Subject :	**CoE 431 Software Design**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 135, CoE 235, CoE 336	**Practical :**	**-** Hr/wk
		Tutorial :	

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Course Description:

Foundations of software design, reasoning about software, software life cycle, requirements, project management and testing. Including the calculus of programs, quality and test measurement, survey of formal specification techniques and design languages, human-computer interaction, graphical user interfaces.

Course Topics:

1. **Software life cycle and process models**: life cycle, life cycle model, quality, phases, Process improvement, Process assessment models, metrics, standards and guidelines.
2. **Software requirements and specifications:** Requirements analysis modeling techniques, Prototyping, formal specification techniques, functional and non-functional requirements.
3. **Software design:** design concepts, architecture, structured design, Object-oriented analysis and design, Component-level design, Design for reuse, Quality in relation to specification (completeness, consistency, simplicity, verifiability).
4. **Software testing:** Testing fundamentals, tools, test plan creation, test case generation Validation planning, Black-box and white-box testing techniques, Unit integration, validation, system testing, Object-oriented testing, , Measures of Reliability and Availability, and inspections
5. **Software evolution:** Software maintenance, forms of maintenance, defect removal, upgrade, enhancement, Patterns of behavior, bottlenecks measurement, regression testing version control, Software re-use, and Reengineering.
6. **Project management:** Programming environments, Requirements analysis and design modeling tools, teams composition, project management difficulty, Resource allocation, Gantt charts, Project planning, costing, and timely compliance and delivery.
7. **Concurrent Design:** performance constraints, real-time features remands, Hardware and software co-design.
8. **Computer Interfaces**: define HCI, context, reasons, web interface, Human performance models, usability testing, graphical user interfaces GUI, web interfaces.

Subject : **CoE 432 Computer network** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 337 **Practical :**

Tutorial :

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Course Description:

Introduction to the design and performance analysis of computer networks Architectures, protocols, standards and technologies of computer networks. Including different computer networks types, media, models, switching, retransmission, flow and error control.

Course Topics:

1. **Introduction and overview:** General definition, fundamental concepts of network, reasons for studying networks, type of nodes, types of computers (LANs, MANs, WANs), Network Criteria (performance, reliability, and security), hardware and software components of networks , network types (LAN, WAN, MAN, and wireless),and Network line configuration (point-to-point, multipoint).
2. **Network Topologies** (mesh, star, tree, bus, ring), LAN Network Models (client/server and peer to peer).
3. **Network architecture:** Protocol suits and layering concepts, OSI reference models, Connection-oriented and connectionless services.
4. **Flow and Error Control:** ARQ system utilization of networks: stop and wait protocol and Sliding Window, Go back N and selective repeat protocols. Error detection techniques.
5. **Media Access Control:** Random access, control access, CSMA, Reservation, Polling, token ring, Channelization.
6. **LAN and WAN technologies:** Ethernet, token Ring, Gigabit Ethernet, network evaluation, efficiency, capacity.
7. **Network and internetworking devices:** as repeaters, bridges, switches, routers, and gateways.
8. **Switching techniques and communication services:** Circuit and packet switching.
9. **Wireless network:** wireless standards, wireless LANs, ESS and BSS, Distribution.

Subject : **CoE 433 Control Systems** **Units "Credit Hours": 3**

Theoretical : 3 Hr/wk

Pre-requisite: CoE 232, Pre-calculus **Practical : -** Hr/wk

Tutorial : 1 Hr/wk

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Course Description:

This course is to explore the modeling of linear dynamic systems via differential equations and transfer functions utilizing state-space and input-output representations; analysis of control systems in the time and frequency domains and using transfer function and state-space methods; study of the classical stability tests, such as the Routh-Hurwitz and Nyquist criterions, and design methods using root-locus plots and Bode plots.

Course Topics:

1- **Mathematical models of control systems, Transfer functions and block diagrams**:
Mathematical models for electrical and mechanical systems. Simple spring- dash-pot system and DC servomotor, transfer function, block diagram representation, signal flow graph and Mason's formula,

2- **Time-domain responses:** Time response of first order system, time response of second order system, transient response and steady state error.

3- **Stability Analysis:** Stability analysis by Routh- Hurwitz criterion, root locus plot, frequency response method, Nyquist criterion a Bode plot techniques.

4-**State space analysis:** Standard form, state space model from differential equation, solution of state equation, state transition matrix, controllability test, observability test.

5- **Digital Control Systems:** Introduction to digital control systems, pulse transfer function.

Subject :	**CoE 434 Engineering Project**	**Units "Credit Hours":**	**6 (3*2)**
	Two semesters	**Theoretical :**	**1** Hr/wk
Pre-requisite:	Senior Standing "4th Year Standing"	**Practical :**	**4** Hr/wk
		Tutorial :	

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Note:- The Course is covered by two semesters

This course covers the complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills, and discusses student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility ---considerations, Detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact.

