King Fahd University of Petroleum & Minerals

Computer Engineering Department

Self-Study Report

Submitted to

KFUPM ABET COMMITTEE

King Fahd University of Petroleum & Minerals, Dhahran

COE ABET COMMITTEE TEAM

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Table of Contents

A. Background Information

1. Degree Titles

The computer engineering (COE) program was established in 1986 as part of the college of computer sciences and engineering at King Fahd University of Petroleum and Minerals. The degree title for those students who satisfactorily complete the program is the Bachelor of Science in Computer Engineering. This is the only Bachelor Degree offered by the program. More details about the program are available in the department website at http://www.ccse.kfupm.edu.sa/coe.

2. Program Modes

There is only one computer engineering program, and all students are full-time day and on-campus program students. The academic year is composed of two 15-week regular semesters in the Fall and Spring semesters and an 8-week condensed Summer. Each graduating student has to complete successfully 131 credits. Each semester credit is one 50-minute lecture a week or 3 hours of lab a week.

The program provides the student two opportunities for industrial training either through two-month summer training program or through 7-month co-op-training program. The summer training program is equivalent 0 credits while the co-op program is equivalent to 9 credits. The student has to submit a progress report on a regular basis during the training period and a final report should be submitted by the end of the training period. A committee will be formed by the department where the student will present and defend his work.

More, the program gives the students the opportunity to pursue concentrations (during the last year of the program) in some subspecialties like Computer Communication and Networks, Computer Architecture, Digital System Design, and Computer Application**.**

3. Contact Information

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B. Accreditation Summary

1. Students

1.1 Admission Procedure

KFUPM has a well thought-out process that has been successful over the years of evaluating student performance, monitoring their progress, and providing them with timely advising. This process starts from the first day a student joins the university and continues till the time him graduates.

An applicant for admission to an undergraduate program at King Fahd University of Petroleum & Minerals (KFUPM) must satisfy the following minimum requirements:

1. He should have Saudi secondary school certificate, or its equivalent, majored in natural or technological sciences.
2. He is required to take entrance exam administered by the National Assessment Center for Higher Education in a large number of centers across the Kingdom which consists of:
   a) The **aptitude test** has two components: Mathematics and Linguistics. The test is aimed at determining the general capabilities of students in the two areas mentioned above.

   b) The **subject test** is an objective type multiple-choice test given in five subjects, i.e., Mathematics, Physics, Chemistry, Biology and English. The objective of this examination is to evaluate the student's knowledge and ability in English and Science.
3. The university assigns certain weight to the three components, i.e., high school grade, the aptitude test and subject test scores. A cut-off point is decided for the weighted average of the applicant's grades in the three components and the eligible students are pronounced successful for admission.
4. The number of students accepted is limited to the number of seats available as decided by the University Council based on the capacity of resources at the University.
5. The applicant must submit the required documents to the University within a specified period.
6. An applicant who has graduated from a secondary school system outside the Kingdom of Saudi Arabia must have completed twelve years of combined primary and secondary school studies from a recognized school. He is also required to provide an equivalency certificate from the Saudi Ministry of Education.

Admission to KFUPM is highly competitive. As explained above, applicants are granted admission in accordance with an overall evaluation on the basis of their academic record plus the entrance examinations, but only to the extent permitted by the maximum number of new admissions established for each academic year. Six

categories of admission are recognized, each is associated with the academic level to which the students are admitted.

1. Admission to the **Preparatory Year Program**: Most newly admitted students spend their first academic year in the Preparatory Year Program. The major objectives of this program are:
   (a) to improve the students' English proficiency and thus enable them to begin the first year of undergraduate studies in English as the principal language of instruction;
   (b) to review and reinforce the students' knowledge of mathematical and analytical techniques (with English)
   (c) to introduce the students to new subject areas and techniques such as physical science and computer science to improve their manual dexterity and develop their practical skills;
   (d) to improve the students' physical well-being through Physical Education courses, and
   (e) to familiarize the students with the rigors of the demanding academic work of a technical university, including all requisite study skills.

   Students are placed at the appropriate levels of the program as they advance through the first year's courses and they are required to pass each level of courses in the curriculum.
2. Partial Promotion to Freshman Level: Students whose performance in the entrance examination is outstanding are given a chance to take the University promotion examination in English and Mathematics. Those who pass the test(s) in one or both the subjects are partially promoted to freshman level and are allowed to take college level courses along with the remaining Prep-Year courses.
3. Promotion to Freshman Level: Students have to score a minimum grade of "C" in all Prep-Year English and Math courses, and a minimum of "D" in all remaining courses to be eligible for promotion to freshman level.

4. No special policy for admission into engineering fields. However, once a student is admitted to the freshman year, he can choose any of the fields of study he wishes, including those in engineering which are open to him.
5. A student seeking transfer to a department from another department at KFUPM, must have the approval of both departments. All courses required by the department to which the student is transferring and which the student has successfully passed are transferable.
6. Admission to Degree Programs with Advanced Standing: As described in *Admission to Advanced Placement* below.

1.2 Advising of Students

Each student is assigned a faculty advisor from his department at the time of his initial enrollment. The academic advisor (AA) is a faculty member in the academic department or the college in which the student is enrolled. The number of students assigned for each AA does not exceed 20 to ensure the effectiveness of the advising system. AA is available to solve any problem that might arise during the student program. The advisor of the preparatory year students is the Director of the Preparatory Year Program or anyone he authorizes to act on his behalf. The University considers student advising by faculty as an important teaching-related activity. AA is expected to advise students in planning their academic programs during early registration, registration and throughout the academic year whenever a student seeks his advisor's input in academic matters. A student advisor has four major roles:

1. Advise and help students in early registration and registration formalities,

2. Provide guidance in dropping and adding courses and in improving academic performance,

3. Ensure that the students understand the academic regulations and follow their academic programs in a sequential order, and

4. Follow-up the students' academic progress, especially those who are not in good academic standing.

The students have access to an electronic copy of the undergraduate bulletin which describes elaborately the program requirements:
http://www.kfupm.edu.sa/kfupm/admissions/undergrad_bulletin.pdf

Also, a hard copy of the bulletin is available at the university Bookstore.

At the beginning of the early registration and registration period, the Deanship of Admissions & Registration supplies the list of advisees assigned and the most recent transcripts of student's academic records and their degree audit (Analysis of Degree Programs) to each advisor for his use. A student selects his courses in a semester in consultation with the advisor, who ensures that the courses are chosen appropriately in accordance with the degree plans, satisfying the prerequisites and other specific requirements of the courses and complying with the minimum and maximum course loads allowed for early registration and registration of courses by students. An advisor must be closely familiar with the regulations of the University, which are specified by the Deanship of Admissions & Registration.

A mid-semester week is designated as the early registration week of the next semester. On early registration, a student can make changes to his course selection with the consultation and approval of the advisor. Students are allowed to early register after they have consulted with their academic advisors. It is the duty of the academic advisor to assist his advisees in interpreting and understanding the academic regulations, in choosing the required and the elective courses in the desired sequence, in verifying the

degree requirements for graduation, and in improving academic performance. The advisor can also review these courses on-line to monitor the student choices. The university's automated registration system checks for pre- and co-requisites and does not allow students to enroll in a course when they have not successfully completed or currently taking all requirements for their courses. The automated system allow a student to register based on courses currently registered (not completed yet), the system will automatically drop the courses if the student did not successfully completed the pre-requites.

The early registration and confirmation of the registration are performed online using the Deanship of Admission and Registration (DAR) website: (http://regweb.kfupm.edu.sa) through the Internet. The use of on-line registration in the last two years has produced effective results in reducing the time and effort for registration process.

All the information needed to guide and help the students to conduct the registration process are provided in details in this web-page: http://regweb.kfupm.edu.sa. Moreover, the registration instructions for advisors are provided. In addition to the courses schedule, timing, and locations of the registration, the web-page includes registration procedure, steps for adding and dropping courses, and section changing.

The minimum course load is 12 credit hours during a regular semester. This condition is relaxed in the last semester before graduation. The maximum course load is 19 credit hours.

However, students who are not on good status, the maximum course load is 13 credit hours. Also, preparatory year students who are promoted to freshman level with cumulative GPA less than 2.00 should not exceed 13 credit hours. Students having early-registered in more than 13 credit hours should drop course(s) to bring the course load within 13 credit hours. Otherwise, their course(s) will be dropped after the last day of adding.

For students on good academic standing status, the total number of credit hours registered by a student in any two consecutive semesters should be at least 28. A student is permitted to register for 21 credit hours with the approval of the department chairman if the student has maintained a minimum cumulative GPA of 3.00 out of 4.00 in all works undertaken during the preceding terms in which he earned his last 28 credit hours.

The registrar frequently updates the bylaws and procedures concerning this matter.

The university has established a special office called "Counseling and Advising Center (CAAC)" (http://www.kfupm.edu.sa/caac/) under the Deanship' of Student Affairs for this purpose. Counseling is a collaborative process, which involves the development of a unique, confidential help-oriented relationship. The CAAC treats all of its contacts with students in a highly confidential manner. The CAAC has a number of professionals specialized in social counseling. The center provides the following counseling services:

1 Individual Counseling: A student meets with a counselor on a one-to-one basis to work through personal concerns.

2 Group Counseling: Counseling in groups offers a broad range of insight and support from peers and professional counselors.

3 Couples Counseling: Couples counseling works toward alleviating the strains in a close relationship. In such cases, one of the relatives, usually the father or a brother, are contacted and asked to visit the center.

The campus medical center in the university provides professional counseling when necessary through a psychiatry physician. It also provides transferring to other around hospitals.

1.3 Monitoring Students' Progress

KFUPM registrar office prepares a document called degree audit for every student. The degree audit is a summary of the individual student's graduation status. It contains a list of all courses that must be completed by the student to meet the graduation requirements of his chosen major, which of those courses have actually been completed, which are left to be completed, and an estimated graduation time given normal semester course loads. In summary, the Academic Department Head and the Registrar are jointly responsible to ensure that all students meet the program requirements.

1.4 Requirements for Graduation

To become eligible for a Bachelor of Science degree in an engineering program, a student must fulfill the following requirements:

- Cumulative and major GPAs of 2.00 or higher on a 4.00 point scale.
- Completion of the number of semester-credit-hours required by the department.
- Completion of the prescribed and elective academic work required by the department.

Every student follows a degree plan to monitor progress through his program and to certify that all graduation requirements are fulfilled.

1.5 Institution Policies for Acceptance of Transfer Students

1.5.1 Transfer of a student from outside KFUPM

The transfer of a student from outside the KFUPM may be accepted under the following conditions:

1. The student should have been enrolled at a recognized college or university.

2. The student must not have been dismissed from that institution for disciplinary reasons.

3. The student must satisfy the transfer provisions as determined by the University Council.

All transfer applications are submitted to the Admission and Academic Standing Committee, which evaluates and ensures that the applicant fulfills the mentioned requirements, in addition to any other provisions the committee deems necessary, in coordination with the colleges concerned. If, after his transfer, it is discovered that a student had been dismissed from his previous university for disciplinary reasons, his enrollment will be considered canceled as from the date of acceptance of his transfer to the University.

Transfer students are evaluated as follows.

- If a student wishes to transfer courses from another university, the Deanship of Admissions and Registration forwards to all concerned departments the relevant materials for evaluation stating the courses the student desires credit in.
- The Department chairman requests the curriculum committee chairman to perform these evaluations and to maintain consistency in evaluating transfers.
- The College Council reviews the courses taken by the student outside the University based on the recommendations of the department, which offer equivalent courses.
- If the student has earned grades of 'C' or the equivalent or higher in courses taken at a recognized university which are judged sufficiently equivalent to individual course requirements listed in the student's chosen degree program at KFUPM, the corresponding KFUPM courses are waived and the "C" grade or above gained elsewhere are transferable as pass grades.
- The evaluation of academic transcripts from other institutions is done by the academic department concerned.
- The Deanship of Admissions & Registration coordinates this evaluation for the final transfer of credits.
- To qualify for an undergraduate degree: from KFUPM, a student must acquire a minimum of **36** semester-credit hours of course work at KFUPM, including a minimum of **18** credit-hours in his major.

The detailed policies and regulations regarding credit transfer of students are described in the KFUPM Undergraduate Study and Examinations

1.5.2 Transfer of within KFUPM colleges

A student may be transferred from another college to the program inside the university in accordance with University Council rules as follows:

1. A student may transfer from another college within the university into the program before he completes the sixth academic level.

2. The student should continue to study all the courses registered for at the level preceding the transfer, in compliance with the adding and dropping rules.

3. The transfer from one college to another will be recorded in the academic record of the student the term following his transfer.

4. A student is allowed a maximum of two transfers from one college to another.

The academic record of a student transferred from one college to another includes all the courses he has studied together with the grades, the semester GPA and cumulative GPA obtained throughout his period of study at the university.

1.5.3 Transfer within CCSE college

With the approval of the Dean of the College, a student may transfer from one department to another within the college t according to the following rules:

1. A student may transfer at any time before he completes the sixth academic level. The College Council may consider exceptional cases where students have already completed the sixth level.

2. The transfer will be recorded in the academic record of the student at the beginning of the term following the transfer.

3. A student is allowed a maximum of two transfers within the same college. The college council may consider exceptional cases.

The academic record of a student transferring from one major to another will include all the courses the student has taken, including the grades, the semester GPA and cumulative GPA obtained throughout his period of study at the University.

2. Program Educational Objectives

2.1 Introduction

The Program Educational Objectives (PEOs) of the Computer Engineering Department of KFUPM are supported by the COE program learning outcomes in accordance with the declared mission of King Fahd University of Petroleum and Minerals (KFUPM) and the objectives of the College of Computer Sciences and Engineering (CCSE).

The KFUPM mission and the CCSE objectives, which drive the education and shape the identity of the engineering graduates of the Computer Engineering (COE) department, are reviewed in the following paragraphs.

2.2 KFUPM Mission

King Fahd University of Petroleum and Minerals (KFUPM), founded in 1963, is one of the most prestigious institutions of higher education in the Middle East region. As one of the distinguished technical universities in the Kingdom of Saudi Arabia, the resources of the University constitute an invaluable asset for the intellectual, economic, and social enrichment of the Kingdom.

As an institution of higher learning, KFUPM is committed to:

a. Preparing professionals empowered with the knowledge, skills, values and confidence to take a leadership role in the development of the Kingdom in the fields of science, engineering, environmental design and business.

b. Producing research that contributes to the knowledge and sustainable development of the Kingdom and region by providing innovative solutions to identified economic and technical problems and opportunities.

c. Providing a stimulating campus environment for the welfare of its students, faculty and staff, and offering outstanding professional services and out-reach programs to the society at large

2.3 KFUPM Vision

The university's vision is *"To be a vibrant multicultural University of international repute focused on quality education and innovative research that prepares professionals and entrepreneurs to lead social, economic and technical development in the region."*

The mission and vision of KFUPM is posted on its web site at:

http://www.kfupm.edu.sa/opq/University_Mission_Vision_Values.html

2.4 College Objectives

The College of Computer Sciences & Engineering (CCSE) was created in 1986. It was the result of reorganization based on grouping computer-related disciplines together to better serve the development plans of the Kingdom.

The main objectives of the college are:

1. To provide the skilled manpower needed for the fulfillment of the country's development plans. In particular: information & computer scientists, computer engineers, and systems engineers.
2. To prepare students for graduate work and research in their field of specialization.
3. To provide a link through which computer technologies and their applications could be transferred to the country.
4. To provide the country, through research and graduate studies, with skills, ideas, and innovations in certain areas of advanced technologies.

The CCSE objectives are posted on the college web site at: http://www.ccse.kfupm.edu.sa/ccse-web/pages/page.php?page=Objectives

2.5 Computer Engineering Program Educational Objectives (PEOs)

In consistency with the mission of the University and the CCSE objectives, the following Educational Objectives were adopted for the Computer Engineering Program:

The objectives of the **computer engineering program** are to produce computer engineering graduates who are prepared to:

1. Practice their profession with confidence and global competitiveness and make intellectual contributions to it;
2. Pursue a life-long career of personal and professional growth with superior work ethics and character and
3. Pursue advanced study and research at the graduate level.

These PEOs were formulated in light of the declared university mission and college objectives. They were adopted by the COE department council on Sunday November 12, 2006 after an elaborate discussion of an initial set of PEOs that were proposed by a departmental subcommittee commissioned for this task. Further, the COE department council has discussed and ratified an assessment strategy together with a review process to evaluate the extent to which the COE program achieves these PEOs. The assessment strategy and review process involve the COE department constituency at various levels as will be detailed in the coming sections.

The Computer Engineering PEOs are closely related to and are consistent with the KFUPM mission. For instance, the first and second objectives directly serve item (i) of KFUPM's mission while the third objective directly serves item (ii). Likewise, the COE PEOs are directly related to and serve the CCSE stated objectives. For instance, the first

and second PEOs directly serve CCSE's first and third objectives while the third PEO serves CCSE's second and fourth objectives.

The Computer Engineering program educational objectives (PEOs) are published on the departmental web site at:

http://www.ccse.kfupm.edu.sa/coe/

2.6 Constituencies

The major Computer Engineering program constituencies are:

1) Faculty

2) Students

3) Industrial Advisory Board

4) Alumni and

5) Employers.

The review process of the PEOs involves all of the above constituencies. The PEOs establishment process, however, has only involved a subset of these constituencies. The constituents mainly influence the objectives through their interaction with faculty (directly during meetings or indirectly through surveys). The conclusions of these discussions and interactions are carried forward by the faculty who then formulate any changes or additions to the program educational objectives or outcomes.

2.7 PEO Assessment Process

The review process of the COE department PEOs will be conducted every **four years** with the next review to be conducted in the academic year 2011-2012. Assessing the extent to which the PEOs are achieved is, however, an ongoing process through various assessment tools. It is only that every fourth year, assessment data collected from the various sources throughout the past four years will be compiled, analyzed, and corrective actions and/or refinements of the PEOs will be conducted as needed. Following is a list of the assessment tools that will be used for this purpose.

2.8 PEO Assessment Tools

The review process of the COE department PEOs involves all of the department constituencies. The PEOs will be assessed using the following tools:

1. Student input through student Exit Surveys:

   Students graduating from the COE program will be surveyed upon finishing all their program requirements to determine their perception of their own readiness for their chosen careers.

   This process is conducted at the end of each semester.

2. Employer input is collected through two mechanisms:

    a. Direct surveys of known employers of COE graduates (preferably at the executive level). This is done once every four years.

    b. Every semester, employers of COE coop students are asked to fill an evaluation form (for each student) that include questions related to the COE PEOs and learning outcomes.

3. Alumni input regarding the COE PEOs and learning outcomes is collected every two years through surveys.

4. Advisory board input is sought on an annual basis through direct meetings, discussions and surveys

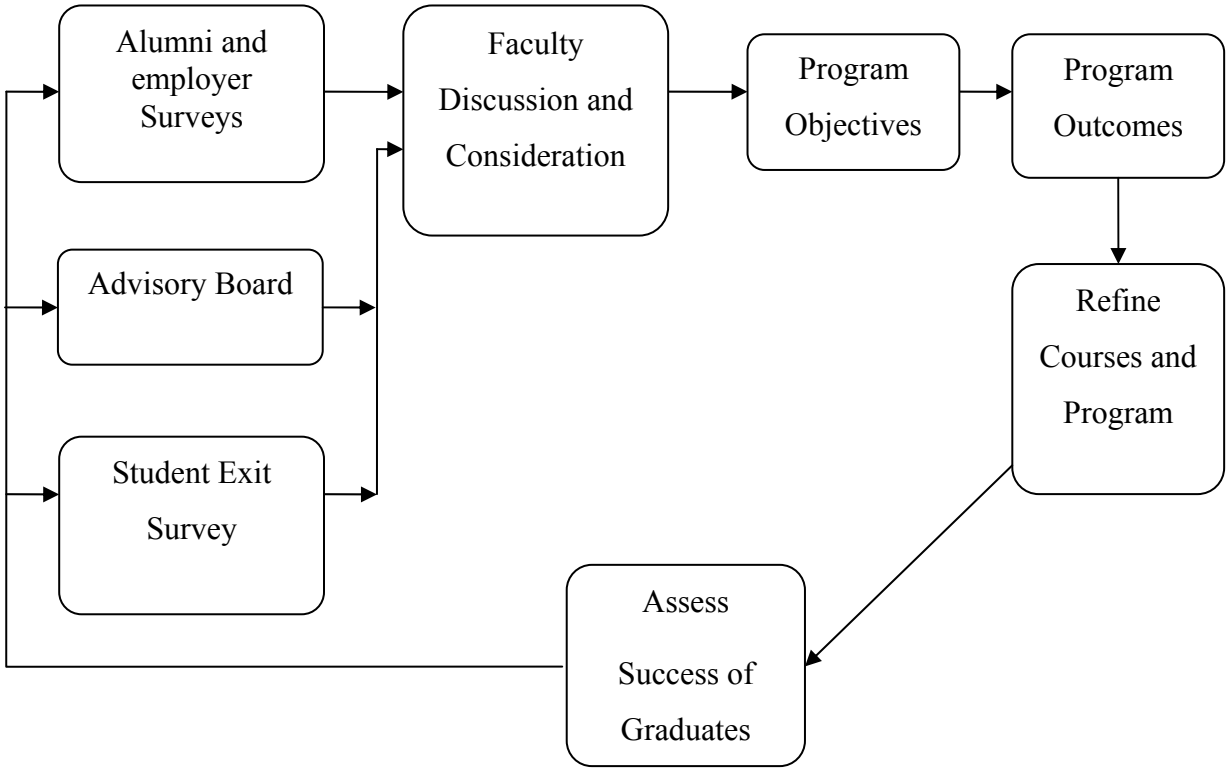


Figure 1. High Level Overview of the PEOs Assessment Process

Figure 1 shows an overview of the COE department assessment process for the COE PEOs.