Subject :	**CoE 421 Ethics, Society, Profession**	**Units "Credit Hours":**	**2**
		Theoretical :	**2** Hr/wk
Pre-requisite:	Senior Standing "4th Year Standing"	**Practical :**	
		Tutorial :	

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Course Description:

This course explores many of the ethical issues that a practicing engineer might encounter in the course of his or her professional engineering practice. The course contains a discussion of ethical theories, develops several ethical problem-solving methods, and contains case studies based on real events that illustrate the problems faced by engineers. The case studies also show the effects that engineering decisions have on society.

Course Topics:

1. Introduction: Engineering Ethics, Personal vs. Professional Ethics, Origins of Ethical Thought, Ethics and the Law.
2. Professionalism and Codes of Ethics.
3. Understanding Ethical Problems.
4. Ethical Problem-Solving Techniques.
5. Risk, Safety, and Accidents.
6. The Rights and Responsibilities of Engineers.
7. Ethical Issues in Engineering Practice.

Subject : **CoE 422 Project Management** **Units "Credit Hours":** **2**

Theoretical : **2** Hr/wk

Pre-requisite: Senior "4th Year Standing" **Practical :**

Tutorial : **1** Hr/wk

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Course Description:

This course is specifically designed to provide the knowledge and techniques required to properly manage projects of all types and sizes. Course material covers the approaches and practices in project management over the lifespan of the project cycle. This course is a highly interactive course with hands-on in-class practicing projects and analysis of real-world project examples. While providing the knowledge in project planning and control techniques, it focuses on the development of project leadership, teamwork, and problem solving skills.

Course Topics:

1. Project, Characteristic of Project, Project Management, Stakeholders.
2. Project Life Cycle, Characteristic of Project Life Cycle, Project Versus Operation.
3. Project Management Life Cycle, Process Group Life Cycle, Characteristic of Project Management Life Cycle, Project management Process, Project Management Knowledge Areas.
4. Form of Organization.
5. Network, Critical Path Method.
6. Pert Technique (Time and Cost).
7. Precedence Technique.
8. Applications of Microsoft Project.
9. Applications of Primavera.
10. The Resource Allocation Problems.
11. Linear Programming.
12. Profile Maximization problems.
13. Maintenance Concept and Policy.
14. Systems.

Subject :	**CoE 435 Embedded Computing Systems**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 237, CoE 335	**Practical :**	**-** Hr/wk
		Tutorial :	

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Course description: Introducing microcontrollers for embedded system design. I/O interfacing analogue and digital signals, Real time OS, Multiprocessor systems, Networking for embedded systems, hardware and software design techniques.

Course Topics

1- **Introduction to embedded systems:** Indicate some reasons for studying embedded systems, Product life cycle, Quality design, Debugging, Computers, processors, memory, and microcontrollers, Digital logic and open collector, Types of real-time systems.

2- **Embedded ARM microcontrollers:** ARM processor architecture, Software model, Addressing modes, programming instructions, Fundamental concepts of assembly language and linking: labels, address management.

3- **Microcontroller Hardware:** Microcontroller I/O pins, I/O programming and the direction register, Phased-lock loop, SysTick timer, Measurement of dynamic efficiency, Power management, Fault tolerant system.

4- **Real-time operating systems:** Fundamentals, Foreground/Background, Delay tasks, Round Robin scheduler, Semaphores, Thread synchronization or rendezvous, Resource sharing, non-reentrant code or mutual exclusion, Thread communication using: mailbox and FIFO queue, Switch debouncing, Deadlocks, Monitors, Free RTOS.

5- **Interfacing and Communication:** Introduction to interfacing, , Synchronous serial interface SSI, LCD interface, Scanned keyboard, Actuators, Pulse width modulation, Motors drivers, I^2C interface, USB interface, High speed interfacing: Hardware FIFO, Dual-port memory, DMA controllers sensors interface.

6- **Interrupt programming and real-time systems:** I/O synchronization, Interrupt concepts, Polled I/O vs. interrupt-driven I/O, NVIC on ARM processor, SysTick periodic interrupts, Timer periodic interrupt, Ballast code timing, Multithreading.

7- **Analog I/O Interfacing:** Analog to digital conversion, Real-time data acquisition, Digital to analog conversion, 4~20mA signal standards.

8- **Software design:** Quality programming, Modular software design, and Threads, Call graph, Data-flow graph, Top-down vs. bottom-up design, Memory management and the Heap.

9- **Networked embedded systems:** Networked embedded systems, Reentrant programming, Critical section, Network topologies: ring, bus, multi-hop., Producer- consumer using FIFO queue, Distributed systems, Wireless communication, Internet-enabled embedded systems.

10- **High speed networks:** Fundamentals, CAN, Ethernet, Internet of Things.

11- Robotic systems: Introduction to Digital Control, Closed-loop control, PID controllers, Fuzzy logic control.

Subject :	**CoE 436 Network Technology**	**Units "Credit Hours":**	**3**
		Theoretical :	**3** Hr/wk
Pre-requisite:	CoE 235, CoE 432	**Practical :**	**-** Hr/wk
		Tutorial :	

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Course Description:

The concepts of internetworking, internetwork architecture, protocols, network services and applications. Server based operation. Networking problem notification and control. Authentication and security issues.