Highlights of this process are given below:

i. The COE department will appoint a standing Assessment Committee (AC) to supervise, coordinate and collect results of various assessment tools as described above.
ii. By the end of each academic year, the undergraduate committee (UC) will analyze the assessment data for this year and report its findings to the department council. If needed, the committee, based on assessment results, may suggest quick remedial actions that have to be approved by the department council.
iii. Every four years (PEO review cycle), the COE department chair initiates the program objectives review process in the fall semester of the review year by appointing a special Program Assessment Committee (PAC). The chairman of the UC should be a member of the PAC.
iv. The PAC compiles all of the assessment data, UC reports for the past four years together with all remedial actions implemented during that period based on which PAC may recommend certain actions including refinement to the COE program courses, course outcomes and/or PEOs and program outcomes. Further, PAC may suggest major revision of the COE program, including suggestions for incorporating options/streams in the program. PAC will report its findings and recommendations to the COE department council.
v. The UC has primary responsibility for monitoring the success of the COE program in meeting its stated objectives. To this end, UC will
    a. assess the level of success of the COE program in meeting the program outcomes;
    b. make recommendations for improvements in COE courses to the department council based on this review;
    c. follow up on program changes recommended previously to ensure that they are meeting their goals; and
    d. prepare an annual report documenting the committee's findings and recommendations for program and course improvements.
    e. The COE Department will maintain all course files, records of all assessment reports, and refinements adopted in the undergraduate program.

vi. PAC has the primary responsibility of evaluating the success of the COE program in meeting its PEOs. To this end, PAC will:
    a. analyze assessment data for the past four years, taking into consideration adopted remedial actions during that period
    b. based on the above analysis, determine the level of success of the COE program in meeting its stated objectives, and identify areas of improvement
    c. propose ***strategic*** recommendations to the department council regarding necessary changes/revision in the COE program, its program outcomes, or the PEOs;
    d. follow up on implemented program changes/refinements to ensure that they are meeting their goals; and

e. prepare a report documenting the committee's findings together with strategic recommendations for program and course improvements.

3. Program Outcomes

3.1 Outcomes of the Computer Engineering Program

After review of the ABET Criteria and the program objectives, the faculty have decided that the ABET Criteria (3a-3k) encompass the spirit of our educational vision, and therefore, have chosen these in addition to three more outcomes recommended by ABET for computer engineering programs as the outcomes of the computer engineering program.

The Compute Engineering program outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
Our interpretation of multidisciplinary teams includes teams of individuals with similar educational backgrounds focusing on different aspects of a project as well as teams of individuals with different educational backgrounds.
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
Our intrepretation of this includes teaching students that the underlying theory is important because the technology will change, coupled with enahncing their self-learning ability.
(j) knowledge of contemporary issues
Our interpretation of this includes presenting students with issues such as the impact of globalization, the outsourcing of both engineering and other support jobs as practiced by modern international companies.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(l) Knowledge of Probability and Statistics and their applications in Computer Engineering
(m) Knowledge of Discrete Mathematics
(n) The ability to design a system that involves the integration of hardware and software components

It should be noted that outcomes (l) and (m) were added to the program outcomes as knowledge of probability and statistics and knowledge of discrete mathematics are considered important for computer engineers and they were added as was recommended by ABET for computer engineering programs. Outcome (n) was added to the program outcomes in order to emphasize in our program integration aspects between hardware and software components in the design process. This is different from outcome (c) which focuses on design aspects in general which may not include the integration of both hardware and software components.

3.2 Relation of Program Outcomes and Educational Objectives

The Computer Engineering program education objectives are served by the Program Outcomes. The relationship illustrating the program outcomes serving each objective is mapped in Table I given below. Below we describe the relation between program education objectives and outcomes in more detail.

Objective 1: Practice profession with confidence and global competitiveness and make intellectual contributions to it

In order for computer engineering students to be able to practice their profession with confidence and global competitiveness, students must have the basic and fundamental knowledge of mathematics, science and engineering and they should be able to apply it in formulating and solving computer-engineering problems. They should be able to design the required experimental setup and know how to interpret the collected data to help them analyze the problem they are facing and lead them to effective solutions. The students must have the required skills and experience with modern tools to enable them perform the targeted tasks. Computer engineering profession often involves design aspects that need to meet specific targets like cost, speed, power, etc. They are also often based on teamwork that demands good experience on how to work effectively within a team to maintain global competitiveness. Thus, our program focuses on enhancing our students design abilities by integrating design aspects in many courses and includes system design issues that focus on integration of hardware and system components, which is a common practice nowadays in computer systems design. In addition, teamwork is encouraged throughout the program in lab work and in all course projects and senior design project. A necessary aspect of successful engineers is their abilities to communicate their ideas effectively in presenting their work or in sharing information with other team members. This is one of the important outcomes addressed by our program. Preparing the students in all these aspects will give them the confidence to practice the computer engineering profession and be able to make contributions to it.

Objective 2: Pursue a life-long career of personal and professional growth with superior work ethics and character

The computer engineering field is one of the fields that are growing rapidly. This puts a requirement on engineers to develop their knowledge and skills to remain up to date and to grow in their profession. Thus, it is important to train the students on how to acquire knowledge and be able to learn it. Ability to engage in life-long learning is an important aspect of our program as often computer engineers have to learn a new programming language or to learn the use of a new engineering tool. In order for our students to be able to grow professionally in their career, they must be trained to practice their profession with superior work ethics and character. In addition, they must be aware of the impact of engineering solutions in global and societal context and be aware of contemporary issues affecting their economy and career.

Table I. Program outcomes related to program educational objectives.

Program Educational Objectives	Program Outcomes
1. Practice profession with confidence and global competitiveness and make intellectual contributions to it	a, b, c, d, e, g, k, l, m , n
2. Pursue a life-long career of personal and professional growth with superior work ethics and character	f, i, h, j
3. Pursue advanced study and research at the graduate level	a, b, e, g, i, k

Objective 3: Pursue advanced study and research at the graduate level

This objective is aligned with one of the university objectives in preparing our students for pursuing advanced study and research at the graduate level. For students to be well-prepared for pursuing graduate studies, they must have the necessary foundation in mathematic, science and engineering to formulate and solve research problems. They should be skillful at using necessary tools to allow them to perform necessary experiments to evaluate their proposed solutions. In addition, they must have excellent

self-learning ability, as graduate studies and research require reading and understanding other published work. Excellent writing skill is an important aspect of graduate studies to help the student in his Thesis write-up and in publishing his research work.

3.3 Program Outcomes Coverage in Curriculum

In order to guarantee that the outcomes of the computer engineering program will be achieved by students by the end of the program, it is necessary that these outcomes be injected and be well covered throughout the program curriculum. We have decided that the program outcomes should be covered by core courses in the program. Each program outcome is addressed by a set of core courses in the program increasing the likelihood of its achievement by the end of the program.

The learning outcomes of each core course are mapped to the program outcomes with a level of emphasis being either low (L), medium (M), or High (H). The level of emphasis is related to the weight used for assessing an outcome in each course. For each core course, faculty members have agreed on a minimum weight that should be used in the assessment of each course outcome. This minimum weight guarantees a minimum level of coverage for an outcome in a course and is used for deciding the level of coverage for the program outcome corresponding to the course outcome.

The level of emphasis for an outcome is determined based on the weight as follows:

- When the course outcome weight is < 10%, it will be given a Low rank (L).
- When the course outcome weight is between 10% and 20% it will be given a Medium rank (M).
- When the course outcome weight is ≥ 20% it will be given a High rank (H).

Table II shows the mapping between course outcomes and program outcomes. The program outcomes are covered in an overlapping manner over the program's curriculum core courses. Design capabilities are well covered in several courses. The ability to apply knowledge of math, science and engineering to solve engineering problems are also well addressed in several courses. Teamwork is encouraged in all courses with lab work and/or project. Ability to design and conduct experiments is covered in courses involving lab work and other related courses. The use of engineering tools is also emphasized in all courses with lab work and those having a course project. Students are also trained on self learning abilities in several courses. Communication skills are emphasized in all courses with a project in addition to the seminar course, coop and summer training. The seminar course (COE 390) is focused on enhancing students' oral presentation skills. In addition, a focused course on technical report writing (ENGL 214) is taken by all students and is focused on enhancing their writing skills. A dedicated course (IAS 211) that educates students on ethical issues and professional ethics is taken by all students. In addition, computing ethics aspects are covered in the seminar course (COE 390). Impact of engineering solutions on global and societal context is addressed in the seminar course (COE 390) and in the senior design project. Knowledge of contemporary issues are also

addressed in the seminar course (COE 390), the senior design project and in other courses taken by the students from Islamic department.

Detailed course outcomes and their mapping to program outcomes are shown in Appendix I.

Table II. Coverage of program outcomes by core COE courses.

	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**
COE 202	H		H								L			
COE 203		M	H	L			L				H			
COE 205			H	L					L		L			
COE 305	M	L	H	L	H				L		L			
COE 308	H		H		L				L		L			
COE 341	M		H		H				L		L			
COE 344	M	L			H					L	L			
COE 360	L	L	H	L			L				M			
COE 390						M	H	L	M	M				
COE 400	M	M		M	L		M		L		L			H
COE 485	L	M	H	M	L	L	M	L	L	L	M			
COE 351			H	M		M	H		M		M			
COE 399				M		M	H		M		H			
STAT 319												H		
ICS 252													H	
IAS 211						H								
ENGL 214							H							

3.4 Program Outcomes Assessment Process

One of the important aspects considered in developing the assessment process is to design a process that will help in making effective program improvements while being efficient and maintainable. The proposed assessment process is shown in Figure 1 and is based on the following key steps:

1. Once the program educational objectives are derived based on input of all program constituents, program outcomes are revised and updated to cover the program educational objectives.
2. Based on the program outcomes, it is decided in which course each outcome will be covered and the level of emphasis of an outcome as has been described in the previous section. In this step, it will be ensured that all program outcomes are well addressed and covered in the curriculum through mainly the core courses of the program.
3. Course outcomes will be assessed both directly and indirectly by course instructors and each instructor indicates based on his assessment of course outcomes whether the outcomes are achieved or they need improvement. In case an outcome needs improvement, the faculty member provides suggestions for improving the coverage of that outcome the next offering of the course.
4. Then, for each program outcome, a set of assessment methods are determined that will be used for assessing this outcome. In addition, a performance criteria will be set to determine whether the program is considered met or not. This is based on developing rubrics that are used to assess and evaluate an outcome. The program outcomes assessment is decided to be independent of the course assessment and grading process and it is mainly based on a set of high level courses, a set of surveys and a COE exit exam. The following set of courses and surveys in addition to COE Exit exam and Industry Advisory Board input are used in the assessment of program outcomes:

    - COE 390: Seminar
    - COE 400: System Design Lab
    - COE 485: Senior Design Project
    - COE 350/351: Co-Operative Work
    - COE 399: COE Summer Training
    - Graduate Exit Survey
    - Alumni Survey
    - Employer Survey
    - COE Exit Exam
    - Industrial Advisory Board input

    More details will be given later in this section on the assessment of program outcomes and the assessment methods used.

The department has formed two committees to take care of the assessment process, the assessment committee and the undergraduate committee. The assessment committee is responsible for the design and control of the direct and indirect assessment processes, data collection and presentation, and the data delivery to the undergraduate committee.

The Assessment Committee has the following two tasks:

1. Design the ***indirect*** assessment tools and plan and schedule the indirect assessment process. The task involves the following subtasks:

(i) Design web-based indirect assessment tools such as surveys for course outcomes, graduating students, Alumni, employer, and Advisory board, etc.

(ii) Set up a plan and a schedule for T062 for carrying out all indirect assessment.

(iii) Supervise the assessment process according to the plan and time, and generate statistical distribution in the form of graphical output for each tool-question to be delivered to the Undergraduate Committee.

2. Design the ***direct*** assessment tools and supervise the direct assessment process. The task involves the following subtasks:

(i) Design web-based direct assessment tools such as evaluation forms for faculty course teaching, exit exam, course project, oral presentation, lab report, project report, capstone report, teamwork, etc.

(ii) Schedule and coordinate the exit exam and its grading.

(iii) Provide guidelines for the Faculty on how to use the web-based evaluation forms and corresponding data collection.

(iv) Supervise the assessment process according to the plan and time, and generate statistical distribution in the form of graphical output for each tool-question to be delivered to the Undergraduate Committee.

The Undergraduate Committee (UC), in addition to its current duties, is responsible of the following task:

(i) Carrying out analysis of direct and indirect assessment data provided by the Assessment Committee and the Faculty based on course assessment results.

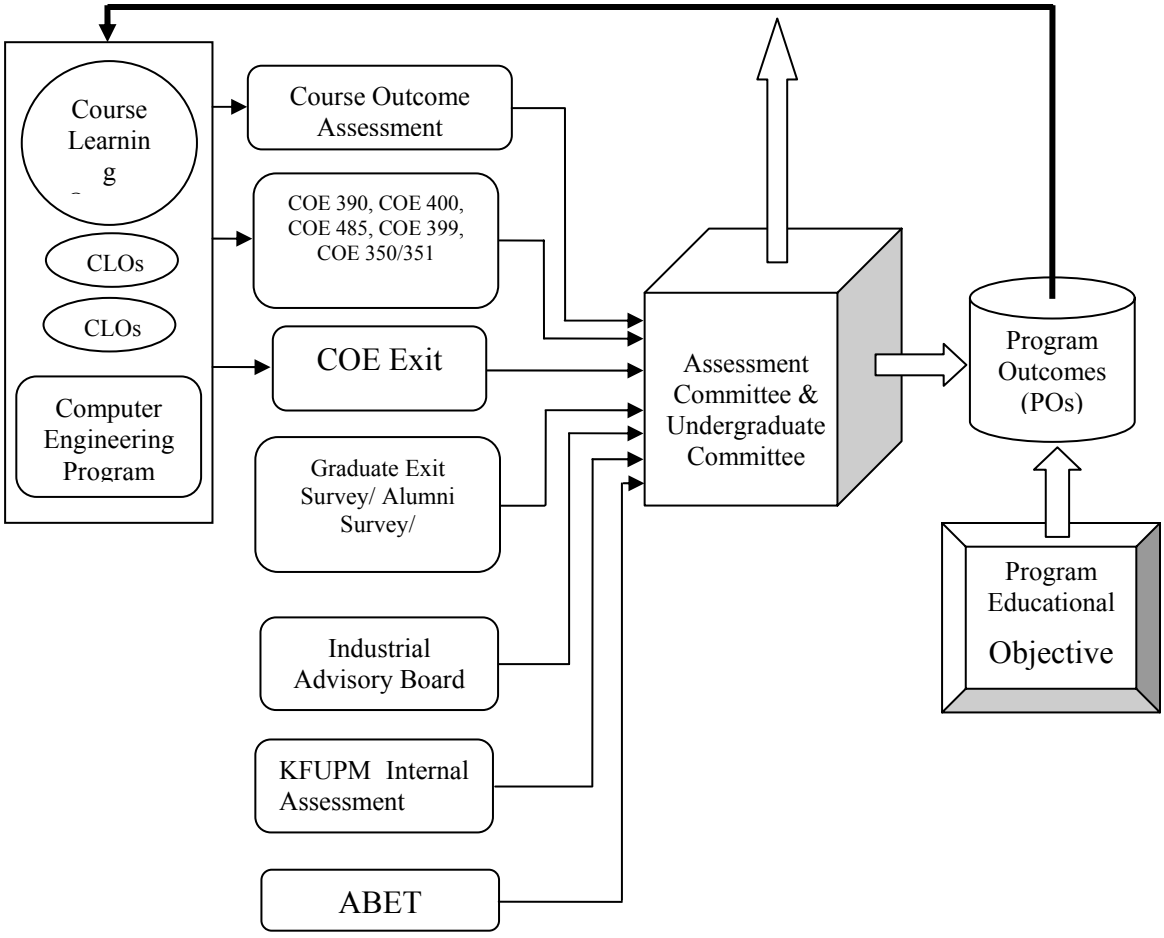
(ii) Based on analysis of assessment data, identify potential problems and suggest recommendations for making improvements. This may include more emphasis in outcome coverage in courses or recommendations for curriculum revisions.

(iii) Implementing approved recommendations.

6. The university performs internal assessment of the computer-engineering program every three years. Also, ABET assesses the program every six years. Comments received through this assessment process will be taken into account in revising program outcomes and covering them in courses.

Next, we will cover the assessment methods used in more detail in the following subsections.

Figure 1 Program outcomes assessment process.



3.4.1 Course Outcomes Assessment

For each course in the computer engineering major, faculty involved in teaching the course have prepared a **Course Learning Outcomes Table** that includes the following for each outcome:

- **Outcome indicators and details**: this describes the main course topics that will be focused on to achieve the outcome.
- Suggested assessment methods and metrics.
- **Outcome minimum weight**: this indicates the importance of the outcome in the course. It is the minimum weight from the total course score (out of 100) that must be used for assessing the outcome or covering the outcome in the course.
- A mapping between the course learning outcome and ABET program outcomes.
- Each outcome is given a rank as **Low, High, or Medium** that correlates with the weight used for assessing the outcome. This weight will be used in the final mapping table between courses and ABET program outcomes.
    - When the course outcome weight is < 10%, it will be given a Low rank (L).
    - When the course outcome weight is between 10% and 20% it will be given a Medium rank (M).
    - When the course outcome weight is ≥ 20% it will be given a High rank (H).

Course learning outcomes tables for all core computer-engineering courses are given in Appendix I.

Course outcomes are assessed by course instructors both directly and indirectly. One suggested way to report the direct assessment of course learning outcomes is based on using **Course Learning Outcomes Evaluation Table** that includes the following for each outcome:

- **Outcome minimum weight**: this indicates the importance of the outcome in the course. It is the minimum weight from the total

course score (out of 100) that must be used for assessing the outcome or covering the outcome in the course.

- **Outcome weight**: this is to be filled by the instructor indicating how much weight was used by the instructor for assessing the outcome.
- **Assessment Method**: this describes what methods were used to asses the outcome, the weight of each method, and the evidence of assessment.
- **Class Average:** indicates the student's average performance in the outcome.

It should be noted that the evaluation criteria for each outcome is flexible and can vary from an instructor to an instructor. However, it should be constrained with the minimum weight specified.

An example of course learning outcomes evaluation table is given in Table III.

Class average for an outcome is computed by adding the average weights obtained from each assessment method used for the outcome divided by the total outcome weight. An example is shown below:

Class Average of Outcome 1 = [Assignments (12.1) + Quizzes (5.3) + Exam I (9.5) + Exam II (12.1) + Lab Work (4.1) + Project (7)] / 71 * 100 = 50.1/71*100 = 70.6.

Faculty may use the proposed outcome evaluation table or other methods to report the assessment of course learning outcomes. The important component in the direct assessment process is that each faculty must address the following important points for each outcome:

- Whether a course outcome is considered achieved with satisfactory levels or not and provide justification for that.
- If an outcome needs improvements, suggest possible actions for improvement in the next offering of the course.

Course outcomes are also assessed indirectly through the use of a questionnaire in the last week of the semester. In this questionnaire, students are asked to evaluate their course outcome achievement in the course. An example of indirect outcome assessment form is given in Table IV. The achievement of each course outcome is rated as either: Excellent (E), Good (G), Average (A), or Poor (P). A composite value is computed for each outcome out of 4. If the composite value of any outcome is below **2.5**, the instructor needs to comment on this and suggest corrective actions for improvement.

The Undergraduate committee will review and evaluate the course assessment results every semester within the first two weeks of the beginning of a semester. Then, a report will be generated summarizing the findings and suggesting recommendations for

addressing outcomes who achievement found need improvement to the department. The findings and suggested recommendations will be sent to all faculty members and discussions will be held in a department council. Once recommendations are approved, they are implemented by concerned faculty in related courses.

3.4.2 Program Outcomes Assessment

In this section, we describe how each program outcome is assessed. For each program outcome, an assessment and evaluation plan is developed that contains the following elements:

1. ***Assessment and Evaluation Methods:*** This describes what assessment methods are used to collect data and how will the data be evaluated and interpreted.
2. ***Performance Criteria:*** This determines the criteria used to indicate that an outcome has been achieved with satisfactory levels or needs improvement.
3. ***Implementation Plan:*** This indicates how the outcome will covered in the curriculum and if an outcome needs improvement where in the curriculum improvements need to be made to improve outcome coverage.
4. ***Logistics:*** This indicates when the data will be collected and who will collect it, interpret it, and report the results.
5. ***Feedback:*** This section specifies who needs to know the results to improve the program outcomes achievement and assessment process.

Before we describe the assessment and evaluation plan for program outcomes, we briefly describe the assessment methods used in the assessment of program outcomes.

(i) ***Industrial Advisory Board***

The industrial advisory board consists of members from industrial organizations, which hire a good percentage of our graduates. The industrial advisory board will be asked to provide their input on the program learning outcomes and how they are covered in the courses. They will also be asked to provide feedback on the achievement of program outcomes by our graduates and which outcomes need to be improved through the program. Whenever possible, they will also be asked to evaluate some of students work especially the senior design project and co-operative work, through which many of the program outcomes can be assessed. Meetings with the industrial advisory board will be arranged once every semester or once every year at the latest.

(ii) ***Employer Survey***

Our students take either a six-week summer training program or a twenty-eight week co-operative work program. During these activities, a faculty member and a company supervisor supervise the students. Company supervisors are asked to evaluate the performance of the students during these activities. We will use employer survey to ask employers to assess the program outcomes achievement by the students. In addition, employer surveys will be sent to companies who hire our graduate students.

Table III. Course learning outcomes evaluation table example.

COE 205 Computer Organization and Assembly Language Programming

Outcome	Outcome Min. Weight	Assessment Method								
		Assignments	**Quizzes**	**Exam I**	**Exam II**	**Exam III**	**Final Exam**	**Lab Work**	**Project**	**Total**
O1	**55%**	**15%**	**8%**	**15%**	**20%**			**5%**	**8%**	**71%**
	Average	12.1%	5.3%	9.5%	12.1%			4.1%	7%	50.1%(70.6%
	Evidence	#1-4	#1-4, 6	Q1-5	Q1-5			#1-13	Report	
O2	**4%**							**5%**		**5%**
	Average							4.1%		4.1% (82%)
	Evidenc							#1-13		
O3	**15%**						**20%**			**20%**
	Average						11.8%			11.8% (59%)
	Evidenc						Q1-5			
O4	**2%**		**2%**							**2%**
	Average		1.3%							1.3% (65%)
	Evidenc		#5							
O5	**2%**								**2%**	**2%**
	Average								1%	1% (50%)
	Evidenc								Report	
Weight		**15%**	**10%**	**15%**	**20%**		**20%**	**10%**	**10%**	**100%**

Table IV. Course learning outcomes indirect assessment form example.

COE 205 - Computer Organization & Assembly Language Course Outcomes Assessment						
Instructor:			**Term:**			
Criteria	**Student Evaluation**					
	E (4)	**G (3)**	**A (2)**	**P (1)**	**NA (0)**	**Composite**
1. As a result of this course, my ability to analyze, design, implement, and test assembly language programs can be described as,	10	5	3	2		3.15
2. As a result of this course, my ability to use tools and skills in analyzing and debugging assembly language programs can be described as,						0
3. As a result of this course, my ability to design the datapath and control unit of a simple CPU can be described as,						0
4. As a result of this course, my ability to demonstrate self-learning capability can be described as,						0
5. As a result of this course, my ability to work in a team can be described as,						0
	Number of Responses: 20					

Surveys for summer training program will be conducted yearly while surveys for co-operative program will be conducted every semester as students join the co-operative program every semester. Additional employer surveys will be conducted yearly.

(iii) ***Graduate Exit Survey***

The graduate exit survey will be conducted every semester asking computer-engineering graduates to assess their ability in achieving each of the program outcomes and provide feedback on which outcome they think needs improvement and more emphasis in the program.

(iv) ***Computer Engineering Exit Exam***

The computer engineering exam is designed based on the core computer-engineering courses in which all the program outcomes are covered. This includes the courses: COE 202, COE 205, COE 305, COE 308, COE 341, COE 344, COE 360, and COE 400. The exam characteristics are as follows:

- 60 questions (multiple choice format) in total
- Two hours exam setting
- Each question should take an average of 2 minutes to answer
- Each question should map into one of the outcomes (a through n) claimed by the course.

The COE exit exam will be focused on fundamentals and will provide a good feedback in identifying some areas of improvements in the program.

The COE exit exam will be conducted every semester and all graduating students will be encouraged to take it. Students will be given certificates by the department declaring that they have passed the COE exit exam. Students who pass the exam with distinction will have that indicated in their certificates and highest exam achievers will be given rewards by the department. This will encourage the students to take the exam and will help in providing a proper feedback.

(v) ***Seminar Course (COE 390)***

This course will be used in the program outcomes assessment as it addresses some of the program outcomes with more emphasis than other courses. In this course, effective presentation skills are covered and students are given the chance to give two presentations. In the first presentation, students will be coached on the areas that need improvement and will receive feedback from both the instructor and other students based on the use of oral presentation assessment rubric. The second presentation has a high weight in the course and the presentations skills of the students will be assessed to determine their ability in achieving this outcome. The first presentation is based on a topic related to computing ethics and the second is based on a technical computer-engineering topic.

Professional code of ethics and computing ethics issues are also covered in this course. In addition, aspects related to contemporary issues and impact of engineering solutions in a global and societal context are addressed in the course through invited speaker's presentations. Students will be asked to assess the achievement of the course outcomes at the end of the semester and these results will be used as part of the assessment of related program outcomes.

(vi) ***System Design Laboratory (COE 400)***

The purpose of this course is to integrate student's knowledge of hardware and software in the design, implementation, debugging, and documentation of one major system. The twin learning experience of making hardware versus software decisions, and participating in a structured design are integrated into the same design exercise.

This course is taken by all computer-engineering students at the senior level and covers many of the program outcomes. Samples of students reports are collected every semester are used to assess the covered outcomes using proper assessment rubrics.

(vii) ***Senior Design Project (COE 485)***

The purpose of this course is to integrate student's knowledge of hardware and software in the design. This course is designed to give students the experience of tackling a realistic engineering problem. The intent is to show how to put theoretical knowledge gained into practical use by starting from a word description of a problem and proceeding through various design phases to end up with a practical engineering solution. Various projects are offered by COE faculty in their respective specialization areas. The project advisor guides the student in conducting feasibility study, preparation of specifications, and the methodology for the design. Detailed design and implementation of the project are carried out followed by testing, debugging, and documentation. An oral presentation and a final report are given at the end of the semester.

All computer engineering students in the non-coop program option take this course. It covers many of the program outcomes and provides a good assessment tool for measuring the achievement of those outcomes. Sample reports and presentations made by the students will be collected and evaluated using proper rubrics.

(viii) ***Cooperative Work (COE 350/351)***

This course is taken by all computer-engineering students in the coop program. It is based on a continuous period of 28 weeks spent in industry with

the purpose of acquiring practical experience in different areas of Computer Engineering. During this period, a student is exposed to the profession of Computer Engineering by working in the field. Students are required to submit a final report and give a presentation about their experience and the knowledge they gained during their cooperative work.

Sample of coop reports and presentations will be collected every semester and they will be evaluated using proper rubrics.

(ix) Summer Training *(COE 399)*

The aim of summer training is to provide students with direct on-the-job experience working with professionals in the field. This training provides an opportunity to expose students to the reality of professional practice. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained.

Samples of students reports and presentations will collected every year and they will used to assess some of the program outcomes using proper rubrics.

The assessment and evaluation plan for the program outcomes is shown in Table V. For each program outcome, the assessment and evaluation methods are given. Scoring rubrics designed by the undergraduate committee are used for the assessment of outcomes. For each used assessment method, a performance criterion is given indicating when an outcome is considered achieved. Finally, the frequency of assessment of each program outcome is indicated.

The assessment committee will perform the assessment process and collect all the needed data. The undergraduate committee will use the designed rubrics to evaluate the outcomes and determine whether they are met or not. It will then generate a summary of the assessment process, which will be presented to all faculty members in the department with recommendations for improvement. Once recommendations for improvement are approved by the department council, necessary changes will be implemented.

The detail of the evaluation criterion for each Rubric is available at the Appendix II of this report.

Table V. Program outcomes assessment and evaluation plan.

Program Outcome	Assessment & Evaluation Methods	Performance Criteria	Logistics
(a) an ability to apply knowledge of mathematics, science, and engineering	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	• Samples of COE 400, COE 344 and COE 305 lab reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(c) an ability to design a system, component, or process to meet desired needs	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5	Assessments will be conducted every semester.

	Employer Survey	• A score ≥ 3 out of 5	
(d) an ability to function on multi-disciplinary teams	• Samples of COE 400, COE 485 and COE 351 reports • Peer & instructor evaluations in COE 400 • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(e) an ability to identify, formulate, and solve engineering problems	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(f) an understanding of professional and ethical responsibility	• Students GPA in IAS 211 • COE 390 Indirect Assessment • Graduate Exit Survey	• Average GPA ≥ 2.5 out of 4 • A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of	Assessments will be conducted every semester.

	• Coop and Summer Training Employer Survey	5	
(g) an ability to communicate effectively	• Samples of COE 400, COE 485, COE 399 and COE 351 reports • Sample COE 485 and COE 351 presentations • Graduate Exit Survey • Coop and summer training Employer survey	• A score ≥ 2.5 out of 4 • A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester except for COE 399 which will be assessed in a yearly basis.
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(i) a recognition of the need for, and an ability to engage in life-long learning	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey	• A score ≥ 2.5 out of 4	Assessments will be conducted every semester.

	• Coop Employer Survey	• A score ≥ 3 out of 5 • A score ≥ 3 out of 5	
(j) knowledge of contemporary issues	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.
(l) Knowledge of Probability and Statistics and their applications in Computer Engineering	• STAT319 • Graduate Exit Survey • Coop Employer Survey	• Average GPA ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessment will be made every semester except for STAT319 which will be assessed in a yearly basis.
(m) Knowledge of	• ICS 251	• Average GPA ≥	Assessment will be

Discrete Mathematics	• Graduate Exit Survey • Coop Employer Survey	2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	made every semester except for ICS251 which will be assessed in a yearly basis.
(n) The ability to design a system that involves the integration of hardware and software components	• Samples of COE 400, COE 485 and COE 351 reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.

4. Assessment and evaluation

Since the last ABET visit to the COE department, the COE program has undergone several cycles of assessment-improvement cycles. Indeed, the assessment methods and procedures themselves have gone through several evolutions. In this section a detailed summary of these cycles are presented.

4.1 First Assessment-Correction cycle (1999-2001)

This corrective cycle was in response to the comments/assessment of the ABET team who visited the department. Although, the program was fully accredited, some concerns were raised by the ABET team. The table below summarizes the most serious of these concerns and the corrective actions that were taken by the department:

Concerns Raised by ABET	Analysis and Corrective action taken by the COE department
1. There was no enough flexibility in the program. Students could not select general electives from arts or other disciplines (other than their major)	This problem was compounded by the fact that KFUPM is a technical institution; it had no arts college. The issue was taken with the university administration (since it was a common problem for all programs) and many electives were created under the 'General Studies' division. Students now have access to, a relatively, wide selection of general interest courses such as Psychology, Industrial Sociology and Production, International Relations, Man and environment in addition to many courses on Arabic literature and Islamic theology. Students also have access to courses in Architecture, Marketing, Accounting, Finance, and Business Administration. The COE program was modified to allow students to take 3 general electives to take advantage of the presence of these courses.
2. There was a need to create a process for validating and evaluating the attainment of the established program objectives and outcomes.	The process has been created as explained in this report under criterion C2.
3. Projects taken by students in COE485 (Senior Design Project Course) and in the Co-Op course (COE351) were mainly limited to analysis and hence did not provide any design experience for the students. There was a need to strengthen the program's design	– The department had established two Ad-hoc committees (one for COE351 and another for COE485) to look into this issue. These courses were modified accordingly, – Also, many new electives were created within the program to expose the

component through greater emphasis on economic factors, safety, reliability, aesthetic, ethics, and social impact	students to emerging technologies and contemporary issues related to technology, – Also the university has created a course on Ethics (including work ethics) that was made compulsory upon all KFUPM students.

4.2 Second Assessment-Correction Cycle (2001-2004)

This cycle started with a self-assessment process. The Deanship of Academic Development (DAD) had arranged for assessment teams made of faculty invited from prestigious US universities as well as local faculty to visit and assess all engineering programs in KFUPM (including the COE). The COE department has formed a committee called Program Representative Team (PRT) to coordinate with the assessment team (AT). Three surveys were conducted in order to assess the performance of the COE graduates in light of the stated program objectives and program outcomes. These surveys were exit survey, alumni survey, and employers' surveys. The PRT team also consulted extensively with COE faculty and students (through public meetings and surveys). Benchmarks were identified that define the various measures of success, which would be used over the next five years to quantify achievements and progress.

The results of assessment are summarized below:

4.2.1 Program Objectives Assessment

Objective	How measured	When measured	Improvement identified	Improvement made
1	Surveys: Outcomes 1-2 have substantial contribution to the objective while outcomes 3-5 have moderate contribution to the objective.	Term 022	None	None
2	Surveys: Outcomes 2-3 have	Term 022	Design of efficient computer	Enhancing the design/analysis content of the COE

	substantial contribution to the objective while outcomes 1 & 4 have moderate contribution to the objective.		systems, Analysis of digital systems	Program
3	Surveys: Outcomes 4-7 have substantial contribution to the objective.	Term 022	Awareness of contemporary engineering issues, professional and ethical responsibility	Professional seminars/workshops , Professional Ethics in the course COE 390, Contemporary design issues in COE 400 and COE 485.

4.2.2 Program Outcomes

The table below shows the assessment results for the alignment of the program outcomes with the program objectives:

Table 1: How the program outcomes support (aligned with) the program objectives

	Program Objectives									
Outcome	1	2(a)	2(b)	2(c)	2(d)	2(e)	2(f)	2(g)	2(h)	3
(1)	√	√	√	√	√	√	√			
(2)	√	√	√	√	√	√	√			
(3)	√	√	√		√		√	√		
(4)	√				√		√	√	√	√
(5)									√	
(6)	√	√		√	√	√	√	√		√
(7)	√	√	√		√					√

1) Graduating Students Survey:

Graduating students were surveyed and the following table show summary of the results:

Assessment Attribute	Agreed or Strongly Agreed %
The work in the program is too heavy and induces a lot of pressure	73
The program is effective in enhancing team-working abilities	72
The program administration is effective in supporting learning	72
The program is effective in developing analytic and problem solving skills.	81
The program is effective in developing independent thinking	63
The program is effective in developing written communication skills.	85
The program is effective in developing planning abilities	72
The mathematical content of the program is adequate for pursuing advanced courses in the program	50

In addition, most of the students proposed to increase the weight of the course projects. Some of them suggested having separate course projects rather than having the same project for all students

2) Assessment of the COE Curriculum

As a result of the assessment exercise, a table linking the courses to the program outcomes was generated based on instructors' feedback. This table is shown below:

Courses or Group of courses	**Program Outcomes**						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
COE 200, COE 205, COE 305, COE 360	√	√	√				
COE 400, COE 485	√	√	√	√	√	√	√

COE 399, COE 350, 351, 352[1]	√	√	√	√	√	√	√
COE 390					√	√	√
COE 308	√						
COE 342	√	√					
COE 442	√	√					
ICS Courses	√	√	√	√			
STAT & MATH, Physics & Chemistry Courses	√			√			
English Courses					√		
IAS Courses					√		√
EE Courses	√	√	√				
Technical Electives	√			√		√	
COE Electives	√					√	

In addition**,** COE courses that contained a significant portion (30% or more) of theory, problem Analysis and solution design were identified and are listed below:

Element	Courses
Theoretical background	All courses with the exception of ENGL, IAS, and PE, (COE 350, 351, 352), COE 390, and COE 399.
Problem analysis	All courses with the exception of ENGL, IAS, and PE, and COE 390,
Solution design	COE 200, COE 205, COE 305, COE 360, COE 400, COE 485, ICS 202, ICS 431, COE 399, (COE 350, 351, 352)

Assessment also showed that the curriculum had adequate coverage of Mathematics, Basic Sciences, Humanities, Social Sciences, Arts, Ethical, Professional & Other requirements.

Also the assessment showed that information technology contents are integrated throughout the program as the table below shows:

[1] *These are summer training and cooperative training courses. Depending on the nature of the training program, it is possible to satisfy any of the stated program outcomes*

Course	IT Contents
COE 200	Use of CAD tools for the design, simulation and synthesis of digital system
COE 205	Use MACRO assemblers to write assembly code for various applications.
COE 305	Assembly Programming and Microprocessor Interfacing
COE 360	Use of CAD tools for the design, simulation and synthesis of VLSI circuits
COE 442	Network simulators are used to analyze network performance
ICS courses	Language compilers and development tools are used to build large software projects
EE courses	Use Circuit analysis CAD tools, e.g. SPICE
COE 400 and 485	Use various CAD tools for design entry, modeling, verification, fabrication (e.g. on PCB) and synthesis

4.2.3 Observation/Recommendation of the PRT:

The following observations and recommendations were proposed by the PRT to the COE department which approved them and moved to implement them:

I. **COE Faculty Contribution to Learning:** Further refinement in faculty contribution to students learning should be considered. Followings are some guidelines:
   - Use of different approaches to explain difficult as well as important concepts.
   - Encourage student-faculty interaction inside and outside the classroom.
   - Incorporate teamwork as an integral part of the leaning process.
   - Provide effective consultation and advising procedures.
   - Use of educational tools, e.g. multi-media animated figures and explanations, etc

II. **COE Program:** The results of the surveys showed that students, alumni, and employers appreciated the COE program. The following recommendations were made to strengthen the program further:
   - Emphasizing writing and presentation skills.
   - Emphasizing experimental skills.

- Strengthening the ability to design on different levels, i.e., system, component, and process.

III. **Training:** The followings were recommended to further strengthen the training aspect within the COE program:
- Emphasizing ability to carry out task independently
- Emphasizing ability to identify one's strengths and weaknesses.

IV. **COE Curriculum:**

- Introduce a revised version of the current undergraduate curriculum substantially equivalent to the best computer engineering undergraduate curriculum in North America.
- Develop effective mechanisms for faculty/industry personnel exchanges.
- Develop effective mechanisms for faculty to conduct industrial/governmental consultation services.
- Establish a Program Advisory Committee (PAC) for consultation on undergraduate curriculum development and improvement and for setting long-term research directions.

Curriculum Revision

As a result of the self-assessment exercise the department imparked in a major curriculum activity that took two years. The two main objectives of the revision were: 1) To remove any redundancy or overlap between courses, particularly core courses, 2) To identify gaps, if any, between core courses and include such topics that are deemed important to fill in these gaps. To achieve these objectives courses were classified into five areas and benchmarked against the core topics specified by the IEEE/ACM joint Task Force on Computing Curricula for Computer Engineering (CCCE 2001). The curriculum was also extensively benchmarked against reputable North American universities. All course syllabi were re-designed to conform to the self-assessment requirements of stating course objectives and learning outcomes using a provided template.

The following table summarizes the changes to COE curriculum and the justification for these changes:

Change	Justification

Splitting COE 200 (3-3-4) course "Fundamentals of Computer Engineering" into Lecture and Lab as: 1. COE 200 Lecture (3-0-3) "Fundamentals of Computer Engineering" and 2. COE 201 Lab (0-3-1) "Digital Design Laboratory" <Pre-requisite: COE 200>	Due to the advancements in digital design technology, and the introduction of the FPGA based design in the digital design lab, it has become difficult for some students to digest the material and conduct experiments in the same term. The FPGA based design technology eliminates the wiring overhead and allows the students to efficiently implement digital designs. Separating the lecture and the lab as two separate courses will significantly enhance the quality of the lab and increase the gained benefits of the application of the studied concepts.
Changing Prerequisites of COE courses as: a. Prerequisite of COE 205 "Computer Organization and Assembly Language" changed from COE 200 and ICS 201 to COE 200 "Fundamentals to Computer Engineering" and ICS 102 "Introduction to Computing". b. Prerequisite of COE 305 "Microcomputer System Design" changed from COE 205 to COE 205 "Computer Organization and Assembly Language" and COE 201 "Digital Design Laboratory". c. Prerequisite of COE 308 "Computer Architecture" changed from COE 205 to COE 205 and COE 201. d. MATH 102 "Calculus II" is made a prerequisite to COE 342 "Data & Computer Communications" (Renumbered: COE 341). e. STAT 319 "Probability and Statistics for Engineers and Scientists" is made a prerequisite to COE 442 (renumbered: COE 344 in the	• Based on the memo received from the office of the Vice Rector for Academic Affairs, the department has made a thorough review and suggested the above modifications.

revised curriculum) "Computer Networks" instead of being a Co-requisite to COE 342 (renumbered: COE 344 in the revised curriculum) "Data and Computer Communications". f. Adding "*or Consent of Instructor*" to the prerequisite requirements of the elective courses COE 441, 443, 444, 445, 446, 447, and 449	• Allows students from other departments to enroll
Introducing ICS 334 "Database Systems" course as a required COE course for students with Coop option.	Due to the market needs and the experience of our coop students in the industry, it has been found that the industry often requires some work related to data base design and its applications. For this reason, we find it useful for our students to have this knowledge before they go to the coop work.
Reducing the degree total number of credit hours: • The number of COE electives has been reduced from 3 courses to 2 courses. • Accordingly, the revised program reduces the number of credit hours to 130 for the non-coop option and 131 for the coop option.	• The total number of credits has increased due to modifications in other courses, e.g. ICS 202 "Data Structures" was increased from 3 to 4. To keep the number of credits at 130 or 131, one COE elective has been removed. • To compensate for the reduced flexibility due to this change, more flexibility has been introduced by replacing the ICS-elective course with a more flexible IT-elective as detailed below.
Replacing the ICS Elective with an IT Elective. The ICS elective course (*one of either ICS 313 "Fundamentals of Programming Languages" or ICS 353 "Design and Analysis of Algorithms"*) has been replaced by an IT elective course with a list of 4 possible courses instead of 2. The IT elective is satisfied by taking any of the 4 following courses:	• The ICS 313 was replaced by ICS 334 (Database Systems) for more coherence between the coop and non-coop options, to address local market needs, and to keep in line with the recommended IEEE/ACM joint Task Force on Computing Curricula for Computer Engineering (CCCE 2001). • The SWE 360 has been added to the list to be more in tune with the CCCE 2001 and to improve the program flexibility. • The COE elective has been added to the list to compensate for the deleted COE

a. ICS 353 Design and Analysis of Algorithms (3-0-3) or b. ICS 334 Database Systems (3-3-4) or c. SWE 360 Principles of Software Engineering (3-3-4) or d. COE xxx COE elective	elective. • Increasing the number of courses in this elective from only 2 electives to 4 enhances the program flexibility. • Furthermore, since the list covers courses from ICS, SWE and COE, it is more appropriate to call it an IT-elective rather than just an ICS-elective.