Course Topics:

1. Internetworking Protocol suites (TCP/IP) ,protocols stack, functions and layers.
2. **Internet addressing:** Logical addressing, classful and classless addressing, subnetting, and address translation.
3. **Networking Protocol:** IPv4, IPv6, Packetizing, datagram and virtual circuit networks, network services, fragmentation.
4. **Network supporting protocols:** Address mapping ARP, RARP, BOOTP, DHCP, error reporting ICMP. Multicasting IGMP. Routing concepts.
5. **Process- to- Process delivery protocols:** Connectionless and Connection-Oriented Service, transport control protocol TCP, user datagram protocol UDP, stream transfer control protocol SCTP, Multi homing.
6. **Application Level Protocols:** Telnet, FTP, TFTP, NFS, SMTP, LPD, X Window, SNMP, DNS.
7. **Network Congestion:** packet switching network congestion, Open-loop congestion control, and Closed-loop congestion control.
8. **Client-server computing:** Web technologies: Server-side programs; common gateway interface (CGI), applet concept, HTTP, client-server relationship, Uniform Resource Locator, scripts.
9. **Network Security Concepts:** Authentication, Encryption and decryption, cryptography, Public key, private key, symmetric key, filtering.

Subject : **CoE 437 Parallel Processing Architecture** **Units "Credit Hours": 3**
Theoretical : 3 Hr/wk
Pre-requisite: CoE 234, CoE 331 **Practical :**
Tutorial :

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Course Description: Instruction level pipelining and Superscalar Processors, Multiple Processor Organizations, Closely and loosely coupled multiprocessors systems, Symmetric Multiprocessors, Clusters, UMA NUMA, Vector Computations, RISC: Instruction execution characteristics, RISC architecture and pipelining. RISC vs CISC. Management methods for parallel computers.

Course Topics:

1. **Introduction:** Necessity of high performance, constraints of conventional architecture, Von Neuman architecture, limitations, evolution of parallel processors.
2. **Parallelism:** parallelism of Uniprocessor architecture, parallel processing mechanisms, multiple function units, parallelism and pipelining within CPU, overlapped CPU, use of memory hierarchy system.
3. **Architectural Classifications of parallel computers:** Flynn's classifications (SISD, SIMD, MISD, and MIMD) computer organizations, classification based on computing between processing elements, SIMD.
4. **Memory architecture of Parallel Processing:** shared, distributed, and hybrid distributed- shared memory, UMA and NUMA, COMA.
5. **Multiprocessor Architecture:** multiprocessor systems, loosely coupled, tightly coupled, multiprocessor characteristics, inter processor communication networks (time shared buses, crossbar switches).
6. **Vector and array Processors:** basic vector architecture, vector processor, vector instruction types, array processors (array, wave front array, systolic array, bus architecture), matrix multiplication systolic array, processors, switching methodology, network topology. Multithread architecture.
7. **Pipeline Mechanism**: instruction pipelining, multiple function units, internal data forwarding, linear pipeline processors, speedup, efficiency, throughput, classification of pipeline processors (arithmetic, instruction). Hazard types (data, structural, and control), hazards handling and reducing, role of cache memory on pipeline system.
8. **Branch Handling:** Techniques of branch handling(pipelining, looping, out of order execution, software scheduling), predicted execution, speculative loading, superscalar processors, very large instruction word processor VLIW, case study (Pentium Processor).
9. **Interconnection Networks:** static versus dynamic SIMD networks, network performance static networks (linear, tree, torus, cube, hypercube, mesh, ring). Dynamic interconnection networks; switches versus links, single stage network (shuffle exchange), multistage interconnection networks MIN (perfect shuffle, inverse shuffle, bit reversal, and butterfly) Omega MIN.

Subject : **CoE E3x Elective courses (x= 1,2,3, …….,9)**

Units "Credit Hours": **3**

Theoretical : **3** Hr/wk

Pre-requisite:

Practical :

Tutorial :

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x= 1- Computer-Aided Analysis.

2- Electronics Design.

3- Information Theory.

4- Image Processing.

5- Knowledge Engineering

6- Cloud Computing.

7- Discrete Control.

8- Data Mining.

9- **Network Security**

Chapter6: Criterion6 (Faculty)

6.1 Leadership Responsibilities

The chairman of the Computer Engineering department is the most pivotal of all positions concerned with the instructional development. The policies of the college and university delegate the prime responsibility of the department daily operation to the chairman. The chairman is thus, assigned the task of running and management of the department. As the executive officer, the chairman is responsible to both the dean of the college of engineering and the department. It is the chairman who maintains daily contacts with the administration, with faculty and with students. It is in this last context where the chairman has to ensure that the department's mission and educational objectives are met. This could be achieved through the following:

1. Departmental affairs: developing and accomplishing departmental missions and objectives within those of the university; establishing departmental policies; conducting departmental meetings; involving faculty members and students in departmental decision making and activities.
2. Academic affairs: establishing departmental degree programs and curricula; evaluating, updating and improving program curricula, and the enforcing the quality of instruction.
3. Office management: administering departmental facilities; hiring, supervising, evaluating staff personnel (secretaries, laboratory assistants); establishing file and record systems (faculty, students, courses, academic data, correspondence); maintaining equipment and other department properties; requisitioning supplies; ordering textbooks.
4. Personal professional performance: providing professional leadership and setting an example in the department; demonstrating professional competence in teaching, research, and other professional activities; participating in professional associations and community service, setting academic standards; preparing term schedules of courses.
5. Faculty affairs:
    - Recruiting and orienting new faculty members; supporting and encouraging high performance in teaching, research, conference attendance, seminars, workshops, and other professional activities;
    - Enforcing faculty responsibilities and protecting faculty rights; evaluating faculty members and making documented recommendations to the dean for them.
6. Student affairs:
    - Facilitating a constructive environment to consolidate the program teaching and learning process.
    - Curricular and career advising of students.
    - Responding to student grievances and complaints.
    - Certifying students for graduation.

7. Program affairs:
    - Arranging meetings with faculty to decide on further steps to improve the program.
    - Managing the essential funds for laboratory equipment, day-to-day functioning, other department social activities, etc.
    - Executing the CoE Program, alteration, and improvement proposed by program constituencies.
8. External communications: conveying university policies and actions to the department, representing the department in the college, the university and all external agencies and communicating departmental programs and activities to students.
9. Budgetary affairs: preparing annual departmental budget requests; administering budgetary allocations (preparing requisitions, authorizing expenditures, maintaining budget records).

6.2 Authority and Responsibility of Faculty

Faculty members are the back bone of the department and their role in the running of the department is very crucial. It is the department senate or faculty council that makes decisions, recommendations, proposals and policy changes within the department. The approval of the majority of the council is essential prior to passing to the chairman for further action. In effect, the department's council role is not limited only to academic matters but goes beyond that to include all aspects of governing the department. Though the responsibilities could vary among individuals in the department, all members participate in the following activities:

1. Teaching: proposing new curriculum courses, modifying and updating existing courses; course evaluation through conducting exams, quizzes, assignments, projects, etc. In order to provide consistency in the department, faculty members in the Computer Engineering Department are recommended to:
    - Keeping up to date with relevant changes in their related fields and carefully preparing lectures and course materials.
    - Being accessible to students for academic consultation during scheduled or prearranged office hours.
    - Informing students regarding course formats, assignments, and methods of evaluation.
    - Maintaining teaching schedules in all but exceptional circumstances.
    - Informing students of any necessary cancellation and rescheduling of instruction.
    - Adhering to the schedules for submission of grades and evaluations by the department.
2. Research: devote a good portion of their time to carry out research or creative work, within the constraints of the relatively heavy teaching loads. All full time faculty members are encouraged to make the results of such activities available, to other researchers and academicians, through publications, lectures, and other appropriate means.
3. Service to the university: some faculty members in the department are assigned different tasks at the university level. This is realized, among other duties, through; reviewing of

academic publications, editorial board members, organizing International conferences, and other academic associations and consultancy assignments.

6.3 Faculty

The computer engineering department has 30 full and part time faculty members, including the chairman of department. In terms of rank distribution, they are broken down as follows:

- 2 Full-Professors
- 4 Assistant Professors
- 8 Lecturers
- 15 Assistant Lecturers

Among our faculty, the number of years of teaching experience ranges from 2 to 33 years, with an average of 321/25= 12.84 years .The number of years of teaching experience, at the University of Basrah, only, ranges from 2 to 27 years, with an average of 287/25= 11.48 years. In the process of assessing the faculty activities in the CoE department it was realized that, on the average, the department is more tilted towards teaching rather than research and other scholarly activities. Detailed information regarding the credentials, experience, workload, and committees' involvement of the faculty member in the CoE department is included in **Tables6.1** and **6.2** below.

Table6.1: Faculty Workload Summary for the Academic Year 2011-2012

Faculty Member	FT or PT	Rank	Degree, Institution from which Degree Earned, Year	Prof. Society	Experience			Classes Taught through 2011-2012 (Credit Hours)	Total Activity Distribution			
					Total Faculty	This Institution	Work & Other		Av. Load Hs/Week	Teaching	Research	Others
Abbas Abdulameer Jasim Alsankor	FT	Assist. Professor	PhD, Basrah University, Iraq 2012	-	13	13	3	CoE231(4),CoE437(6)	14	50%	Chairman responsibilities	
Abduladhem Abdulkareem Ali	FT	Professor	PhD, Basrah University, Iraq, 1997	IEEE	31	31	6	CoE434(3)	7	23.33%	Graduate Studies Load + Avicenna Center Responsibilities	
Turki Younis Abdullah	FT	Professor	PhD, Basrah University, Iraq, 2000	-	33	33	-	CoE421(2)	8	26.67%	Graduate Studies Load + Scientific Promotion Responsibilities	
Ghaida A. Al-Suhail	FT	Assist. Professor	PhD, Basrah University, Iraq, 2007	-	26	26	4	CoE435(6),CoE421(4)	18	46.00%	Graduate Studies Load	
Haroutuon Intranik Hairik	FT	Assist. Professor	PhD, Basrah University, Iraq, 2005	-	31	31	4	CoE131(6),CoE433(6), CoE134(2)	14	60.00%	Graduate Studies Load	
Fatima Kadhum Hasan	FT	Lecturer	PhD, Basrah University, Iraq,2006	-	25	25	-	CoE333(6),CoE134(2), CoE135(1),CoE231(1)	14	38.33%	Graduate Studies Load	