4.3 Third Assessment-Correction Cycle (2004-2007)

By the end of the previous curriculum revision, it became apparent that the COE curriculum still needs more work. As was stated earlier, the previous curriculum revision was mainly concerned with maintenance tasks (removal of overlaps, redundancies and gaps from courses, updating course contents …etc.) of the courses themselves. Also significant efforts in the past were spend on updating the departmental lab facilities and the course labs themselves (COE203, COE205 and COE305 labs). These efforts meant that only a limited curriculum revision was possible. A main concern that came from COE faculty, administration and university administration was that the COE program did not have a clear identity. Surely, the COE program had many strong points, but a distinguishing characteristic was lacking, or at least not visible enough. As a result, the COE department formed a new curriculum committee to review the curriculum from the ground up. This curriculum revision is in its final stage and is expected to end by May, 2007. The activities of this committee are summarized below:

4.3.1 The adopted top-down revision strategy

Guiding Principles:

The following principles were adopted to guide the whole process:

a. **Computer Engineering** is an internationally recognized discipline. Hence, to call any program as such, it has to follow internationally recognized and accepted standards for curriculum contents and methods of delivery.
b. **Engineering** is a profession with internationally agreed upon requirements and characteristics.
c. Two standards were adopted to comply with **a** and **b** above. These are:
    1. The IEEE/ACM Computer Engineering Curriculum as detailed and published in their Computing Curricula report (revised in 2001),
    2. The ABET guidelines for Engineering programs (New ABET 2000 criteria)

d. The above standards are flexible in the implementation and allow the inclusion of additional components in the curriculum that are tailored for a specific environment (such as Saudi Arabia's)
e. For an efficient curriculum design/review, the process has to follow a top-down approach; 1st determining the broad lines of the curriculum, objectives, outcomes, major options and components then proceeding with the detailed implementation.

Methodology: The adopted curriculum revision strategy is summarized below:

1 Set objectives for the program in line with the college's and university's

2 Set program outcomes including

   a. discipline specific skills

   b. profession specific skills

   c. personal and transferable skills

3 List areas of relevance to COE Curriculum – from IEEE and other programs

4 Based on the program objectives, categorize the areas of interest to COE:

   i. COE areas of focus (core) - preferably focusing on those that meet program objectives,

   ii. COE areas of added value

   iii. COE areas of interest

   iv. Associated areas

      a. areas of added value (from assessment perspective)

      b. areas of interest

5 Map the weak points identified in the assessment exercise and that are relevant to the curriculum into the areas identified in step 4.

6 Estimate the number of hours for each of the above areas

7 Generate a table that maps areas in step 4 with the learning outcomes in 2, which also includes the number of hours in step 5, and a link to the weaknesses identified in the assessment exercise

8 Assign a working group for each of the areas to come up with:

   a. learning outcomes for each area that maps into the learning outcomes of the program,

   b. list of courses for each area,

   c. learning outcomes for each course and syllabus

d. identify how the weaknesses identified in the assessment exercise and which is relevant to their area has been addressed including the corrective action

9 Review the results of each group and integrate it into the final curriculum

4.3.2 The adoption of new program objectives and outcomes

The committee opted for broad program objectives as was explained in section C.2. After close coordination with the assessment committee, these objectives were mapped to 14 program outcomes. These included ABET's a-k outcomes, two computer engineering-specific ABET outcomes (l & m) and an additional outcome (n) related to the local needs. These outcomes were then mapped to courses learning outcomes. The curriculum and assessment committees ensured that each of the program outcomes was injected in several core courses throughout the program.

4.3.3 Summary of the new curriculum

The curriculum committee proposed the following:

1. Maintaining the current levels of basic science courses, English courses and IAS courses

2. No significant changes to sophomore courses (allowing change of majors)

3. Reduced focus on ICS areas and increased focus on COE areas

4. Minimum set of core courses in all breadth areas. The committee, through extensive benchmarking, made sure that it did not go below the minimum standard for the coverage of an area. This resulted in a maximum of two courses per breadth area. The following areas have been designated as breadth areas:

    a. Math and Science (profession-specific)
    b. Professional and Personal skills (Engineering-profession related skills)
    c. Computer Organization and Architecture (Discipline-specific)
    d. Digital System Design (Discipline-specific)
    e. Embedded Systems (Discipline-specific)
    f. Electronic Circuits/VLSI (Discipline-specific)
    g. Computer Networks (Discipline-specific)
    h. Information Representation, Processing and Security (Discipline-specific)
    i. Computer Sciences (Programming, Algorithms, integration with hardware ….) (Discipline-specific)

5. Increased number of electives allowing the student to pick at least two areas of depth. The following areas have been designated as areas of depth:

a. **Advanced Networking**: Integrated network/service management, Web Service Technology, Wireless and Mobile Computing (including Mesh, Ad-Hoc and sensor networks), Optical Networks

b. **VLSI:** VLSI Design, Testing and Verification, Software-Hardware Co-design, Systems on Chips, Electronic Design Automation

c. **High performance computing:** Grid Computing, Fault-Tolerant Computing

d. **Non-Conventional Computing:** Configurable Computing, Pervasive Computing, Bio-Informatics, Optical Computing

e. **Computer Systems Applications:** Robotics, Multimedia Systems, Computer Vision, IT Security Systems

6. Maintaining a good number of un-restricted general electives, allowing the students more breadth of knowledge and more exposure to contemporary issues

7. Coverage of engineering practices, skills and project management through the seminar and capstone project courses

8. Integration of different COE disciplines through three courses; the first is an introduction to computer systems, embedded systems and the capstone project courses

9. Proposed two new course; COE260 (3-3-4), Digital Electronics for Computer Engineers, replacing EE203 and COE360 and COE319 (2-3-3), Applications of Statistics in COE, to replace Stat319.

10. The chain of courses in the area of computer architecture (COE205, COE308, COE305 and COE400) is changed to reflect the new departmental focus into the following:

    a. COE 208 Computer Architecture and Organization (3-3-4), with COE 202 (Digital Logic Design) as pre-requisite,

    b. COE 307 Computer Systems (3-0-3), with COE 208 as pre-requisite,

    c. COE 305 Embedded Microprocessor System Design (3-3-4), with COE 203 (Digital Logic Lab) and COE208 as pre-requisites,

    d. COE 400 Embedded Systems (1-6-3), with COE 305 as pre-requisite,

11. COE485 (Senior Design Project) is to become a capstone project course (2-3-3) with a structured project and an introduction to engineering practices (project management, communication skills, …etc.)

The committee held frequent presentations to the COE department council to get its approval of all intermediate steps. Four reports were generated, sent to all COE faculties for their reviews and feedback, which the committee incorporated in its work.

4.4 Current Assessment-Correction Cycle (2005-2007)

Starting in 2005 the COE department embarked upon a major task of reviewing and upgrading our assessment process itself. The new process was explained in section c.3 above. Starting with the 061 semester, the COE department started collecting assessment data for the new assessment process. Some early actions have already been proposed and implemented regarding improving students' communication skills, knowledge of contemporary issues and impact of engineering solutions on society. The table below shows these actions:

Issue	Actions taken
1. Improving Students' communication skills	❖ Enrollment in COE390 (Seminar) was limited to 15 students to allow for two presentations per student to allow the faculty to observe and guide them more ❖ All COE electives are now required to have a course project where students must write a project report and present their work ❖ All students returning from their coop or summer training are required to write a report about their work experience and present their work
2. Improving Students' knowledge of contemporary issues	❖ Projects offered to students in COE400 (Emb. Syst.) and COE485 (Sen. Des. Proj.) must deal with some of the contemporary issues facing the society (e.g. rising costs of health care, cyber crimes and security …etc.) ❖ Each student must prepare an essay about a contemporary issue, write a report about it and present it to the class ❖ Each semester, the department invites a speaker from outside the department to speak about a contemporary issue that is affecting the Kingdom

3. Improving Students' understanding of Impact of engineering solutions on society	❖ Each semester, the students in COE390 attend a presentation on this subject by an invited speaker (with industrial experience). They are also required to write an essay on the subject afterwards giving more examples on some engineering solutions and how they impacted the society ❖ As part of their COE400 and COE485 projects, students are required to comment on how they believe their project would impact the society

By the end of the 062 semester, the COE department would have gathered assessment data (both direct and indirect) to start assessing the effects of all previous corrective actions.

5. Curriculum

This section describes how the engineering faculty assures that the curriculum devotes adequate attention and time to each curricular component area and describes how students are prepared for computer engineering practice in a manner that is consistent with the learning goals and educational objectives of the program and institution. Computer engineering requirements prepare students for engineering practice through a curriculum that culminates in a major design experience.

This section also describes how the engineering experience incorporates engineering standards and realistic constraints into the program. It also describes how the curriculum allocates time to the professional component, which including mathematics, basic science, engineering, and general education.

5.1 Preparation for Engineering Practice

The COE program implements an education in science, mathematics, engineering science, engineering design and general studies that meets or exceeds the expectations of the ABET criteria. The COE department requirements for a Bachelor of Sciences degree in Computer Engineering are summarized in Table 5.1. Those requirements are specified by the courses listed in sections (1) and (2a) of Table 5.1 for a B.Sc. in computer engineering with Co-Op, and the courses listed in sections (1) and (2b) of the same table for a B.Sc. in computer Engineering. As depicted, the minimum total number of credits for a B.Sc. in Computer Engineering with Co-Op is 131 while it is 130 for a B.Sc. in Computer Engineering.

Table 5.1 Requirements for Bachelor of Science in Computer Engineering.

Area		Courses	Credit Hour
(1) Common stream for Computer Engineering	Basic Science	CHEM 101, PHYS 101, 102	**4** 4+4=**8**
	Mathematics	MATH 101, 102, 201, 260, STAT 319	4+4+3+3=**14** **3**
	English	ENGL 101, 102, 214	3+3+3=**9**
	Physical Education	PE 101, 102	1+1=**2**
	Islamic Studies and Humanities	IAS 111, 101, 212, 201, 322, 301, 4xx	2+2+2+2+2+2+2=**14**
	Information and Computer Science	ICS 102, 201, 202, 252, 431	3+4+4+3+4=**18**
	Electrical Engineering	EE 201, 203	4+4=**8**
	IT Electives	COE xxx, ICS 353, or SWE 360	**3**
	General Electives	Xxx	**3**
	Computer Engineering	COE 202, 203, 205, 305, 308, 341, 360, 390, 344, 4xx	3+1+4+4+3+3+3+14 +3=**29**
	Capstone Project	COE 400	**3**
(2a) BSc in Computer Engineering with	Computer Engineering	COE 350, 351	0+9=**9**
	Information and Computer	ICS 324	**3**

Co-Op	Science		
	Total (minimum)		**131**
(2b) BSc in Computer Engineering	Computer Engineering	COE 399, 485, 4xx	0+3+3=**6**
	IT Electives	Or ICS 324	
	General Electives	Yyy, zzz	3+3=**6**
	Total (minimum)		**130**

Details on the COE courses are provided in the Appendix. Student transcripts and transcript audits for recent COE graduates will be made available to the visitors. The COE Student Guide is a primary academic advising tool. The COE courses are designed to provide student flexibility while assuring that sufficient breadth and grounding in the fundamentals is maintained. Students are prevented from over-specializing by the policy of restricting the number of courses offered in a given specialization.

The following subsections describe: (1) requirements for Bachelor of Science in Computer Engineering (Subsection 5.1.1), and (2) Computer Engineering Curriculum Plan (Subsection 5.1.2).

5.1.1 Requirements for Bachelor of Science in Computer Engineering

The following subsections describes the program areas: (1) Basic Science, (2) Mathematics, (3) English, Physicals Education, Islamic Studies, and Humanities, (4) Information and Computer Science, (5) Electrical Engineering, , (6) Information Technology, (7) Computer Engineering, (8) Capstone Project, (9) BS with Co-op, and (10) BS without Co-op.

5.1.1.1 Basic Sciences

In this area the students must complete a three four-credit hour courses with laboratory for each course. The courses are General Chemistry (CHEM 101), General Physics 1 (PHY 101), and General Physics (PHY 102). In the CHEM 101 course the fundamental concepts of chemistry using both qualitative and quantitative approaches are introduced. The PHY 101 course covers topics related to particle kinematics and dynamics, rotational kinematics, rigid body dynamics, simple harmonic motion; the static, and dynamics of fluids. The course also emphasizes on basic physics laws such as conservation of energy and momentum. Finally, the PHY 102 focuses on topics related to wave motion and sound, temperature, first and second law of thermodynamics, kinetic theory of gases, Coulomb's law, the electric field, Gauss' law, electric potential, capacitors and dielectrics, D.C. circuits, the magnetic field, and Ampere's and Faraday's laws. It should be noted each of the three courses includes a laboratory where students carry out

experiments in the respective fields to reinforce the given material and more importantly are prepared with laboratory skills to be needed for further advanced courses.

5.1.1.2 Mathematics

Realizing the importance of this area, the program requires that students complete the following set of courses: Calculus I (MATH 101), Calculus II (MATH 102), Calculus III (MATH 201), Introduction to Differential Equations and Linear Algebra (MATH 260), and Probability and Statistics for Engineering and Scientists (STAT 319). The total number of credit hours in this area is 17 credit hours. MATH 101 and MATH 102 cover basic topics in calculus including continuity, differentiability, and integration of real-valued functions. In addition sequences and series are also covered in these fundamental courses. In MATH 201, more advanced topics such as polar, cylindrical, and spherical coordinate systems are utilized. Functions of two and three variables and related concepts such as partial and directional derivatives, and double and triple integrals are also covered. Finally, in STAT 319 the students are introduced into the subjects of presentation and interpretation of data, elementary probability concepts, random variables and probability distributions. The course also focuses on estimation, tests of hypotheses for one sample problem. It should be mentioned that STAT 319 includes a laboratory session where students perform problem solving using statistics software.

5.1.1.3 English, Physicals Education, Islamic Studies, and Humanities

To complement the technical part of the COE program, the students are required to complete a minimum of 34 or 28 credit hours for a B.Sc. in Computer Engineering and B.Sc. in Computer Engineering with Co-op, respectively. These credit hours span the sub-areas of English, Physical Education, Islamic Studies and Humanities, and General Electives. The courses in this area prepare the students with communication skills in both English and Arabic language, provide an introduction into human rights, ethics, and Shareeah in Islam. The courses also offer basic training in physical education and an opportunity to freely select topics in the general electives category. This non-technical supplement contributes significantly into the production of a well-rounded and well-informed graduate with societal, local and international, reflections.

5.1.1.4 Information and Computer Science Area

Students in the B.Sc. Computer Engineering program are required to complete five courses from the Information and Computer Science (ICS) department with four courses having associated laboratories. These courses amount to 18 credit hours. The courses indent is to provide the undergraduate with strong background in related computer sciences such as programming, data structures, discrete structures, and operating systems. The courses in this area are further detailed and described in section 5.2 Computer Science Component.

5.1.1.5 Electrical Engineering Area

Electric Circuits I (EE 201) and Electronics II (EE 203) are two required courses from the Electrical Engineering department for students enrolled in the B.Sc. Computer Engineering program. The EE 201 courses serve to give students the necessary and needed background in basic electrical circuit analysis while EE 201 serves to provide the needed background in semiconductor physics, digital electronics, analog electronics, and amplifiers. In fact EE 203 is a prerequisite for our COE 360 course.

5.1.1.6 Information Technology Area

In this area, students must select one of three courses: an elective course from the computer engineering department (COE 4xx), the Design and Analysis of Algorithms (ICS 352) course from the Information and Computer Science department, or the Introduction to Software Engineering (SWE 360) course from the Software Engineering department. This area allows the student to either broaden his knowledge and training in computer science and software field (e.g. ICS 352 or SWE 360) or provide in-depth education in a selected area in computer engineering (e.g. COE 4xx).

5.1.1.7 Computer Engineering Area

This area includes nine core COE courses namely: Digital Logic Design (COE 202), Digital Logic Laboratory (COE 203), Computer Organization and Assembly Language (COE 205), Micro Computer System Design (COE 305), Computer Architecture (COE 308), Data and Computer Communications (COE 341), Computer Networks (COE 344), Principles of VLSI Design (COE 360), and Seminar (COE 390). An additional 400-level elective course (COE 4xx) is required in this area. These courses, together with System Design Laboratory course (COE 400), represent the backbone of the B.Sc. in Computer Engineering program. The courses COE 202 and COE 203 server the digital systems design area, while COE 305 and COE 308 serve the computer architecture area. The area of computer communications and networking is served by COE 341 and COE 344, whereas COE 360 serves the electronics and VLSI area. The COE 390 course provides the students with the opportunity to improve their presentation skills in addition to emphasizing the various social and ethical responsibilities of the computing profession. This area include 4 laboratories (COE 203, COE 205, COE 305, and COE 344) while the rest of the courses, for the exception of COE 390, contain significant design projects. For more details on the professional component please refer to section 5.3 Design Experience Component.

5.1.1.8 Capstone Project

The Systems Design Laboratory course (COE 400) represents one major design project course for the B.Sc. Computer Engineering program where all students with and without Co-Op options have to complete. Other design component exists in other COE courses as well. The COE 400 course is a project-oriented course to integrate student's hardware and software knowledge through the design, implementation, debugging and documentation of one major system. In this course students are expected to work in teams to come up with a final working system where they learn to make design decisions weighing various engineering factors and tradeoffs, e.g. cost/performance, and hardware/software. More details on this capstone project course are included in section 5.3 Design Experience Component.

5.1.1.9 B.Sc. in Computer Engineering with Co-Op

Students with the Co-Op option has to complete, in addition to the courses specified in the Common Stream (Table 5.1-(1)) for Computer Engineering, the following courses: Database Systems (ICS 324) and Cooperative Assignment (COE 350 and COE 351). The co-op program, represented by COE 350 and COE 351, is a continuous period of 28 weeks spent in industry with the purpose of acquiring practical experience in different areas of Computer Engineering. During this period, a student is exposed to the profession of Computer Engineering by working in the field and regularly interacting with his academic advisor through direct contact and meeting as well as through submission of an action plan, three progress reports, and a final Co-op report. Most often the advisor provides feedback to the Co-op student based on personal contacts and Co-op progress reports. Students are required to submit a final report and deliver a presentation about the experience, knowledge, and engineering skills, gained during their cooperative work. A Co-op examination committee if formed by the COE Co-op coordinator to evaluate the student presentation, various reports, and make overall evaluation decision on the Co-op work.

5.1.1.10 B.Sc. in Computer Engineering

For the non co-op option, students have to complete, in addition to the courses specified in the Common Stream (Table 5.1-(1)) for Computer Engineering, the following set of courses: Summer Training (COE 399), Senior Design Project (COE 485), a four hundred-level elective course from the Computer Engineering department (COE 4xx), and two general non-Computer Engineering elective courses YYY and ZZZ. Students with this option can complete ICS 324 as an IT elective in place of the courses listed in the subsection 5.1.1.6 Information Technology Area.

5.1.2 Computer Engineering Plan

The Computer Engineering curriculum plan is a five year plan with a total of 130 and 131 credit hours for the non co-op and co-op options, respectively. In the following two subsections the Plans for the two options are described.

5.1.2.1 Plan for B.Sc. in Computer Engineering

The suggested plan for the B.Sc. degree in Computer Engineering without Co-op option is shown in the following table.

First year (Preparatory)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
MATH	001	Preparatory Math I	3	1	4	MATH	002	Preparatory Math II	3	1	4
ENGL	001	Preparatory English I	15	5	8	ENGL	002	Prep. English II	15	5	8
PE	001	Prep Physical Educ. I	0	2	1	PE	002	Prep. Physical Educ. II	0	2	1
ME	001	Prep. Shop I	0	2	1	ME	002	Prep. Shop II	0	2	1
Total			**18**	**10**	**14**				**18**	**10**	**14**

Second year (Freshman)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
MATH	101	Calculus I	4	0	4	MATH	102	Calculus II	4	0	4
PHYS	101	General Physics I	3	3	4	PHYS	102	General Physics II	3	3	4
CHEM	101	General Chemistry I	3	4	4	ICS	102	Introd. to Computing	2	3	3
ENGL	101	English Composition I	3	0	3	ENGL	102	English Composition II	3	0	3
IAS	111	Belief and its Consequences	2	0	2	IAS	101	Practical Grammar	2	0	2
						PE	101	Physical Education I	0	2	1
Total			**15**	**7**	**17**				**14**	**8**	**17**

Third year (Sophomore)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
COE	202	Fundam. of Comp. Eng.	3	0	3	COE	205	Comp. Org. & Ass. Lang.	3	3	4
EE	201	Electric Circuits I	3	3	4	COE	203	Dig. Design Lab.	0	3	1
ICS	201	Introduction to CS	3	3	4	ICS	202	Data Structures	3	3	4
MATH	201	Calculus III	3	0	3	ICS	252	Discrete Mathematics	3	0	3
IAS	212	Ethics in Islam	2	0	2	MATH	260	Introduction to Linear Algebra & Diff. Equ.	3	0	3
PE	102	Physical Education II	0	2	1	ENGL	214	Tech. Report Writing	3	0	3
Total			**14**	**8**	**17**				**15**	**9**	**18**

Fourth year (Junior)

Course	Num	Title	LT	LB	CR	Course	Num	Title	LT	LB	CR
COE	305	Microcomp. Syst. Design	3	3	4	COE	308	Computer Architecture	3	0	3
STAT	319	Prob &Stat. For Eng.&Sc.	2	3	3	COE	344	Computer Networks	3	3	4
COE	341	Data & Computer Comm.	3	0	3	COE	390	Seminar	1	0	1
COE/ICS/ SWE	Xxx	**IT Elective**	3	0	3	EE	203	Electronics I	3	3	4
						yyy	yyy	Free Elective	3	0	3
IAS	201	Writing for Prof. Need	2	0	2	IAS	322	Human Rights in Islam	2	0	2
Total			**13**	**6**	**15**				**15**	**6**	**17**

COE	399	COE Summer Training	0	0	0

Fifth year (Senior)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
COE	485	Senior Design Project	1	6	3	COE	400	System Design Lab	1	6	3
COE	4xx	COE Elective	3	0	3	COE	4xx	COE Elective	3	0	3
ICS	431	Operating Systems	3	3	4	zzz	zzz	Free Elective	3	0	3
COE	360	Principles of VLSI Desg.	3	0	3	xxx	xxx	General Elective	3	0	3
IAS	301	Literary Styles	2	0	2	IAS	4xx	IAS Elective	2	0	2
Total			**15**	**9**	**15**				**12**	**6**	**14**

For the first and second year, the Computer Engineering student covers mainly basic sciences and mathematical courses. In addition, some courses belonging to the general education component are also planned such as ENGL and PE courses. During the second year, the students also complete ICS 102 where they introduced to programming language very early in their program.