Majid Abdulnabi Alwan Altameemi	FT	Lecturer	PhD, Basrah University, Iraq, 2002	-	28	28	4	CoE336(2)	12	20.00%		
Ali Ahmed abed	FT	Assist. Professor	PhD, Basrah University, Iraq, 2012	-	14	13	2	CoE436(4), CoE437(4)	20	50.00%	33%	
Mohammed Abedali Jodah	FT	Lecturer	PhD Basrah University, Iraq, 2014	-	11	11	3	CoE334(6)	18	26.67%	undergraduate Studies responsibilities coordinator	
Wasan Abdulrazaq Wali	FT	Lecturer	PhD, Basrah University, Iraq 2014	-	18	18	3	CoE215	8	26.67%	16%	56%
Abdulkareem Khamees Hasan	FT	Lecturer	MSc, Basrah University, Iraq, 1986	-	26	26	9	CoE134(1),CoE437(2)	11	36.67%	16.67%	46.66%
Lu'ai Talib Alubaichi	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2004	-	10	10	4	CoE135(2),CoE337(2)	13.5	45.00%	16.67%	38.33%
Alaa' Falah Abdulhasan Alibadi	FT	Assist. Lecturer		-	8	8	-	CoE232(4), Co437(6)				
Ali Esam Hameed Alhadad	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2006	PhD Study Scholarship								
Atheel Kadhum	FT	Assist. Lecturer	MSc, Basrah	-	4		4	-				

Abdulzahraa			University, Iraq, 2008									
Dunia Sattar Tahir Aljubori	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2006	-	5	5	-	CoE234(5),CoE421(2), CoE335(2)	14	46.67%	16.67%	36.66%
Mus'aab Adel Ali	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2006	PhD Study Scholarship								
Ghasaq Chasib Almayahi	FT	Assist. Lecturer	MSc, Basrah University, 2006	-	5	5	-	CoE133(6),CoE421(2), CoE234(0),CoE237(1)	14	46.67%	16.67%	36.66%
Intisar Tua'ess Huaidi	FT	Assist. Lecturer	MSc, Basrah University, Iraq,2006	PhD Study Scholarship								
Hiba Hakim Abdulzahraa	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2004	-	4	4	3	CoE334(6)	8	26.67%	16.67%	56.66%
Israa' Sabri Abdulameer	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2009	-	3	3	-	CoE132(6), CoE421(2), CoE235(1), CoE133(1)	13	43.33%	16.67%	40.00%
Mohaned Hamid Khalaf	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2007	PhD Study Scholarship								
Imad Abdulrazzaq Jassim	FT	Assist. Lecturer	MSc, Basrah University, Iraq, 2005	PhD Study Scholarship								

Hassanin Shaker Husein	**FT**	**Assist. Lecturer**	**MSc, Basrah University, Iraq, 2010**		**1**	**1**	**5**	**CoE121(6), CoE221(6), CoE337(6), CoE437(5)**				
Ali Nabeel Ibrahim	**FT**	**Assist. Lecturer**	**MSc, GGS University, India, 2009**	**PhD Study Scholarship**								
Mohammed Kati' Audah	**FT**	**Assist. Lecturer**	**MSc, Basrah University, Iraq, 2012**		**1**	**1**	**7**	**CoE132(2),CoE437(5)**	**15**			
Ali Mohammed Ahmed	**FT**	**Assist. Lecturer**	**MSc., Basrah University, Iraq, 2012**		**1**	**1**	**7**	**CoE213**	**15**			

Table6.2: Faculty Involvement in Regular Committees at the Department

No.	Committee	Members
1	**Scientific Advisory and Graduate Affairs Committee**	- Abbas A. Jasim - Majid Abdulnabi Alwan Altameemi - Abduladhem Abdulkareem Ali - Turki Younis Abdullah - Ali Ahmed Abed - Mohammed Abd Ali Jodah - Haroutuon Intranik Hairik - Fatima Kadhum Hasan - Ghaida A. Al-Suhail
2	**Examination Committee**	- Abbas A. Jasim - Majid A. Alwan - Mohammed Abd Ali - Mohammed Kati' Audah
3	**Importation Committee**	- Majid A. Alwan - Mohammed Abd Ali Jodah - Mohammed Kati'
4	**Summer Industrial Training Committee**	- Haroutuon Intranik Hairik - Mohammed Kati' Audah
5	**Gratis Book Committee**	- Fatima Kadhum Hasan - Mohammed Kati' Audah - Wafaa' Abdulwahab Hamza
6	**Laboratory Maintenance Committee**	- AbdulKareem Khamis - Mohammed Abedali Jodah - Mohammed Kati' Audah
7	**Quality Assurance Committee**	- Abbas A. Jasim - Mohammed Abd Ali Jodah - Kalid Ali Abbas

6.4 Faculty Competencies

The department is offering a wide spectrum of courses in diverse areas of computer engineering courses that includes, though not limited to; computer networks, computer architecture, digital design, microprocessors, control, signal processing, electronics, operating systems, software and programming, and communications. **Table6.3** gives the names of faculty, area of interest, and current program curricular areas taught by them.