For the third year, students must complete the COE 202, COE 203, and COE 205. The COE 202 introduces the basics of logic design for combinational and sequential circuits with applications. The corresponding lab COE 203 emphasizes the use of FPGAs to implement combinational and sequential circuits. The students use various software tools to model, simulate and implement digital circuits. The COE 205 emphasizes the use of assembly language tools such as the Microsoft Macro Assembler, Linker, and Debugger to develop, analyze, and debug Intel x8086 assembly language programs. The student's COE laboratory experience is also reinforced with the required laboratory work in COE 205. The COE 205 lab work emphasizes the use of tools and provides hands on experience in assembly language programming. The course project is intended to make the students apply the concepts learned in the course in designing and implementing a program satisfying a given functionality through team work. The project also involves requirements of self-learning capability.

For the fourth year, students will complete COE 305, COE 341 and an IT elective for the first semester. COE 305 extends the knowledge base of COE 203 and COE 205 and focuses on microprocessor architecture and organization and related topics. This course is tightly coupled with its lab which exposes the students to various aspects of microprocessor engineering including signal analysis, design and fabrication of medium-sized 80x86 microprocessor based system, testing, hardware troubleshooting, and conducting I/O interfacing experiments using professional processor kits. In COE 341, the students are introduced to the concepts of data and computer communications. The course lays the ground for subsequent courses in the program on networking. It includes a programming assignment where students use software tools to develop skills for the simulation, analysis, and design of communication processes and components. A term paper assignment gives students exposure to recent developments in the field and enhances their aptitudes for research and self-learning. For the second semester students must complete COE 308, COE 344, and COE 390. In COE 308, students cover topics in computer architecture that includes memory management, integer and floating point arithmetic, pipelining, and superscalar architectures. Reduced Instruction Set Computers, parallel architectures, and interconnection networks are amongst the topics covered in the course. In addition, the course emphasizes the use of MIPS assembly language tools such as the SPIM and MARS software simulators to develop, analyze, and debug MIPS assembly language programs. It also emphasizes the use of simulators for the design and the simulation of the datapath and control of a processor. The course project is intended to build the students' ability to design, implement, simulate, and test the operation of a simple pipelined processor. COE 344, builds on the knowledge base of COE 341 and covers topics including OSI model, WAN and LAN design issues. In addition, it tackles

in depth the application layer, transport layer, network layer, and medium access layer from design, protocol, and analysis perspective. The associated lab allows the students to utilize software and hardware tools to develop skills in regard to the design, implementation, and analysis of computer networks. Finally, COE 390 is designed to improve students` ability for presenting their technical work and to teach students the nature of engineering as a profession, codes of professional conducts, ethics and responsibility, and the role of engineering societies and organizations world-wide. The students participate in discussions held by COE faculty members and invited guests on the topics outlined earlier. For the summer term of the forth year, students with the no co-op option must complete the summer training course COE 399. The aim of the summer training is to provide students with direct on-the-job experience working with professionals in the field. This training provides an opportunity to expose students to the reality of professional practice. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained.

For the fifth year, students in the B.Sc. in Computer Engineering with the no co-op option must complete COE 485, COE 360, COE 400, and two 400 hundred level elective courses COE 4xx. COE 360 introduces the principles of VLSI design and the covered topics include MOS transistor operation and limitations, MOS digital logic circuits (NMOS & CMOS), static & dynamic logic, and transistor sizing. MOS IC fabrication, layout and design rules, stick diagrams, IC Design and Verification Tools, subsystem design and case studies are amongst the topics covered as well. This course emphasizes the use of different CAD tools for the design and verification of digital integrated circuits. The course project is intended to build the students' ability to design, implement, and verify a digital integrated circuit. It also helps developing the student's ability to plan, work within a team and to communicate his design efforts. For COE 485 is designed to give students the experience of tackling a realistic engineering problem. The intent is to show how to put theoretical knowledge gained into practical use by starting from a word description of a problem and proceeding through various design phases to end up with a practical engineering solution. Various projects are offered by COE faculty in their respective specialization areas. The project advisor guides the student in conducting feasibility study, preparation of specifications, and the methodology for the design. Detailed design and implementation of the project are carried out followed by testing, debugging, and documentation. An oral presentation and a final report are given at the end of the semester. The COE 400, the capstone design project course for the B.Sc. degree in Computer Engineering, is a project-oriented course to integrate student's hardware and software knowledge through the design, implementation, debugging and documentation of one major system. This course represents the culmination of design, analysis, and implementation experience for students in our program. For more details please refer to the details in section 5.3 Design Experience Component, In addition to these courses students must select two elective courses COE 4xx in the area of their interest. The department offers a variety of elective courses in the areas of computer networks, digital systems design, computer architecture, robotics, etc.

5.1.2.2 Plan for B.Sc. in Computer Engineering with Co-Op

The program for students with the Co-Op option is the same as that for students with the no co-op option except for the fourth and fifth years. For descriptions of semester plans for first, second, and third years of the program with co-op option please refer to the previous subsection 5.1.2.1 Suggested Plan for Non Co-Op Option. In this subsection, the fourth and fifth year for the program with the co-op option are described. The suggested plans for the fourth and fifth year of the B.Sc. program in Computer Engineering with the co-op option are shown in the following two tables, respectively.

Fourth year (junior- co-op option)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
COE	305	Microcomp. Syst. Design	3	3	4	COE	308	Computer Architecture	3	0	3
STAT	319	Prob &Stat. For Eng.&Sc.	2	3	3	COE	344	Computer Networks	3	3	4
COE	341	Data & Computer Comm.	3	0	3	COE	390	Seminar	1	0	1
COE/ICS /SWE	Xxx	IT Elective	3	0	3	COE	360	Principles of VLSI Desg.	3	0	3
EE	203	Electronics I	3	3	4	ICS	324	Data Base Systems	3	3	4
IAS	201	Writing for Prof. Need	2	0	2	IAS	322	Human Rights in Islam	2	0	2
Total			**16**	**9**	**19**				**15**	**6**	**17**
COE	350	Co-operative work	0	0	0						

Fifth year (senior - co-op option)

Course	Num.	Title	LT	LB	CR	Course	Num.	Title	LT	LB	CR
COE	351	Co-op. Work (cont.)	0	0	9	COE	400	System Design Lab.	1	6	3
						COE	4xx	COE Elective	3	0	3
						ICS	431	Operating Systems	3	3	4
						Xxx	xxx	General Elective	3	0	3
						IAS	301	Literary Styles	2	0	2
						IAS	4xx	IAS Elective	2	0	2
Total			**0**	**0**	**9**				**14**	**9**	**17**

The fourth year of the B.Sc. program in Computer Engineering with the co-op option is similar to that without the co-op option except for the ICS 324 which is typically completed before the co-op assignment starts. Furthermore, COE 360 is completed during the second semester of the fourth year rather than the first term of fifth year as in the regular program. The students register in the co-op course COE 350 in the summer and continue for the first (winter) semester of the fifth year as COE 351. An alternative is to register co-op course in the second (spring) semester as the course COE 350 and continue it during the summer semester as COE 351. The former arrangement is the one depicted in the suggest plans above. Upon the return of the co-op interns the second semester is very similar to that for the no co-op option with the exception of less COE and general electives.

5.2 Computer Science Component

Computer Science has long been an essential component to the Computer Engineering curriculum, and we maintain close working relationships with the Information and Computer Science (ICS) department. There are common committees and common graduate programs between the Computer Engineering and the Computer Science departments at the Master and Ph.D. levels.

For the undergraduate program in Computer Engineering, there are five required ICS courses, four of which have dedicated laboratories associated with the respective courses, for a total of 12 Computer Science laboratory hours included in the Computer Engineering professional component. The total Computer Science Component accounts for 18 credit hours, as shown in the following table.

Course #	Title	Lecture	Lab	Credits
ICS 102	Introduction to Computing	2	3	3
ICS 201	Introduction to Computer Science	3	3	4
ICS 202	Data Structures	3	3	4
ICS 252	Discrete Structures I	3		3
ICS 431	Operating Systems	3	3	4
COE/ICS/SWE	IT Elective	3		3
	Total Computer Science Requirement	17	12	21

Depth in Computer Science is achieved through courses in programming, data structures, and operating systems. This sequence of courses combines a rigorous theoretical base with significant laboratory experience and provides students a focused experience and an appreciation of large-scale software systems.

The ICS 102 course introduces the Java programming language and basic object-oriented programming concepts to freshmen-level students. In the lab, students exercise the use of the various features of object oriented programming taught in the course. This includes the implementation of basic applets.

The ICS 201 course covers advanced programming concepts, graphical user interfaces, basic data structures, and searching and sorting techniques.

The ICS 202 course covers the analysis of data structures, the specification and design of advanced abstract data types, garbage collection, secondary storage structures and files. It also introduces design patterns, and includes case studies and practice in developing medium scale programs. Emphasis is placed on frameworks and component architectures.

The ICS 252 course covers topics including basics of propositional and predicate logic, set theory, and relations. It also covers mathematical reasoning and combinatorial analysis.

The Operating Systems course (ICS 431) covers processes, inter-process communication and synchronization, process scheduling, memory management, file systems, security, and protection. Case studies are covered from real operating systems.

In addition to the above required courses, many Computer Engineering students take the Database Systems course as an elective course, before going into summer training or COOP. Many students choose to take this course because it helps them in their working environment.

5.3 Design Experience Component

Design experience, particularly in large-scale projects, is central to the COE program. The COE 400 Digital System Design is a design project course where knowledge and skills acquired from various components of the COE program are integrated into a structured design project. COE 400 is centered on building embedded systems from the hardware/software co-design perspective as well as introducing RTOS environment. The methodology for building such systems is also taught in this course.

The IEEE/ACM body of knowledge in Computer Engineering has been used as a model in the design of COE 400 as a platform for the integration of the major computer engineering modules like (1) embedded systems, (2) computer system engineering hardware and software, and (3) introducing operating systems. The course starts with an introduction on microcontrollers and microcontroller-based systems; direct programming, introduce Real Time Operating Systems, and finally presents standard interfaces and their usage. COE 400 exposes the student to development at high-level programming construct as well as at assembly language programming. Even-driven practice is developed through the programming interrupt handling procedures.

The COE-400 is a project-oriented course where students focus on the design, development and management of an entire project as a group with all what this implies. The students also learn how to use microcontrollers and build microcontroller application systems. This course presents an embedded processor and its software development system. Specific external devices are controlled using some designed hardware interfaces, which represent the design aspect in the course. The rest is to use concurrent programming for which each process controls an external device through its interface. The result is the ability to simultaneously operate the external devices using the above embedded computer.

COE 400 exposes the students to teamwork which consists of a small group of no more than 5 students. A leader is assigned to each team. The team leader may generate a warning against a specific team member when the above is not making acceptable progress in the team.

Each semester COE 400 exposes the students to an open-ended (problem-based) design project of a complexity that is adjusted to cover one full semester of work at the senior level. The student team is expected to deliver the following sequence of requirements: (1) a specification report describing the product that is the objective of the project, (2) a task description report describing how the project tasks are distributed over the team members and the allotted time for each task, (3) a design report describing the proposed solution to the problem, discussing its technical and cost aspects, and its feasibility

constraints in resource and time, (4) an implementation and testing report describing the implementation details, debugging, testing, and evaluation.

The Computer Engineering option (No Co-op) allows the student to develop the depth or specialization in the discipline by taking the Senior Design Project course (COE 485) and getting more exposure to COE electives and others. The senior design project allows further refinements of the engineering design component and the integration skills culminating in the Digital System Design (COE 400). In addition the student is offered a wider exposure to the general electives such as courses from EE, Math, Management, Marketing, etc.

The Computer Engineering with the Co-Op option provides the COE student real-life cooperative professional development. During 8 months (Spring with Summer or Summer with Fall) the students engage in a Saudi or International company while being assigned an academic Co-Op advisor in addition to an industry Co-Op supervisor. The student is exposed to the profession of computer engineering in the industry by its multidisciplinary teams and a wider engineering perceptive. In addition to a Co-op plan the student is required to carry out extensive written communication (three progress reports and final report) and communicate with his academic advisor as well as with the Co-Op academic coordinator for submitting of the above material and receiving feedback. The Co-op student returning from Co-op brings an innovative and global perception of computer engineering profession which guides him finishing his engineering education and deciding about his future career.

5.4 General Education Component

The General Education component is well focused and complements the technical component to achieve the program educational outcomes and program educational objectives of the Computer Engineering program.

The general education courses are in the following areas: English (9 Credits), Arabic studies (6 Credits), Islamic/humanities studies (8 Credits), and Physical Education (2 Credits), e.g. a total of 25 credits. In addition to these areas, non-coop computer engineering program students are required to complete three free elective courses (9 Credits) while the coop computer engineering program students are required to complete one free elective course (9 Credits), e.g. 34 credit hours or 28 credit hours of general education courses for non-coop program and coop program options, respectively. The curriculum for the Computer Engineering program consists of 130 or 131 credit hours for non-coop program and coop program options, respectively.

The courses contributing directly to the General Education component are listed in Table 5.1. The mission of the 15-course general education curriculum at King Fahd University of Petroleum and Minerals is twofold: to nurture the formation of the undergraduate student as a thinking and caring citizen of the world of today, and to provide the general educational background against which the student can put into relief the more advanced intellectual or technical attainment of a “major” field of study.

Table5.1 General Education Component

Communications	1	ENGL 101	Introduction to Academic	3 credits	

(English)			Discourse		
	2	ENGL 102	Introduction to Report Writing	3 credits	
	3	ENGL 214	Academic and Professional Communication	3 credits	
			Subtotal credit hours		**9**
Communications (Arabic)	4	IAS 101	Practical Grammar	2 credits	
	5	IAS 201	Writing for Professional Needs	2 credits	
	6	IAS 301	Language Communication Skills	2 credits	
			Subtotal credit hours		**6**
Islamic/Humanities	7	IAS 111	Belief and its Consequences	2 credits	
	8	IAS 212	Professional Ethics	2 credits	
	9	IAS 322	Human Rights in Islam	2 credits	
	10	IAS 4xx	IAS Elective	2 credits	
			Subtotal credit hours		**8**
Physical Education	11	PE 101	Physical Education I	1 credit	
	12	PE 102	Physical Education II	1 credit	
			Subtotal credit hours		**2**
General Electives	13	XXX xxx	Free Elective I*	3 credits	
	14	XXX xxx	Free Elective II*	3 credits	
	15	XXX xxx	General Elective	3 credits	
			Subtotal credit hours		**9 (3)**
			Total General Education	**34 credits**	**34 (28)**

* Only for "BS in Computer Engineering" (No Co-op) program option.

It should be highlighted that the General Education component courses are university requirements and are common for all programs within King Fahd University of Petroleum and Minerals. The component attempts to integrate a broad education in the areas of Communications, Islamic and Humanities, and Physical Education with each student's major area of study.

The General Education component courses can be classified into the following subcomponents:

- Communication Skills subcomponent: In this track, Computer Engineering students are required to complete three courses (ENGL 101, ENGL 102, and ENGL 214) with 9 credit hours of English language focusing on composition, technical writing, and communication skills. These courses are offered by the English department. In addition, another three courses (IAS 101, IAS 201, and IAS 301) with 8 credit hours focusing on writing, literary studies, and communication skills in Arabic language The latter three courses are offered by the Islamic and Arabic Studies department.
- Islamic/Humanities subcomponent: A total of 4 courses with 8 credit hours are required from Computer Engineering students in this subcomponent. These courses are offered by the Islamic and Arabic Studies department in the College

of Sciences. 3 courses, each worth 2 credit hours are prescribed to be IAS 111, IAS 212, and IAS 322. The focus of IAS 111 is to highlight the characteristics of the Islamic faith and its view of the universe, human beings and life. The importance and guidelines of ethics in Islam and in general are the focus of IAS 212. The course also presents a perspective on profession ethics and employer-employee relationship as specified in the governmental regulation of Saudi Arabia. The focal point for IAS 322 is the nobility of human and human rights in Islam and its uniqueness. The basic human rights are also detailed in this course. In addition to the three aforementioned prescribed courses, the students are required to select fourth 400 level course from the Islamic and Arabic Studies department to supplement this subcomponent. It should be mentioned that for students of non-Muslim faith, the programs allows the substitution of previous by courses in the area of Social and Behavioral Sciences. Finally, in regard to the professional ethics topic, the Computer Engineering program includes a core course COE 390 Seminar of 1 credit hour focusing also on communication and presentation skills for students. The course also details the ethics codes and guidelines for professions relevant to computing in specific and those for engineering in general.

- Physical Education subcomponent: All students are required to complete two courses PE 101 and PE 102, with 1 credit hour for each course, as part of the core curriculum.
- General Elective subcomponent: This track includes three courses for non-coop program Computer Engineering students or one general elective course for coop program Computer Engineering students. The course can belong to any department to promote broad education and well-roundness.

6. Faculty

The COE faculty is committed to the program development and course coverage in addition to maintaining continuity and improvement of academic standards. The interest and qualifications of department faculty members are sufficient to plan, teach, modify

and update all offered COE courses, and curriculum. The COE faculty collectively presents an impressive level of competence in their respective areas of specialty through their academic, research and industrial experiences.

The COE department has currently twenty-eight full time faculty members of which nineteen have doctorate degrees (68%). The distribution of the full-time faculty ranks is as follows: three professors, one associate professor, fifteen assistant professors and nine lecturers. There is also one adjunct professor, in addition to two assistant professors who are currently on deputation to other government institutions in the kingdom.

There are four major curricular areas in the undergraduate program at the COE department. These are:

1. Computer networks and data communications,
2. Computer architecture and organization,
3. VLSI and digital systems design,
4. Computer applications.

Table 6.1 lists all COE faculty members, giving the academic rank, areas of specialization, and the curricular areas of the program covered by each. Brief resumes for all faculty members are included in Appendix B. The number of faculty providing teaching support for the above four curricular areas are 14, 16, 11, and 14, respectively. This shows that the number of faculty in each area of specializations adequately cater for the requirements of the four major program areas and meet the quality standards expected for the program. As an example of the support provided during a typical semester, Table 6.2 gives details of the courses offered in the fall semester of the academic year 2005/6. Twenty four faculty members delivered 16 lecture courses and 7 laboratory courses covering all four program areas to 1229 students in 65 sections. The average number of students per section was 21 for lectures and 16 for labs. The overall average of the number of sections per faculty was 2.7. With a total enrolment of 444 students for that semester, the student-to-faculty ratio was 18.5:1. This shows the adequacy of faculty size for the offered program and the student population.

COE faculty members have a wide range of responsibilities in addition to teaching, including other student-faculty interaction, student advising and counseling, research activities, professional services, professional development, and interaction with industry.

The COE faculty members dedicate at least 6 office hours per week where they makes themselves available at office for offering help and consultation to the advisees. The faculty members also interact with students through the activities of student clubs such as the computer club, the IEEE student branch at KFUPM, and in regular research seminar series. Life in the University campus allows other avenues of interaction through social, sports, and leisure activities. The college of CCSE organizes an annual dinner meeting attended by the Dean and Department Chairmen, faculty, and the students to discuss issues of mutual concern. Student-faculty communication is most often carried out via e-mail and discussion forums on the course WebCT site have increased significantly over the past few years. Moreover, the department adopts a formal academic advising scheme where every faculty advises about 20 COE students on average and provides on-demand academic guidance and consultation. The faculty members are always available to

provide guidance and to advise students during the pre-registration and registration days and dedicate one office day to answer student queries in person after posting final grades at the end of the semester.

The faculty member actively pursues research in their area of specialization. In addition to personal research efforts, they utilize many avenues available for funding at KFUPM as well as external funding by industry and research funding national agencies. During the academic year 2005/6 COE faculty were engaged in 1 project supported by Industry, 24 internally funded projects by KFUPM, and 2 project supported by King Abdul Aziz City for Science and Technology (KACST). During the same year, the faculty members produced 2 patents and a total of 110 publications, of which 18 were in refereed journals, 57 in international conferences, 23 in regional conferences, and 12 in national conferences. A total of 18 technical reports were also authored by faculty in the same period. Faculty also contributed 36 research seminars, 24 of which were given outside the department while 12 were part of an ongoing series of research seminars which provides a forum for interaction and exchange of research ideas amongst faculty and graduate students.

Professional services provided by faculty members include contributing to university, college, and department committees which focus on enhancing the academic programs and their outcomes, improving the welfare of the students and faculty, and increasing interaction between the University and the surrounding community and industry. During the academic year 2005/6, faculty members contributed to 9 university, 32 college, and 41 department committees. In addition, faculty supervised 52 senior design projects completed by 81 students, 35 Co-Op training projects completed by 48 students in 20 companies, as well as 38 summer training students. Faculty members have also supervised 2 PhD and 4 Master theses to completion during the same year.