Table6.3: Faculty's Specialization and the Program Curricular Areas

Faculty	Area of Interest		Curricular Areas
	General	Specific	
Dr. Abbas Abdulameer Jasim	Computer Engineering	Computer Networks	Digital Design, Networks
Dr. Abduladhem Abdulkareem Ali	Electrical Engineering	Control	Control
Dr. Turki Younis Abdullah	Electrical Engineering	Control	Control
Dr. Ghaida A Al-Suhail	Electrical Engineering	Communications	Computer Networks
Dr. Haroutuon Intranik Hairik	Electrical Engineering	Power Electronics	Power, Control
Dr. Ali Ahmed Abed	Electrical Engineering	Computer & Control	Wireless Control & Wireless Sensor Networks, Operating Systems
Dr. Majid Abdulnabi Alwan Altameemi	Electrical Engineering	Information Technology	Signal Processing
Dr. Fatima Kadhum Hasan	Electrical Engineering	Computer Architecture	Computer Architecture, Digital Design
Dr. Mohammed Abedali Jodah	Computer Engineering	Computer architecture	Microprocessors, FPGA, VHDL
Abdulkareem Khamees Hasan	Electrical Engineering	Electronics	Power
Loai Talib Alubaichi	Electrical Engineering	Control	Communications
Ali Esam Hameed Alhadad	Computer Engineering	Signal Processing	Computer Architecture, Control
Dunia Sattar Tahir Aljubori	Computer Engineering	Signal Processing	Microprocessors, Operating Systems
Mus'aab Adel Ali	Computer Engineering	Signal Processing	Networks, Microprocessors
Ghasaq Chasib Almayahi	Computer Engineering	Control	Software & programming, Microprocessors
Intisar Tua'ess Huaidi	Computer Engineering	Signal Processing	Networks, Control, Operating Systems
Musatafa Isma'eel Ali Alhumairi	Electrical Engineering	Power Electronics	Electronics, Power, Digital Design
Dr. Wasan Abdulrazq Wali	Electrical Engineering	Control	Control
Alaa' Falah Abdulhasan	Electrical Engineering	Control	Intelligent Control
Israa' Sabri Abdulameer	Computer Engineering	Signal Processing	Digital Design, Software & Programming
Atheel Kadhum Abdulzahraa	Computer Engineering	Signal Processing	Digital Design, Software & Programming
Hiba Hakim Abdulzahraa	Computer Engineering	Signal Processing	Digital Design, Software & Programming
Mohaned Hamid Khalaf	Electrical Engineering	Communications	Communications, Power
Imad Abdulrazzaq Jassim	Electrical Engineering	Communications	Communications, Power, Digital Design
Ali Nabeel Ibraheem	Computer Engineering	Software Engineering	Software Engineering, Programming
Hassanin Shaker Hussein	Computer Engineering	Digital Signal Processing	Industrial Electronics and Control
Mohammed Kati' Auda	Electrical Engineering	Image Processing	Image Processing
Amjed Ahmed Majeed	Computer Science	Computer Networks	Computer Networks

6.5 Faculty Size

The total number of students in the department is 203, and the number of the CoE faculty members is 30. This data clearly indicate that, in terms of numbers, there has been no serious problem, thus far, in handling the teaching loads and current undergraduate students enrolled in the program. Thus, student to faculty ratio is about 8:1
The number of courses assigned to each faculty member, (lecturer and above), is two courses, while it is three courses for others.

6.6 Interaction with Students

Every faculty members in the department is requested to allocate a certain number of office hours, depending on his teaching load, per week. These office hours are mainly assigned for helping the students. S/He has the responsibility of making the students aware of the scheduling of these hours. This interaction is much more manifested in; student advising, supervising senior projects, attending senior project exhibitions, professional society advising, and coordinating industrial training. **Table6.4** shows the names of the selected faculty advisors and their number of advisees.

Table6.4: Number of Advisee per Selected Faculty Members

Advisor Name	Advisee Year	No. of Advisee
Dr. Ghaida A. Al-Suhail	4th Year	40
Dr. Fatima Kadhim Hassan	3rd Year	38
Dr. Ali Ahmed Abed	2nd Year	42
Dr. Haroutuon Intranik Hairik	1st Year	65

Chapter7: Criterion7 (Facilities)

7.1 Space

The CoE Department is part of the campus of the college of engineering in Qarmat Ali district, north of Basrah, Basrah, Iraq. The department is a two floors building that incorporates, in it, offices for the faculty members and the supporting staff together with classrooms and laboratories offices:

1. Administrative office: the office of the chairman is located on the second floor of the computer engineering department building with approximately 28 m2, in area.
2. Administrative Supporting Staff; this consists of:
    a. One full time secretary whose job is to administratively assist the chairman; this office is 14 m2, in area, and is directly connected to the chairman's office.
    b. One head's assistant, who is a full-time faculty member whose job is to administratively assist the chairman. This office is 14 m2, in area.

These three offices, the chairman's and the secretary', combine to form the administrative office of the Computer Engineering Department.

3. Faculty offices are allocated in two different levels of the Department's Building. There are 16 faculty offices in the department, each of which is a 14 m2 in area, each faculty (with a PhD) is assigned a separate office. Every faculty office is furnished and equipped with 1 PC and a link to Internet.
4. Storage rooms: There are a total of two storage rooms in the department. Each of these rooms is of 110.25 m2, each.
5. Meeting room**:** this room is about 28 m2, is mainly used for departmental related meetings at different levels. This room is properly furnished and is equipped with data show.
6. Examination Committee Room: it is located at the second floor near the administrative office with 28 m2, in area. Here is where students' records are held. It consists of one printing machine, one PC, and one photocopying/scanner machine.
7. Undergraduate coordinator
8. Postgraduate coordinator: Doing all responsibilites related to postgraduate (MSc. and PhD) students.

7.1.1 Classrooms

The computer engineering department contains 7 halls (6 for undergraduate and 1 for postgraduate students) numbered from 1 to 7. A typical classroom in building is equipped with the following:

- 2X4 m2 Whiteboard (two classrooms are equiped with smart boards).
- Classroom space area 7m X 10.5m (73.5 m_2).

- Split air conditioning units with adjustable temperature.
- Adequate classroom chairs for up to 60 chairs per classroom.

7.1.2 Laboratories

The department of computer engineering has six undergraduate, fully equipped, laboratories, with a total area about 660 m2, all of which are located in the building of the department. These labs are utilized to perform basic experiments needed to help the students understand the engineering concepts covered in the different courses. These Lab facilities could also be utilized used for building the term projects and senior projects as well. The Computer Engineering Labs, however, were structured to be adaptable and upgradable to accommodate the inevitable changes in the CoE curriculum. Enough efforts are exerted sure in order to make sure that lab equipments are kept in good operating conditions. A summary of the 5 departmental laboratories is given, below, in **Table7.1**. The table also shows the courses associated with each lab.

Table7.1: Laboratories' Names, Space Areas, and Associated Courses

Laboratory' Name	Area in m2	Associated Courses
Networks Lab.	110.25	CoE437, CoE337, CoE432
Real Time lab.	110.25	CoE334, CoE437, CoE234
Programming Lab.	110.25	CoE133, CoE135, CoE337, CoE235
Operating Systems Lab.	110.25	CoE335, CoE437
Electrical Circuits lab.	110.25	CoE134, CoE237, CoE231, CoE337, CoE132
Control Lab.	110.25	CoE437, CoE132

The computer engineering students' utilization of the lab space and equipments could be measured in terms of an index representing ratio between the number of students registered in a certain lab and the lab space area, at a given time slot. This is shown in **Table7.2**.

Table7.2: Student Utilizing Space Area Ratio to Instructional laboratories Space Area

Lab's Name	Sunday	Monday	Tuesday	Wednesday	Thursday
Networks Lab.	1st Semester				
	Open all day (34.47%)	Open all day (36.28%)	-	-	Open all day (36.28%)
	2nd Semester				
	Open all day (34.47%)	Open all day (36.28%)	-	Open all day (36.28%)	-
Real Time lab.	1st Semester				
	Open all day (34.47%)	Open all day (36.28%)	-	Open all day (38.1%)	-
	2nd Semester				
	Open all day (34.47%)	Open all day (36.28%)	-	Open all day (38.1%)	-

Programming Lab.	1st Semester				
	-	Open all day (58.96%)	Open all day (34.47%)	Open all day (38.1%)	Open all day (58.96%)
	2nd Semester				
	-	Open all day (58.96%)	-	Open all day (38.1%)	Open all day (58.96%)
Operating Systems Lab.	1st Semester				
	-	-	Open all day (34.47%)	Open all day (36.28%)	Open all day (36.28%)
	2nd Semester				
	-	-	Open all day (34.47%)	-	-
Electrical Circuits lab.	1st Semester				
	-	Open all day (58.96%)	-	Open all day (38.1%)	Open all day (58.96%)
	2nd Semester				
	-	Open all day (58.96%)	Open all day (34.47%)	Open all day (38.1%)	Open all day (58.96%)
Control Lab.	1st Semester				
	Open all day (34.47%)	-	-	-	Open all day (58.96%)
	2nd Semester				
	Open all day (34.47%)	-	-	-	Open all day (58.96%)

7.2 Resources and Support

7.2.1 Software Support

Table7.3 shows the software facilities that have been made available to the computer engineering students. The table also shows the courses in which these software resources are being applied. In general, the applications of a particular software could be very broad and vary from one subject to another.

Table7.3: Software Applications for Different Courses

Software	Course(s)
Microsoft Visual Studio.NET 2010	CoE337, CoE432
Upuntu Linux 9.0	CoE335
OPNET Academic IT Guru 1998	CoE337
AutoCad	CoE135
LabView 2013	CoE437
Borland C++ Compiler	CoE133
Microsoft Office Package 2007, 2003	General

Microsoft Windows XP Professional	**General**
Adobe Reader 9.0, 7.0	**General**
MatLab 2010	**CoE337**
Keil microVision 2	**CoE436**

7.2.2 Department Library

The department does not have its own library; rather its students use the library of the college.