Faculty members utilize the wide range of opportunities offered by KFUPM for professional development. The university provides funds to support scientific research by faculty through a variety of research grant schemes managed by the Deanship for Scientific Research (DSR). During the academic year 2005/6, COE faculty secured 3 new SABIC/Fast Track research grants with a total value of SR 212,000 and one junior faculty research grant of SR 50,000. Faculty were also granted SR 225,000 for attending 4 national and 20 international research conferences in their area of specialization. Other support is available for book writing and translation and for the development of online courses. A senior faculty can also apply for university support for one-semester sabbatical leave of absence to pursue research of his choice at a reputable academic/research institution. Faculty may also benefit from summer research grants offered by learned societies abroad.

Faculty members pursue academic development as educators through extensive programs offered by the Deanship of Academic Development (DAD) at KFUPM, with special programs designed to help junior faculty. DAD's Teaching & Learning Centre (TLC): promotes excellence in teaching and student learning both inside and outside the classroom through organizing workshops, mini-courses, seminars, consulting services, academic development grants, and peer consultation programs. The Program Assessment

Center (PAC) focuses on programs rather than on individuals, determining how they contribute to student growth and development. It provides information on whether the curriculum as a whole provides students with the knowledge, skills and values that graduates should possess to satisfy the stated mission, goals and learning objectives. The e-Learning Center (ELC) promotes quality self-paced, learner-centered education through the development and delivery of quality web-based courses delivered completely online and assists KFUPM faculty in developing interactive web-based supplementary material aimed at enhance teaching and learning effectiveness of traditional courses. The Testing & Evaluation Center (TEC) provides support and training in test construction and validation, meant to provide further stimulus for active learning and objectives-based instruction. The study and evaluation of faculty performance indicators represent other major concerns for the Center.

The KFUPM Research Institute provides an interface for proposing and managing contractual research with industry. Further interaction with takes place through industry-funded projects, teaching in short courses for industry organized by KFUPM, the CO-OP program, student summer training, the career day, contacts with COE alumni, visits, and attending meetings of professional societies, workshops, and technical exchange meetings. During the academic year 2005/6, COE faculty contributed to 5 short courses and supervised 48 students who completed their Co-Op programs in 20 companies and organizations. The department is in the process of establishing an industry advisory board to help evaluate the curriculum and ensure relevance to the local job market.

Faculty members are motivated to excel through a promotion scheme that takes into account performance in teaching, research, and services. The university faculty promotion guidelines follow international standards in the education profession. Faculty promotion is based on peer evaluation done by external reviewers. Moreover, a number of university awards exist for outstanding faculty performance, including the Excellence in Teaching Award, Excellence in Research Award, and Excellence in Multidisciplinary Research, Excellence in Advising Award, and Excellence in Coordinating Short Courses. The college also offers similar awards. Many COE faculty members have won several of such awards over the years.

King Abdul Aziz City for Science and Technology (KACST), a major research funding institution in the kingdom, offers a nation wide Excellence in Research Certificate. In 2006-2007 one COE faculty member won the first degree, golden, Excellence in Research Certificate for a research project on Telerobotics. The event was also the subject of an article in one nation wide newspaper.

A summary of the faculty profile is as follows:

a. Education: Most faculty members have PhD degrees.
b. Diversity of backgrounds: There is good diversity in aspects such as previous experience, theoretical/practical orientation, age, industrial and research experience, and the country where higher education was acquired.

c. Engineering experience: Over 40% of COE faculty members have worked in industry or research prior to joining the department. This has been extremely helpful in bringing the "real world" of engineering into the classroom and project environments. Several COE faculty members hold patents for industrial processes and products.
d. Teaching experience: The range of experience in the COE specialization areas is wide enough. In addition, there is some depth in the areas of Design Automation, Computer Architecture, and Computer Networks.
e. Ability to communicate: COE faculty members are all effective communicators, as demonstrated by their teaching evaluations and their strong inter-personal skills necessary to stimulate and motivate student learning.
f. Enthusiasm for developing more effective programs: This is demonstrated by the development of new elective courses, extensive revision of the undergraduate curriculum in 2003 to remove redundancies and to accommodate a wider range of student concerns. Two major revisions for the curriculum were carried out in 1999-2001, 2001-2004, 2004-2007, and in 2005-now.
g. Scholarship: During the academic year 2005/6, COE faculty members produced a total of 110 peer-reviewed publications, of which 18 were journal papers and 92 were conference papers. Some COE faculty members have previously published textbooks which are currently used by many computer engineering programs abroad. Faculty members regularly review papers for refereed international journals and conferences. Two faculty members served on the editorial boards of international journals and 8 consultancy services were provided by COE faculty to government and private organizations during the same period.
h. Participation in professional societies, and registration/licensure as Professional Engineers of faculty members: Most of the faculty members are members of at least one professional society. In addition to attending and contributing to the activities of the local and student chapters of such societies, e.g. the IEEE Technical Exchange Meeting, COE faculty regularly review papers for, attend, present research papers, and chair sessions in international conferences organized by such societies. The faculty played a key role in organizing such conferences at KFUPM, e.g. the International Conference of Microelectronics (ICM) in 1994 and 2006.

Table 6.1. COE faculty showing areas of specialization and curricular program area(s) covered. 1 = Computer networks and data communications, 2 = Computer architecture and embedded systems, 3 = VLSI and digital systems design, 4 = Computer applications, (e.g. neural networks, fault tolerant computing, etc.)

No	Name	Academic Rank	Areas of Specialization	Curricular Area(s) Covered			
				1	2	3	4
1	Gutub, Adnan Abdul-Aziz	Chairman, Asst. Prof.	Modeling, Simulating and Synthesizing VLSI Hardware for computer arithmetic operations.	●		●	
2	Mohammed, Sadiq Sait	Professor & Director, ITC	VLSI Design Automation, High Level Synthesis, Hardware Languages, ASIC Design, Heuristics, and Iterative Algorithms.		●	●	●
3	Al-Mouhamed, Mayez	Professor	Computer Architectures, Parallel Processing and Algorithms, Computer Networks, Robotics, and Computer Vision.	●	●		●
4	Abd-El-Barr, Mostafa I	Adjunct Professor	Fault Tolerant Design of Parallel & Distributed Systems, Computer Architecture and Parallel Processing, VLSI Design and Testing, Computer Networks Optimization, Multiple Valued Logic Systems Design.		●	●	●
5	Abdel-Aal, Radwan	Professor	Machine learning and data mining applications, Data acquisition and analysis for nuclear physics, Microcomputer system design, Testing of digital systems	●	●		
6	Amin, Alaaeldin A.	Asso. Prof.	VLSI Design and Testing. Computer Arithmetic, Cryptographic Hardware, and Asynchronous Design.			●	●

No	Name	Academic Rank	Areas of Specialization	Curricular Area(s) Covered			
				1	2	3	4
7	El-Maleh, A.	Asst. Prof.	Synthesis and Testing of Digital Systems, Design of Reliable Systems, Interconnect Efficient Low Density Parity Check Code Design			●	●
8	Al-Najjar, Atef J.	Asst. Prof.	Parallel, Distributed and Intelligent Computer and e-Education Systems, Multi Media.		●		●
9	Elrabaa, M.	Asst. Prof.	VLSI, Digital Circuit Design, Mixed Analog-Digital Circuits. Reconfigurable Computing, Networks-on-Chip, Systems-on-Chip.			●	
10	Naseer, A. R.	Asst. Prof.	Wireless sensor networks security, High level synthesis, FPGA based Synthesis, Embedded Systems, Computer Architecture, Microcomputer System Design, System Software, Computer Networking.	●	●	●	
11	Baroudi, Uthman	Asst. Prof.	Computer Networks, Wireless Networking and Radio Resource Management, Wireless sensor networks.	●			
12	Sqalli, M.	Asst. Prof.	Network Design and Management, Traffic Engineering, Iterative Heuristics, Constraint and Case Based Reasoning.	●			●

No	Name	Academic Rank	Areas of Specialization	Curricular Area(s) Covered			
				1	2	3	4
13	Mahmoud, Ashraf Sharif Hasan	Asst. Prof.	Simulation/Modeling/Performance Evaluation of Wireless/Data Networks.	●			
14	Abu-Amara, Marwan	Asst. Prof.	Networking, Wireless and Mobile Computing, Parallel and Distributed Systems, Fault-Tolerance and Reliability.	●			●
15	Al-Kharobi, Talal	Asst. Prof.	Information security, design automation, neural networks.		●		●
16	Mudawar, Muhamed	Asst. Prof.	Processor Micro architecture, Parallel Architectures and Interconnection Networks, Compilers.		●		●
17	Sheltami, Tarek	Asst. Prof.	Wireless ad hoc, sensor and WiMax networks, Performance evaluation of wireless communication Protocols, VoIP in wireless networks	●			
18	Bouharaoua, Abdul-Hafid	Asst. Prof.	Computer Architecture and Digital Systems		●		
19	Al-Yamani, Ahmad A. J	Asst. Prof.	VLSI Design and Test, Computer Aided Design Automation, Reliable Computing, Iterative Heuristics, and Computer Networks.	●		●	

No	Name	Academic Rank	Areas of Specialization	Curricular Area(s) Covered			
				1	2	3	4
20	Almojel, Abdullah I. (on deputation to Ministry of Higher Education)	Asst. Prof.	High-Performance and Parallel Computing, Workload Characterization, Performance Evaluation, Computational Science: N-body problems, Intelligent Image Databases, Multi-media.		●		●
21	Raad, Wasim	Lecturer	Real time Digital signal processing, Embedded systems Design, Smart Cards & RFID.		●		●
22	Garba, Ya'u Isa	Lecturer	Computer networks, systems performance analysis and evaluation, embedded systems	●	●		
23	Hakim, Adiche	Lecturer	Computer networks, network services, routing and switching algorithms, fast switching architectures, quality of services, and redundant and fault tolerant network architectures.	●			●
24	Hassan, Masud-ul-	Lecturer	Embedded Systems, Microcontroller System Design, Digital System Design, FPGA Based Synthesis, Digital System Testing, VLSI Design, Computer Aided Design Automation,		●	●	
25	Kamal, Chenaoua	Lecturer	Color Image Processing. Pattern recognition and	●	●		

No	Name	Academic Rank	Areas of Specialization	Curricular Area(s) Covered			
				1	2	3	4
			classification.				
26	Sarif, Bambang Ali Basyah	Lecturer	Logic synthesis, fault tolerant computing, iterative heuristics, and swarm intelligence			●	●
27	Selmi, Hazim H.M.	Lecturer	Digital Communication. Channel Coding. Error Control.	●	●		
28	Shazli, Syed Zafar	Lecturer	VLSI Testing, Combinatorial optimization		●	●	
			Total	**14**	**16**	**11**	**14**

7. Facilities

7.1 Introduction

The COE faculty and students have adequate facilities suitable to conducting a successful program. The facilities include several classrooms, course/research labs, Unix/Linux labs, College of Computer Sciences & Engineering (CCSE) general-purpose labs, faculty offices, university library, and network access facilities. The classrooms are mainly located in buildings 22, 23, and 24. Both labs and faculty offices are located in buildings 22 and 23. As for the university library it is located in building 8. The network access facilities are provided by the CCSE general-purpose labs in buildings 22 and 23, and by the Information Technology Center (ITC) in the form of a Wireless LAN network available in all university buildings. Supporting such facilities is a wealth of computer applications that are available to both faculty and students.

In the following sections we provide detailed information regarding the classrooms, the course/research labs, the Unix/Linux labs, the CCSE general-purpose labs, the faculty offices, the university library, and the network access facilities.

7.2 Classrooms

Presently, all classrooms are equipped with network connected computers and in-focus projectors. They are primarily used to deliver electronic class notes and perform in-class demos and presentations. For these computers, commonly used Microsoft applications (such as Microsoft Office) are installed. Other more specific software/tools can be installed on request. It should be noted that none of the COE courses was prevented from being offered due to lack of available classrooms. The following table provides the minimum, the maximum, and the average classroom size in terms of the number of students the classroom can accommodate. Also, the table provides similar information regarding the auditoriums available for teaching and group meetings.

Room Type	**Minimum (*chairs*)**	**Maximum (*chairs*)**	**Average (*chairs*)**
Lecture	18	120	38
Auditorium	50	180	102

7.3 Course/Research Labs

Several labs are used by both faculty and students to fulfill course outcomes as well as to conduct research. Such labs are located in buildings 22 and 23. The following table summarizes the list of available labs.

	Lab Name	Location (building / Room)	Purpose	Courses served by lab	Lab capacity in number of students/session	Lab space (Sq. Ft.)
1.	Digital Logic Design Lab	22/340-A	Prototyping of logic circuits	COE 203	13	630
2.	Microprocessor Lab	22/340-B	Processor interfacing and building microcomputer systems	COE 305	12	630
3.	Network & Communication Lab	22/347-A	Conduct experiments related to all layers of TCP/IP protocol stack, network management, network architecture, and network security	COE 344, COE 444, COE 445, COE 485	20	820
4.	Digital System Design Lab	22/347-B	Design, implement, debug and document a major microcontroller based system	COE 400	27	630
5.	Printed Circuit Board Lab	23/019	Electronic circuit implementation on printed circuit boards	COE 400	8	930
6.	Robotics Lab	22/339	Conduct experiments on Internet Tele-Robotics using real-time Client-Server network programming	COE 484, COE 584	9	317
7.	Senior Design Project Lab	22/339-1	Teaching & Projects	COE 485, COE 446	10	317
8.	FPGA & Design Automation Lab	22/333-1	Research	COE 561	8	420
9.	Performance Engineering Lab	22/342	Research	–	3	201
10.	Graduate Research Lab	22/401	Research	–	6	291

All COE labs have the following equipment installed for safety purposes:

1- Fire extinguisher.
2- First aid kit.
3- Smoke detector.
4- Emergency power shutdown switch.
5- Lab safety & precaution guide document.

The details of each of the COE labs are outlined in the following subsections.

7.3.1 Digital Logic Design Lab

The Digital Logic Design Lab is primarily used for prototyping of logic circuits through the use of discrete components (74xx family), EEPROMs (AT 2764) and FPGAs (Xilinx Spartan-3). Hence, the students initially implement combinational circuits on prototyping boards using chips and wires. Next, sequential circuits are implemented using EEPROMs and Flip-Flops. Finally, the students are introduced to FPGA-boards which they program using Xilinx ISE 7.1i WebPack software. The major items used in such experiments are shown in the following table.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)	Utilization*
PC	Dell 933 Dimension	18	75%
ISE 7.1i Webpack software**	Xilinx	14	75%
Printer	HP LaserJet 4210	1	100%
Modelsim XE 6.0**	Mentor Graphics	14	75%
EEPROM Programmer	Dataman Pro	3	13%
Spartan-3 Boards	Digilent	14	75%
Prototyping Boards	Fluent	9	25%

** relative to total number of experiments conducted*

*** software tool*

7.3.2 Microprocessor Lab

The Microprocessor Lab is used by the students to perform Intel microprocessor interfacing and building microcomputer systems. The following table lists the major items available to the students to conduct the experiments.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)	Utilization*
PC	Hp compaq	12	80%
Digital trainer	E&R Instruments	12	65%
Oscilloscope	FLUKE/PM3092	7	70%
Logic analyzer	Thurlby/ LA 3200	6	40%
EPROM eraser	Stag/SE 15	1	15%
EPROM programmer	Chip Master 6000	1	20%
IC tester	RS	1	15%
Function generator	Various	2	10%
Logic probes	Various	12	60%
Chip Master Software (for EPROM programming)**	Chip Master 6000	1	20%
Assembler/Debugger**	Microsoft	12	35%

** relative to total number of experiments conducted*

*** software tool*

7.3.3 Network & Communication Lab

The Network & Communication lab is used for conducting experiments related to all layers of the TCP/IP protocol stack, network management, network architecture, network security, and wireless networking. Thus, the lab supports several courses concerned with such topics. The major items used in such experiments are shown in the following table.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)	Utilization*
PC	IBM	26	100%
Routers	Cisco	12	40%
Switches	Cisco	8	100%
Switches	ExtermeNetworks	3	100%
Switches	3Com	3	100%
Switches	BayStack	3	100%
ATM Switches	ForeRunner	1	7%
Access-Point	Cisco	1	7%
Access-Point	D-Link	5	7%
Modems	US-Robotics	10	7%
Crimping Tools	RS	2	7%
Cable Testers	Fluke	2	7%
Cutters	RS	5	7%
Ethereal**	GNU License		47%
Windows 2000**	Microsoft		100%
Linux**	GNU License		100%
Packet Tracer**	Cisco		
Apache Web Server**			

** relative to total number of experiments conducted*

*** software tool*

7.3.4 Digital System Design Lab

The Digital System Design Lab is used to integrate the students' knowledge in hardware and software gained from lecture and laboratory courses to design, implement, debug and document a major microcontroller based system. The following table lists the major items available to the students to build their projects.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)	Utilization*
PC	Dell 933 Dimension	9	
Printer	HP LaserJet 1300	1	
Flash microcontroller programmer	Flash lab 51	10	90%
8051 IDE environment	Pinnacle 52	10	90%
Ethernet microcontroller development system	Tiny 80C400 board	12	10%
Ethernet to Wi-fi converter		2	
serial communication troubleshooting software**	Comdebug		10%
Labview 7**			10%
Oracle Database**			
Digital oscilloscope		11	
Variable power supplies		5	
Digital trainers		6	
Solder iron		1	

** relative to total number of experiments conducted*

*** software tool*

7.3.5 Printed Circuit Board Lab

The Printed Circuit Board Lab is used to implement electronic circuits on printed circuit boards.

The lab houses all equipment and chemicals necessary to make a professional printed circuit board starting from scratch. The main users of such lab are students of the digital system design course and the senior project course. The following table lists the major items available to fabricate the printed circuit boards.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
DRILLING AND ROUTING MACHINE	CNC-1000 / MAPE	1
PCB DRILLING MACHINE	606-664 / RS	1
HI SPEED DRILL MACHINE FOR PCB	- / Fortex	1
Power Supply	TPS2303DD / IsoTech	1
Solder/ Desolder Unit	Ex-750 / APE	2
Desolder Unit	SMD-500 / APE	2
Rework Station	850 D / Hako	1
Chemicals Tank for PCB manufacturing	PB720 / Mega	1
Copper Plating Tank	PL 904 / Mega	1
TIN / LEAD Plating Tank	PL 902 / Mega	1
Hot Air Drying Machine	BD 610 / Mega	1
Spray etch machine	TE-5P-MD / Mastertech	1
Tin Plating Machine	-	1
UV EXPOSURE UNIT FOR PCB	-	2
Deluxe Screen Printing Machine	- / HG Kippex	1
Drilling and Routing Machine	S62 / Protomat	1
PC / Win XP	Pent. 4 / HP	1
PC / Win XP	Pent. 4 / PC-Net	1
Printer	LaserJet 4 / HP	1
Scanner	UT24 / Plustek	1
Oven	DS2F/ GenLab	1
Dry film laminator	-	1
CAMERA FOR PCB WORK	RM-3600/ Agfa	1
UV EXPOSURE UNIT FOR PCB	2014 / RS	2
INSPECTION UNIT	Vista / PLESSEY	1
UV EXPOSURE UNIT	AY 218 / Mega	1
Eagle Software Version 4.1 for PCB schematic, layout and auto router**		

** relative to total number of experiments conducted*

*** software tool*

7.3.6 Robotics Lab

The Robotics Lab is used to conduct experiments on Internet Tele-Robotics using real-time Client-Server network programming. The objective is to provide a tool to carry out manual work through the Internet. The work is being done at a server station to which a robot arm is connected. The major items used in such experiments are shown in the following table.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	Clone	2
PUMA 560 Robot ARM	Unimation	2
SIX DOF ARMS	KFUPM	10
Cameras	Sony	2
VAL II OS and Robot Programming Language**	2014 / RS	
C# and C++ with Windows and Linux for programming robotic embedded systems**	Vista / PLESSEY	
DirectX-Direct 3D for graphical modeling and visualization**	AY 218 / Mega	
Distributed Component Client-Server Telerobotic System using .NET remoting**		

** relative to total number of experiments conducted*

*** software tool*

7.3.7 Senior Design Project Lab

The Senior Design Project Lab is used by the students to conduct their senior design project. The following table lists the major items available to the students to build their projects.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC w/LCD Monitors / Win XP	Pent. 4 / DTK	2
PC w / Analog monitors / Win XP	Pent. 4 / IBM	3
Laptop PC / Win XP	Pent. 4 / HP	10
Work Station / Unix	Ultra 10 / SUN	1
Terminal	VT 320 / Digital	1
Logic Analyzer	1230 / Tektronik	1
Oscilloscope	300 MHz. / Tektronik	1
Logic Design Board	HP-1 / E& L Instrument	1
Windows XP**		
Unix**		
Mesh Networking Software**		

** relative to total number of experiments conducted*

*** software tool*

7.3.8 FPGA & Design Automation Lab

The FPGA & Design Automation Lab is used mainly to conduct research on digital systems and design automation. The following table lists the major items available to the researchers to conduct their experiments.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
SUN Workstation/Solaris 9.0	SuNBlade 150 / SUN	2
PC/Windows XP	Pent. 4 / Win XP	6
Printer	LaserJet 4 / HP	1
Labview Ver. 7.1 & 8	National Instruments	1 (License for dept. use) + 4
Mentor Graphics	Mentor	3 Different Packages (25 Licenses)
Xilinx Ver ISE 8	Xilinx	1 package (educational license)
Synopsis (under Unix)	-	1
Data Acquisition Test unit	Elvis / National Instruments	2
FPGA & Realtime Controller unit	Compact Rio / National Instruments	1
GPIB Data Acquisition unit	GPIB / National Instruments	1
Vertex 4 Evaluation Development Board	ML402 / Xilinx	1
General Response Instrumentation unit	National Instruments	1
Windows XP**		
Lab view Version 7.1 & 8**		
Mentor Graphics**		
Xilinx Version ISE 8**		
Synopsis**		

** relative to total number of experiments conducted*

*** software tool*

7.3.9 Performance Engineering Lab

The Performance Engineering Lab is used to conduct research on parallelization of algorithms. The following table lists the major items available to the researchers to conduct their experiments.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC / Win XP	Pentium 4 / PC-Net	8
PC / Win XP	Pentium 4 / HP Compaq	3
Switch	4000 / Cisco	1
Hub 24 Port	3300TM / 3 Com	1
Hub	Catalyst 3550 / Cisco	1
Myrinet Switch 16 Port	M3-E16 / Myricom	1
Hub	1000Tx / 3 Com	1

7.3.10 Graduate Research Lab

The Graduate Research Lab is mainly used by graduate students as a general purpose lab. The following table lists the major items available to the graduate students.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC/Win XP	Pentium 4 / PC-Net	2
PC/Win XP	Pentium 4 / IBM	1
PC/Win XP	Pentium 4 / HP	1
Printer	LaserJet 4100TN / HP	1
Projector with Screen	Infocus	1
Scanner	ScanJet 3970/ HP	1

7.3.11 Unix/Linux Labs

Two Unix/Linux labs are available for use by both faculty and students to fulfill course outcomes as well as to conduct research. The first lab is located at room 22/413. The lab contains the following major items.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	HP Compaq	27
Linux OS	Mandrake10.1	Free License

The second lab is located at room 22/338. The lab contains the following major items.

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
Workstation	Sunfire VT120	10
Workstation	Sunfire VT210	5
PC (linux cluster)	HP Compaq	20
Server (linux)	DELL PowerEdge 4400	1
Server (fileserver: unix home directory)	Sun Microsystem StorEDGE L20	1
Server (samba: ccse-fachome and ccse-home)	HP Compaq	2
Server (toolserver, for unix tools and applications)	Sun Ultra Enterprise 450	3
Solaris OS	Solaris 9	Free License
Linux OS	Mandrake 10.1	Free License
Linux OS	Fedora 4	Free License
Opnet	Opnet 12.0 / Opnet Technologies	29
Matlab	Matlab 7.0.1.24704 (R14) / The MathWorks	50
Mentor Graphics	2006 Release / Mentor Graphics	25
Synopsys	2006 Release / Synopsys	20
DFT-PRO	DFT-PRO Pro / Syntest	5
Magic (VLSI cad tools)	Magic-7.1.5	Free License
MPI (parallel computing tools)	mpich-1.2.6	Free License
PVM (parallel computing tools)	pvm-3.4.4	Free License
NS (network simulator)	NS-2.30	Free License

7.3.12 CCSE General-purpose Labs

Several CCSE general-purpose labs are available 24 hours, seven days a week to the students that provide network access as well as a wealth of major computer applications needed by the students in support of their courses, projects, and research. The following are the list of available labs and major items they include.

Lab Location: **22/333**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	HP Compaq DC7100	26
Printer	HP Laserjet 9050n	2

Lab Location: **22/335**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	HP Compaq DC7100	35
Printer	HP Laserjet 9050n	1

Lab Location: **22/410**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	HP Compaq DC7100	35
Printer	HP Laserjet 9050n	1

Lab Location: **22/416**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	Compaq Evo	27
Printer	HP Laserjet 9000dn	1

Lab Location: **23/015**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	Compaq Evo	27
Printer	HP Laserjet 2200d	1

***Lab Location:* 23/017**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	IBM ThinkCenter	36
Printer	HP Laserjet 5siMX	1

***Lab Location:* 23/018**

Hardware/Software Item Name/Description	Model/Manufacturer	Quantity (Unit or License)
PC	HP Compaq DC7100	35
Printer	HP Laserjet 8150DN	1

All CCSE general-purpose labs have access to the following common computer applications.

Software Item Name/Description	Quantity (Unit or License)
CadSoft Eagle 4.1	5 (floating)
MATLAB 7.0	20 (floating)
Microsoft Office 2003	unlimited (bulk license)
Microsoft FrontPage 2003	unlimited (MSDNAA)
Microsoft Project 2003	unlimited (MSDNAA)
Jcreator (Java Editor)	Free license
Microsoft Visual Studio 2003	unlimited (MSDNAA)
Microsoft Visual Studio 2005	unlimited (MSDNAA)
Microsoft Visual Studio 6.0	unlimited (MSDNAA)
Microsoft SQL server clients	unlimited (MSDNAA)
Oracle server clients	Free license
Xilinx ISE 7.1i	Educational license (free)
Macromedia Flash	Single (floating)
Masm	Free license
Synchron Eyes 2.02	50

7.4 Faculty Offices

Most of the faculty offices are located in building 22. Every faculty has his own office that has adequate furniture and that is equipped with a desktop and/or notebook, a printer, and a network connection. In addition, most of the faculty offices are also equipped with a scanner. It should be noted, though, that some faculty offices are small in size such that

they are inadequate to hold a discussion between the faculty and 2 students. The average faculty office space is about 107 square feet.

7.5 University Library

The KFUPM Library is basically a science and engineering library and nearly 80% of its collection is related to the fields of science and engineering. The collection includes books, periodicals, proceedings, theses, reports, maps, charts, electronic resources, and audiovisual materials. The library has acquired a good number of electronic databases and Internet resources, and has established searching mechanisms for such databases. Faculty and students have Intranet and Internet remote access to almost all the databases using the library's URL http://www.kfupm.edu.sa/library/. The library provides assistance to the faculty and students in their search for information and library materials. The following provides a summary of the library's collection:

Item	Quantity
Monographs (including proceedings) vols.	314,189
Electronic Books	66,000 documents
Periodicals (Bound)	82,411 volumes
Periodicals titles (subs)	905 subs
Electronic Journals	32,000
Electronic Documents (proceedings, reports, etc.)	1081
Electronic Databases	39
Microfilms	37,530 reels
Microfiche	67,748 pieces
Media (audio, video, slides, etc.)	4,986 pieces

More specifically, the following table provides a summary of the number of available books and bound periodicals in areas related to COE:

Item	Quantity
Computer Engineering	842
Electrical Engineering	20,889
Information & Computer Science	12,006
Systems Engineering	244

In addition, the library has 1,510 journals' databases and current subscriptions in the area of Computer Science and Engineering, and 933 journals' databases and current subscriptions in the area of Electrical Engineering.

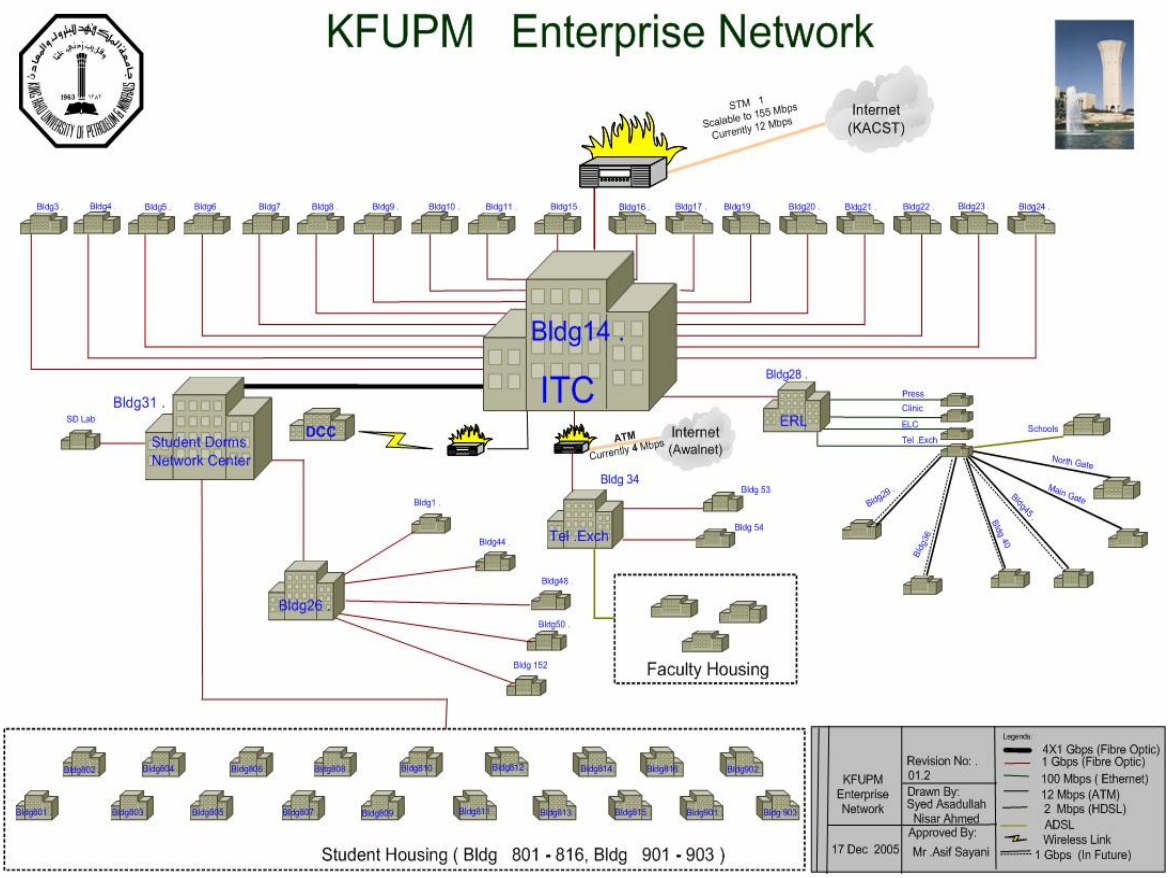
The library continuously expands its collection as shown in the following table that summarizes the amount of library expenditures for the years 2003-2005.

Deanship of Library Affairs Expenditures Record for the years 2003-2005			
Description	**2003**	**2004**	**2005**
Total Library Current Funds	**5,042,098**	**5,854,285**	**6,350,086**
Expenditure for the ***Science and Engineering*** Unit (80 % of total)	**4,033,678**	**4,683,428**	**5,080,069**
Books	492,092	465,196	471,758
Periodicals	2,968,291	3,252,258	3,377,489
Electronic Databases	512,672	916,308	1,150,488
Non-print Materials	22,267	23,792	13,680
Interlibrary Loan	38,356	25,874	66,653

The library has 31 professional staff and 29 para professional staff with recognized library service training. The operating hours of the library are Saturday to Tuesday from 7:30 a.m. to 10:00 p.m., Wednesday from 7:30 a.m. to 8:00 p.m., Thursday from 9:00 a.m. to 8:00 p.m., and Friday from 2:00 p.m. to 8:00 p.m.

7.6 Network Access Facilities

Students can access the network through the use of the CCSE general-purpose labs described earlier or through the use of the Information Technology Center (ITC) campus-wide IEEE 802.11 wireless LAN. The ITC wireless LAN provides full network access to both the students and the faculty, and helps reduce the demand on the general-purpose labs. In general, the ITC is the primary computing facility at KFUPM. It provides computing support for education, research, and administrative applications for the University community. Networking facilities at KFUPM have seen exponential growth over the last five years. The networking facilities provided by ITC comprise a fiber optic Gigabit Ethernet backbone serving more than 10,000+ fast-Ethernet switched network points. All faculty offices, classrooms and PC labs are connected to the network. Faculty housing and multi-story student dorms buildings are also connected to network. As stated earlier, the network is enhanced to provide IEEE 802.11 wireless LAN connectivity to all academic buildings across the campus. A total of 390 access points have been installed across the campus. Dial-in facilities are also available for remote access to KFUPM Intranet and Internet resources. The following schematic shows the overall network connectivity at KFUPM.



7.7 COE Lab Budgets/Upgrades

The COE department continuously addresses any upgrades/additions needs for the labs by estimating the yearly budget needed for the labs and submitting it to the university. The full process used to determine the department lab budget is divided into two levels: (1) The university level, and (2) the department level. The two levels are described next.

At the university level, as every fiscal year is coming to an end, the planning committee at the university level is required to review the needs of major equipment and PCs of all academic colleges and make consolidated recommendations for allocation of appropriate budget for the next fiscal year. In this connection, a memo will be sent to all the academic colleges/departments by the chairman of the university planning committee at least four months before the end of every fiscal year requesting them to prepare their lists of major equipment and PCs for labs to be procured during the following fiscal year. A standard proforma is provided to all the departments to fill their lists of major equipment and PCs for labs and this process is currently made online.

At the department level, the chairman of the COE department labs committee will send a mail to all the faculty and lab coordinators asking them to prepare the list of major

equipment, software tools and PCs for all the labs to be procured during the following fiscal year. The lists of items required for all the labs are to be prepared on the prescribed proforma providing appropriate information in all the following columns – *Item description, quantity, estimated unit cost, Total amount, Priority, justification.* These form the basis for future lab budget allocations and justifications. All lab coordinators will be required to discuss the requirements of their respective labs with the course coordinators and all the instructors teaching the respective courses. The objective is to consider the upgrade/enhancement of lab facilities (in terms of addition of new equipment and PCs as well as replacing old PCs) to:

- Support lab experiments, students senior design projects, course projects, and MS thesis work.
- Support the conduct of newly proposed lab experiments.
- Support setting up of new labs proposed in the emerging areas.
- To support faculty research.
- To remove obsolescence (i.e., Modernization of the labs).

Once these requirements are received from the lab coordinators and faculty on the prescribed proforma, a consolidated list is prepared indicating the budget allocation required for each of the labs as well as a summary of the total labs budget projection. The department labs requirements will be presented at the college council by the COE department chairman and will then be taken up for discussion and subsequent approval. Budget approved at the college council will be sent to the university planning committee for necessary action. Also the labs budget requirements will be entered at the university lab budget online system.

With that process in mind, the following table provides the labs budgets for the fiscal years 2005 to 2007.

YEAR	EQUIPMENT COST (SR)	PCs COST (SR)	TOTAL COST (SR)
2005	521,326	343,000	864,326
2006	488,775	134,280	623,055
2007	356,795	183,000	539,795
TOTAL	**1,366,896**	**660,280**	***2,027,176***

The COE department lab-wise budget allocation summary for the fiscal years 2005-2007 is provided in the next three tables.

8. Support

King Fahd University of Petroleum and Minerals is a government institution fully affiliated to the Saudi Ministry of Higher Education (MHE). KFUPM status in regard to the budget is fully independent and categorized as a sub-budget within the MHE governmental budget which is controlled by the Ministry of Finance. KFUPM submits its budget application directly to the Ministry of Finance. Once the governmental budge is approved and becomes law, the approved section pertaining to KFUPM, is administered directly between KFUPM and the Ministry of Finance.

KFUPM is a fully supported government institution, with the entire budget coming from the Saudi government. Moreover, KFUPM also receives financial contributions from industrial institutions (mainly Saudi ARAMCO). However, such contributions amount to only a small fraction (less than 1%) of the government allocations.

In line with the Ministry of Finance guidelines, KFUPM budget is divided into the following four categories:

1. Salaries and Wages
2. Expenses and Operations
3. Maintenance and Services
4. Assets and Capital expenses (buildings and equipment)

KFUPM budget is prepared by the Department of Budget and Planning through collecting all relevant information from the various colleges and departments in the university. The department receives information on the salaries and wages section of the budget from the Department of Faculty and Personnel Affairs.

The Computer Engineering Department communicates its future requirements in terms of faculty and staff to the Department of Faculty and Personnel Affairs. These needs are verified and approved by the Office of Planning and Quality. Requirements in terms of equipment purchases are directly communicated to the Department of Budget and Planning through the College of Computer Science and Engineering. These are approved by the Office of Planning and Quality against several parameters, including KFUPM policies and regulations, number of students in the department, the research requirements, and existing facilities.

8.1 Faculty professional development

Faculty professional development efforts represent a prime objective of KFUPM administration and are manifested in the following two areas:

1. Academic Development, Which is administered by the Deanship of Academic Development.
2. Research Development, which is administered by the Deanship of Scientific Research.

Funding is allocated by the University is adequate for the needs of the both deanships The Deanship of Academic Development operates the following centers which cater for various aspects of academic development of faculty:

1) Teaching & Learning Centre (TLC): This center promotes excellence in teaching and student learning both inside and outside the classroom. TLC activities include workshops, mini-courses, seminars, consulting services and resources to faculty and graduate teaching assistants to enhance teaching and learning. The TLC also administers several special programs including academic development grants and a scheme for peer teaching consultation to faculty members.

2) Program Assessment Center (PAC): This center is concerned with how educational programs are working and their contribution to student growth and development, focusing on programs rather than individuals. It provides information on whether the curriculum as a whole provides students with the knowledge, skills and values that graduates should possess in accordance with its mission and set goals and learning objectives.

a) **e-Learning Center (ELC):** The e-Learning Center assists the University community in exploiting the potential of new information and instructional technology to enhance teaching and learning. The center promotes quality self-paced, learner-centered education through the development and delivery of web-based courses that can be delivered completely online. The center also helps KFUPM enhance teaching and learning effectiveness through the development of interactive web-based supplementary material to traditional courses and organizing seminars and training workshops on the development and delivery of online material.

3) Testing & Evaluation Center (TAC): This is a specialized resource that provides support and training in methods of test construction and validation. This support should provide further stimulus for active learning and objectives-based instruction. The objective is to target high standards of excellence, while fostering rules of fairness and equity. Study and evaluation of faculty performance indicators are another major concern for the Center.

Example of recent workshops and seminars organized by the DAD centers include:

- Experience sharing in developing online courses, May 26, 2004.
- Mentoring to enhance faculty development, Sept. 01, 2004.
- Developing the communication skills of students, Sept. 04-05, 2004.
- Active learning to foster critical thinking, Sept. 06, 2004.

- Using groups and students teams to promote learning, Sept. 07, 2004.
- Criteria for assigning letter grades, May 15, 2005.
- Evaluating the quality of teaching: An institutional framework, Sept. 03, 2005.
- Using Course Design to Create more Significant Learning Experiences for Students, Good Learning and Good Teaching: How do we Promote more of it?, Sept. 4, 2006.

The mission of the Deanship of Scientific Research (DSR) is to provide a stimulating environment and continuous support that empowers KFUPM faculty and researchers to enhance its national, regional and international leadership in quality research and scholarly activities in science, engineering, management and other related fields of significant importance to the Kingdom. The DSR strategy includes:

- Promote the culture of innovative, interdisciplinary, and collaborative research
- Motivate and support Junior faculty/graduate students research
- Maintain continuous financial support for research and scholarly activities
- Support the establishment and upgrading of state-of-the art research facilities
- Develop and maintain measurement criteria for research outcomes
- Promote the dissemination of research results in quality outlets (e.g. journals, conferences)
- Promote innovative research in cutting edge disciplines and technologies
- Encourage and support team work and interdisciplinary collaborative research.
- Encourage and support scholarly visits and conferences
- Support summer and other international research exchange programs
- Provide support for faculty to attend international technical conferences and meetings
- Establish strong links with scientific research agencies world-wide
- Reward active researchers
- Promote and support research groups

The DSR offers the following grants and awards to KFUPM faculty:

SABIC and Fast Track Research Grants: For research projects having a maximum duration of 18 months and a maximum budget of SR75, 000.

Internal Research Grants: These constitute the main research grant scheme at KFUPM, featuring flexible budget and project duration. They provide funding for faculty and facility development in existing and emerging areas of excellence.

Junior Faculty Grants: This is a one time, 11 month, limited budget (SR 50,000) grant research opportunity for fresh PhD's starting their careers as junior faculty at KFUPM.

Societal Grants: These grants are designed to enhance interaction of KFUPM with the society and enhance its direct contribution to meeting societal needs. They support research in areas other than science, technology and business which are related to the Saudi society.

Book-Writing Grants: for authoring, translation and editing of books. Grants include authoring a scholarly monographs or textbooks targeted towards peers, students the general public in both English and Arabic and the translating relevant books or textbooks into Arabic.

Conference Attendance: The University encourages faculty to participate in high-quality conferences and professional meetings organized by leading professional societies both in the Kingdom and abroad. Support normally covers per diem and conference registration fee and possibly round trip tickets to attend the conference. Each faculty can obtain KFUPM financial support to attend three conferences to present papers each year: one regional, one international, and one from a funded research project. In addition he can apply to attend a conference without presenting a paper based on a recently published journal paper.

Sabbatical Leave: This scheme allows faculty to interact directly with scholars in reputable academic and research institutions. Scholarly activities may include pursuing or extending some ongoing research, initiating research in new and diverse areas, working in industry in research and development, gaining research-oriented experience, creating an engineering design or product or writing a research-oriented book or monograph. Benefits may include full monthly basic salary, regular transportation allowance, return air tickets for the faculty member and his eligible dependents, book allowance, research support, and a limited medical allowance.

International Scholar Programs: Two major scholar programs are open to Saudi faculty:
1) The British Council Summer Research Program, sponsored by British Aerospace Industries, U.K, is a Post-Doctoral research program designed to encourage Saudi faculty members to execute their research projects in British universities.
2) The Fulbright Scholarship Program, jointly funded by the University and the United States Information Service, is also a Post-Doctoral research grant designed to encourage Saudi faculty members to execute their research projects in reputable US universities.

The DSR organized several seminars and workshops for the benefit of KFUPM researchers, recent activities included:

- Workshop on "Use of Raed ERP System for Research Projects" for training faculty on the use of the new KFUPM portal top access DSR services.
- Seminar on “Research Proposal and Conference Application Submission through ERP System”
- Workshop on "Research Future Outlook at KFUPM"

During the academic year 2005-6, COE faculty received around SR 1 M in support from the DSR. Table 8.1 gives details of support received in the various categories.