7.2.3 Laboratories

As mentioned before, there are six major labs, in the department of computer engineering, that are fully utilized in computer engineering courses, term projects and senior design projects as well. All laboratories are air conditioned and room temperatures are regularly monitored and controlled in order to ensure an acceptable working temperature, in the normally hot climate of Basrah. The labs are provided with smart boards or Plazma monitoring systems.
The CoE labs are well maintained and properly run by a designated laboratories maintenance committee and the technical supporting team of technicians. The most recent load distribution among the technical staff is shown in **Table7.4**.

Table7.4: Technicians Assigned Responsibilities for the Operation of the Labs

Technician	Lab. Name
Hanna' Abdulsaid Alwan	Networks Lab.
Fatima Ghannam	Operating Systems lab.
Khalid Ali Abbas Alwan	Electrical Circuits Lab.
Hanady Salah Ahmed	Control Lab.
Fatima Ghannam	Real-Time Systems Lab.

Chapter8: Criterion8 (Support)

8.1 Department Budget Allocation Process

The Iraqi Ministry of Finance allocates the annual budget of all Iraqi ministries including the Ministry of higher Education and Scientific Research. The Ministry of Finance exerts all efforts possible in framing and application of the righteous financial policies to improve and develop the available resources for all ministries.
The Ministry of Higher Education and Scientific Research, in turn, allocates the planned annual budget to the University of Basrah which gives the college of engineering its share of the budget. Then, each department gets its own financial part from the college and uses it in fulfilling:

1. Employees' expenditures: employees' salaries, lectures wages, retired faculty salaries, specific expenses, university expenses, risk expenses, affiliation rewards, and other expenses.
2. Services requirements: deputations, ceremonial activities, students' expenses, researches reinforcement, building cleaning expenses, athletic activities, conferences, and banking services.
3. Commodities requirements: all equipment (laboratorial, medical, schooling, agricultural, publications, books, fuels, and others).
4. Equipment maintenance: all maintenances (watery, electrical, buildings, furniture, books, gardens, records, work, and appliances).
5. Funding costs: furniture (wood and metallic), appliances, personal computers, telephones, copiers, printers, books and magazines, calculators, and machines.
6. Other expenses: students and unofficially employed staff.

8.2 Sources of Financial Support

The college of engineering is a governmental institution that funds its activities from:

1. General governmental funds which represents the greatest portion of the budget.
2. Higher education fund which includes:
    a. Laboratorial tests: 65% of funds for test team, 15% for university, 16% for bonuses, and 4% for maintenance.
    b. Shops rent: 15% for university, 68% for bonuses, and 17% for maintenance.
    c. Continuous learning courses: 65% for course trainers, 15% for university, 16% for bonuses, and 4% for maintenance.
    d. Special courses: 65% for course trainers, 15% for university, 16% for bonuses, and 4% for maintenance.
    e. Industry cooperation: 80% for work team, 10% for university, 8% for bonuses, and 2% for maintenance.
    f. Internet Center: 15% for university, 68% for bonuses, and 17% for maintenance.
    g. Student registration fees: 80% for bonuses and 20% for maintenance.
    h. Exams results objections fees: 80% for bonuses and 20% for maintenance.
    i. Self-funding study master and doctorate fees: 50% for students, 25% for lectures, and 25% for other stuff.
    j. Water desalination plant: 15% for university, 68% for bonuses, and 17% for maintenance.

Table8.2 shows a sample of sources and their income.

Table8.2: Sources and Revenue Sample

Item	Revenue
laboratories Tests	739549000
Shop Rents	6850000
Continuous Learning Courses	11125000
Special Courses	9448000
Industry Cooperation	42693000
Internet Center	4625000
desalination Plant	2275000
Total	**816565000**

8.3 Community Service

The CoE department participates through the engineering consultation office in the college in giving consultation services in all fields for governmental and private sector agencies inside and outside Basrah. Also, it participates through the continuous learning unit in the college in giving several developing courses for the governmental sector employees.

8.4 Faculty Professional Development Support

The office of chancellor's assistant for scientific affairs, office of chancellor's assistant for management affairs, department of planning and continuation, and the cultural affairs office in the University of Basrah participate in developing the college of engineering by offering short and long term scholarships for its master and doctorate students as listed in **Table8.3**.

Table8.3: CoE PhD Scholers during 2011-2017

Faculty Name	Scholership	Country
Lu'ai Talib Ali	Since 2013-up-to-date	UK
Mus'aab Adel Ali	Since 2011-up-to-date	USA
Mohanned Hamid Khalaf	Since 2011-up-to-date	USA
Ali Esam Hameed	Since 2012-up-to-date	USA
Intisar Tua'ess Huaidi	Since 2012-up-to-date	USA
Imad Abdulrazzaq Jasim	Since 2013-up-to-date	UK
Ali Nabeel Ibrahim	Since 2013-up-to-date	Australia