Table 8.1. Details of DSR support received by COE faculty during 2005-6 in the various categories of research and conference attendance.

Category of Support	New Applications Received	New Applications Supported	On-going Projects	Total Support (SR)
Sabic / Fast Track	5	3	7	539,320
Internal	0	0	1	89,200
Junior Faculty	1	1	1	100,000
Conference (Regional)	4	4	NA	40,200
Conference (International)	25	20	NA	184,800
Total, SR				**953,520**

In addition to research grants provided by KFUPM, other avenues for support include:

(1) Contractual Research with industry and government organization which is managed through the KFUPM Research Institute.

(2) Grants by the King Abdul Aziz City for Science and Technology (KACST) which are supervised through the KFUPM Vice Rector for Graduate Studies and Scientific Research.

During 2005/6, KFUPM faculty worked on one funded project for Saudi Aramco with a budget of SR

272,646 and two KACST funded project with a total budget of SR 708,400.

Research Awards: The DSR supports the following awards aimed at encouraging excellence in research:

- Best Research Project Award: Rewards researchers for the quality and significance of research accomplished in the last four calendar years as evidenced by publications in reputed, refereed scientific and/or professional journals.

- Best Research Project Award: Encourages researchers to focus on production of quality research outcomes, innovative ideas, and establishing future research directions, as well as collaboration and timely completion of research projects.

- Research Team Incentive Award: Rewards researcher teams who execute their projects efficiently and effectively through timely completion, efficient manpower management and production of quality deliverables.

8.2 Sufficiency of resources

Towards the end of every fiscal year, the KFUPM Planning Committee reviews the requirements of the university colleges in terms of major equipment and PCs and makes consolidated recommendations for allocation of appropriate funds for the next fiscal year. A memo is sent t=o all academic colleges/departments by the chairman of the committee at least four months before the end of every fiscal year requesting them to prepare their lists of major equipment and PCs for labs for procurement in the following fiscal year. A standard proforma is provided to all departments to fill in their lists of major equipment and PCs for labs.

The Chairman of the Labs Committee at the COE department sends an e-mail to all faculty and Lab coordinators asking them to prepare lists of major equipment, software tools and PCs for all the labs to be procured during the following fiscal year. Following discussions with course coordinators and instructors, lab coordinators prepare the prescribed proforma giving information on *Item description, quantity, estimated unit cost, Total amount, Priority, and justification,* keeping in mind the following objectives:

- Upgrade/enhance lab facilities (addition new equipment & PCs/Replacing old PCs)
- Provide support for lab experiments, senior design projects, course projects and MS Theses
- Support conduction of new lab experiments proposed
- Support setting up new labs proposed in emerging areas of teaching/research
- Support Faculty Research

Upon receiving the requirements from the lab coordinators, a consolidated list is prepared indicating total budget requirements for each lab and a summary of the total Lab budget projection. The COE department requirements are discussed and approved by the College council and then forwarded to the KFUPM Planning Committee for necessary action.

Table 8.2. shows details of the COE projected budget for lab and equipment and PCs for the academic year 2006/7 which was submitted to the university toward the end of year 2005/6.

LAB	EQUIPMENT		PCs	TOTAL COST (SR)
	Description	COST (SR)	COST (SR)	
Robotics Lab	Accessories: Tools, instrumentation, power supplies, and components	10,000	--	10,000
FPGA & Design Automation Lab	- Synopsys Design Tools License Renewal - Accessories	30,000	--	30,000
Microprocessor Lab	- Coldfire evaluation boards, Digital design trainer boards. - Accessories	57,200	--	57,200
Digital Logic Design Lab	- Digital design trainer boards, Heavy duty printer - Accessories	40,000	--	40,000
Senior Design Projects Lab	- TelosB Mote Research Platforms - Accessories	22,000	--	22,000
Performance Engineering Lab	- MICA2 Environmental/GPS Sensor Module - Accessories	20,000	--	20,000
Printed Circuit Board Lab	- Tools and components	10,000	--	10,000
Systems Design Lab	- Contact-less Smart Card Development System, Wireless Medical sensors, Rabbit Development System - Accessories	48,000	63,000	111,000
Network And Communication Lab	- OPNET: 30 Teaching licenses of Modeler and Wireless and one Research license of MPLS - Cricket Mote Research Platform - Accessories	48,125	--	48,125
COE Graduate Lab	- Accessories	10,000	--	10,000
Sensor Networks Lab	- XBOW MICA2 Classroom Kit - TelosB Mote Processor/ Radio Boards with temp, humidity and light sensors - Cricket Developer's Kit - Scatterweb Starter Kit - Embedded Chip Radio Board (ECR) - Accessories	61,470	120,000	181,470
Total		**356,795**	**183,000**	**539,795**

Table 8.2. Projected COE budget for laboratory equipment and PCs for the academic year 2006/7.

8.3 Adequacy of support personnel

The COE relies on the college Network/Computing services group for support on computing and networking facilities. The group provides all the standard IT facilities to our faculty, staff and students, such as, e-mail, Web publishing, storage space, data backup, etc. The group is organized into teams responsible for the following services:

1 Windows Administration Services
2 Unix Administration Services
3 User Support Services
4 PC Lab Administration Services
5 Network & Hardware Services
6 Research & Consultation Services
7 Administrative & Training Services

A team of dedicated engineers supervise the tasks of running, maintaining, and upgrading the various teaching and research laboratories at the department.

The COE department and faculty rely heavily on the excellent resources and support facilities provided by the university. These include:

1. The Central Library.

2. The Information Technology Center.

3. The Maintenance Department

4. The Purchasing Department

5. The Office and Housing Department

Recently, the KFUPM Portal System has been launched as a university-wide enterprise automation system that facilitates access to global university information (IT issues, library, Research, RI, Deanships, administration, etc.). The portal speeds up many faculty services including applications for conference attendance, submission and reviewing of research proposals, promotion applications, as well as office and housing services, maintenance requests, and the processing of purchase orders.

KFUPM offers an attractive compensation package for faculty, including competitive tax-free salaries, free furnishes housing including all utilities, free annual air tickets, free medical care at KFUPM clinics and government hospitals, etc.

Complete Table I-5, *Support Expenditures.* Report the expenditures for support of the engineering program being evaluated. The information is supplied for each of three most recent fiscal years.

YEAR 2005			
LAB	**EQUIPMENT COST (SR)**	**PCs COST (SR)**	**TOTAL COST (SR)**
ROBOTICS LAB	40,000	20,000	60,000
FPGA & DESIGN AUTOMATION LAB	100,000	25,000	125,000
MICROPROCESSOR LAB	32,000	100,000	132,000
DIGITAL LOGIC DESIGN LAB	47,000	25,000	72,000
SENIOR DESIGN PROJECTS LAB	52,000	25,000	77,000
PERFORMANCE ENGINEERING LAB	50,000	25,000	75,000
PRINTED CIRCUIT BOARD LAB	45,000	--	45,000
SYSTEMS DESIGN LAB	42,850	55,000	97,850
NETWORK AND COMMUNICATION LAB	102,476	58,000	160,476
COE GRADUATE LAB	10,000	10,000	20,000
TOTAL	**521,326**	**343,000**	***864,326***

YEAR 2006

LAB	EQUIPMENT COST (SR)	PCs COST (SR)	TOTAL COST (SR)
ROBOTICS LAB	82,000	--	82,000
FPGA & DESIGN AUTOMATION LAB	47,830	--	47,830
MICROPROCESSOR LAB	10,000	--	10,000
DIGITAL LOGIC DESIGN LAB	50,000	--	50,000
SENIOR DESIGN PROJECTS LAB	20,000	--	20,000
PERFORMANCE ENGINEERING LAB	54,700	--	54,700
PRINTED CIRCUIT BOARD LAB	47,250	--	47,250
SYSTEMS DESIGN LAB	51,020	--	51,020
NETWORK AND COMMUNICATION LAB	115,975	134,280	250,255
COE GRADUATE LAB	10,000	--	10,000
TOTAL	**488,775**	**134,280**	***623,055***

YEAR 2007

LAB	EQUIPMENT COST (SR)	PCs COST (SR)	TOTAL COST (SR)
ROBOTICS LAB	10,000	--	10,000
FPGA & DESIGN AUTOMATION LAB	30,000	--	30,000
MICROPROCESSOR LAB	57,200	--	57,200
DIGITAL LOGIC DESIGN LAB	40,000	--	40,000
SENIOR DESIGN PROJECTS LAB	22,000	--	22,000
PERFORMANCE ENGINEERING LAB	20,000	--	20,000
PRINTED CIRCUIT BOARD LAB	10,000	--	10,000
SYSTEMS DESIGN LAB	48,000	63,000	111,000
NETWORK AND COMMUNICATION LAB	48,125	--	48,125
COE GRADUATE LAB	10,000	--	10,000
SENSOR NETWORKS LAB*	61,470	120,000	181,470
TOTAL	**356,795**	**183,000**	***539,795***

** Proposed lab*

9. Computer Engineering Program Criteria

The ABET computer engineering program criteria focuses on only one section of the general criteria, the curriculum. From the 2005-2006 Criteria for Accrediting Engineering Programs:

These program criteria apply to engineering programs which include electrical, electronic, computer, or similar modifiers in their titles.

- *The structure of the curriculum must provide both breath and depth across the range of engineering topics implied by the title of the program.*

  This program provides breadth across the computer hardware-software spectrum. In addition, it provides considerable depth in the following fields - VLSI Design, Computer Architecture, Robotics, and Computer Networks. The combination of circuit design, logic design, computer architecture, computer interfacing, and computer communication coupled with the strong series of design laboratories provides students with a comprehensive treatment of modern hardware design (COE 202, 203, 205, 305, 308, 341, 350-352, 360, 400, and 485). Networking protocols and applications, coupled with some software design provides students with an ideal and integrated view of the software development process and computer networks (ICS 102, 201, 202, 253, 324 (for the COOP option), 431, COE 344).

- *The program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.*

  The program guarantees that students have a working knowledge of these areas through requirements for the following courses:

  1. *Probability and statistics*

     The program requires a common engineering course in probability and statistics with engineering applications. (STAT 319)

  2. *Knowledge of mathematics through differential and integral calculus*

The program requires mathematics including two preparatory courses, three courses in calculus, and one course in differential equations and linear algebra. (MATH 001, 002, 101, 102, 201, 260)

3. *Basic sciences*

The program requires two courses in physics, and one course in chemistry. (PHYS 101, 102, CHEM 101)

4. *Computer science*

The program requires many courses in computer science including introduction to computing, data structures, discrete structures, and operation systems (ICS 102, 201, 202, 253, 431)

5. *Engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.*

The program requires many courses that provide the student with a comprehensive experience in how to analyze and design circuits, logic devices and subsystems, and software subsystems. (COE 202, 203, 205, 305, 308, 341, 344, 360, 400, 485, 351)

- *Programs containing the modifier "computer" in the title must also demonstrate that graduates have knowledge of discrete mathematics.*

The program requires one course in discrete math. (ICS 253)

a. Cooperative Education Criteria

One of the significant strengths of the COE curriculum is the cooperative (COOP) program. The COE COOP program is targeted to enhance the professional development through an alternate sequence of industry and academic experiences. Students have the option to participate in the COOP program or not.

The COOP program is a continuous period of 28 weeks taken in two consecutive semesters; COE 351 + COE 352 (Spring + Summer) or COE 350 + COE 351 (Summer + Fall). The COOP training is spent in industry with the purpose of acquiring practical experience in different areas of Computer Engineering. During this period, a student is exposed to the profession of Computer Engineering by working in the field.

Students are required to submit progress reports during their COOP. After finishing the COOP period, they are required to submit a final report and give a presentation about their experience and the knowledge they gained during their work. COOP students performance is evaluated through the company evaluation, four progress reports, a final report, a summary report, and a presentation on the COOP training to an examining committee.

The COOP is a 9 credit hour course. Thus, the student who selects the COOP option does not need to complete the COE 485 (Senior Design Project). In addition, he needs to take the database systems course (ICS 324), 1 general elective instead of 3, and 2 COE electives instead of 3. The total required credit hours for the COE B.S. degree with the COOP option includes an extra credit hour compared to the same degree without the COOP option.

Students who do not select the COOP option will also have to take a summer training (COE 399) with a pass/fail credit. The aim of the summer training is to provide students with direct on-the-job experience working with professionals in the field. This training provides an opportunity to expose students to the reality of professional practice. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained.

A COE student is eligible for the COOP program if he has completed 85 credit-hours or more of his study, earned a cumulative and a major GPA of 2.0 or above, and has passed a set of required courses. The COOP work must be completed before the student's last semester in the University. All COOP prerequisite courses have to be completed at least two semesters prior to the student's graduation. Thus, it is recommended to start the COOP the summer following the fourth (junior) year. The student will need to spend the summer and the first semester of the fifth (senior) year in the COOP. And, he will have one more semester to finish his courses and complete the COOP requirements.

Students planning to take COOP should discuss it with their academic advisors, and contact the COOP office to get a list of COOP offers. They also need to indicate three choices of companies. The COOP office will coordinate the assignment of students to companies. Students have also the option to do the COOP in a company that is not in the COOP program list, and this has to be arranged with the company and the COOP program office.

The students are reminded that they are ambassadors of the KFUPM COE department. So, their performance in the COOP period affects both the image of the COE department and the future prospects of jobs of COE graduates. They are encouraged to promote the professionalism, ethics and high quality education they received at the department. They

are also reminded to take the initiative to gain useful experience during the COOP program.

Through the COOP training, students develop a better sense of themselves, come to understand much quicker what opportunities exist for them in industry and government world. The COE places the students in leading companies, such as ARAMCO, SBM, and STC. They also frequently receive employment offers following their training.

Appendix I – Additional Program Information

A. Tabular Data for Program

Table I-1. Basic-Level Curriculum

Bachelor of Science in Computer Engineering

Semester	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains <u>Significant</u> Design (✓)*	General Education	Other
1	MATH 101 – Calculus I	4	( )		
1	PHYS 101 – General Physics I	4	( )		
1	CHEM 101 – General Chemistry I	4	( )		
1	ENGL 101 – Intro to Academic Discourse		( )	3	
1	IAS 111 – Belief and its Consequences		( )	2	
2	MATH 102 – Calculus II	4	( )		
2	PHYS 102 – General Physics II	4	( )		
2	ICS 102 – Introduction to Computing		3 ( )		
2	ENGL 102 – Introduction to Report Writing		( )	3	
2	IAS 101 – Practical Grammar		( )	2	
2	PE 101 – Physical Education I		( )		1
3	COE 202 – Digital Logic Design		3 (✓)		
3	EE 201 – Electric Circuits I		4 ( )		
3	ICS 201 – Introduction to Computer Science		4 ( )		
3	MATH 201 – Calculus III	3	( )		
3	IAS 212 – Professional Ethics		( )	2	
3	PE 102 – Physical Education II		( )		1

4	COE 205 – Computer Org. & Assembly Lang.		4 ( )		
4	COE 203 – Digital Logic Laboratory		1 (✓)		
4	ICS 202 – Data Structures		4 ( )		
4	ICS 252 – Discrete Structures I	3	( )		
4	MATH 260 – Linear Algebra & Diff. Equ.	3	( )		
4	ENGL 214 – Academic & Prof Communication		( )	3	

Table I-1. Basic-Level Curriculum (continued)

Bachelor of Science in Computer Engineering

Semester	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics *Check if Contains Significant Design (✓)*	General Education	Other
5	COE 305 – Microcomputer System Design		4 (✓)		
5	STAT 319 – Prob. & Stat. for Eng. & Sc.	3	( )		
5	COE 342 – Data & Computer Comm.		3 ( )		
5	COE/ICS/SWE xxx – IT Elective		3 ( )		
5	IAS 201 – Writing for Professional Needs		( )	2	
6	COE 308 – Computer Architecture		3 (✓)		
6	COE 442 – Computer Networks		4 ( )		
6	COE 390 – Seminar		1 ( )		
6	EE 203 – Electronics I		4 ( )		
6	XXX xxx - Free Elective I		( )	3	
6	IAS 311 – Islamic Shareah		( )	2	
	COE 399 – Summer Training		0 (✓)		
7	COE 485 – Senior Design Project		3 (✓)		
7	COE 4xx – COE Elective I		3 ( )		
7	ICS 431 – Operating Systems		4 ( )		
7	COE 360 – Principles of VLSI Design		3 (✓)		

7	IAS 301 Oral Communication Skills		( )	2	
8	COE 400 – System Design Lab		3 (✓)		
8	COE 4xx – COE Elective II		3 ( )		
8	XXX xxx – Free Elective II		( )	3	
8	XXX xxx – General Elective		( )	3	
8	IAS 4xx - IAS Elective		( )	2	

Table I-1. Basic-Level Curriculum (continued)

Bachelor of Science in Computer Engineering

		Category (Credit Hours)			
		Math & Basic Science	Engineering Topics	General Education	Other
TOTALS-ABET BASIC-LEVEL REQUIREMENTS					
OVERALL TOTAL FOR DEGREE	130 credit hours	**32 hours**	**64 hours**	**32 hours**	**2 hours**
PERCENT OF TOTAL		**24.6 %**	**49.2 %**	**24.6 %**	**1.5 %**

Table I-2. Course and Section Size Summary

Bachelor of Science in Computer Engineering

Term-061

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
COE 202	FUNDAM OF COMP. ENGG.	4	24.5	100%			
COE 203	DIG. DESIGN (LAB)	4	11.75		100 %		
COE 205	COMP. ORG & ASSEMBLY	3	20.66	75%	25%		
COE 305	MICROCOMPUTER SYS DESIGN	2	23	75%	25%		
COE 308	COMPUTER ARCHITECTURE	3	22.66	100%			
COE 341	DATA AND COMP. COMM.	3	20.66	100%			
COE 344	COMP. NETWORKS	1	21	75%	25%		
COE 355	FUND OF COMP. COMMUNICATION	2	25	100%			
COE 360	PRINCIPLES OF VLSI DESIGN	2	15.5	100%			
COE 400	SYS DESIGN LABORATORY	2	15.5	33.3 %	66.6 %		
COE	LOCAL AREA	1	25	100%			

441	**NETWORKS**						
COE 444	**INTERNETWORK DESIGN & MGT**	**1**	**23**	**100%**			
COE 446	**MOBILE COMPUTING**	**1**	**29**	**100%**			
COE 464	**TESTING OF DIGITAL CIRCUMITS**	**1**	**8**	**100%**			

Enter the appropriate percent for each type of class for each course (e.g., 75% lecture, 25% recitation)

Table I-2. Course and Section Size Summary
Bachelor of Science in Computer Engineering
Term-062

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
				Lecture	Laboratory	Recitation	Other
COE 202	FUNDAM OF COMP. ENGG.	3	13.6	100%			
COE 203	DIG. DESIGN (LAB)	6	12.83		100 %		
COE 205	COMP. ORG & ASSEMBLY	1	20	75%	25%		
COE 305	MICROCOMPUTER SYS DESIGN	1	17	75%	25%		
COE 308	COMPUTER ARCHITECTURE	3	30.33	100%			
COE 341	DATA AND COMP. COMM.	2	12	100%			
COE 344	COMP. NETWORKS	2	28.5	75%	25%		
COE 355	FUND OF COMP. COMMUNICATION	2	19.5	100%			
COE 360	PRINCIPLES OF VLSI DESIGN	2	28	100%			
COE 400	SYS DESIGN LABORATORY	2	22	33.3%	66.6 %		

COE 402	PERFO EVALUATION	1	10	100%			
COE 405	DES & MODLNG OF DIGITAL SYS	1	18	100%			
COE 441	LOCAL AREA NETWORKS	1	20	100%			
COE 445	INTERNET INFORMATION SERVICES	1	12	100%			
COE 449	SPECIAL TOPIC: INFORMATION SECURITY	1	22	100%			
COE 484	INTRODUCTION TO ROBOTICS	1	6	100%			

Enter the appropriate percent for each type of class for each course (e.g., 75% lecture, 25% recitation).

Table I-3. Faculty Workload Summary

Bachelor of Science in Computer Engineering

Faculty Member (Name)	FT or PT (%)	Classes Taught (Course No./Credit Hrs.) Term and Year[1]	Total Activity Distribution[2]		
			Teaching	Research	Other[3]
Dr Adnan Gutub	FT	T061: PYP 003 T062: COE 405, CSE 710	10%	10%	80%
Dr. Alaaeldin Amin	FT	T061: 2-Sections of COE 202, COE 599, and CSE 699 T062: 2 Sections of COE 360, COE 599, CSE 699	50%	25%	25%
Dr. Abdel-Aal Radwan	FT	T061: COE 341 (3-0-3) T062: COE 305, COE 341	50%	10%	40%
Dr. Ahmad Jabbar Al-Yamani		T061: COE 202 T062: 2 Sections of COE 353	50%	20%	30%
Dr. Abuamara, Marwan		T061: COE 202, COE 341 T062: COE 341, COE 344	50%	20%	30%
Dr. Abdelhafid Bouhraoua	FT	T061: COE 205, COE 390, COE 485 T062: COE 308, COE 390, COE 400	50%	30%	20%
Dr. Baroudi, Uthman	FT	T061:COE 540, COE 344 T062: COE 402, COE 445, CSE 693	45%	35%	20%

Dr. El-Maleh, Aiman	FT	T061: COE 561, COE 205 T062: COE 205, COE 390, COE 405	50%	25%	25%
Dr. Al-Mouhamed Mayez	FT	T061: COE 584, COE 308 T062: COE 308, COE 484	50%	20%	30%
Dr. Mohammed, Sadiq, S.		T061: COE 572 T062: NIL	25%	25%	50%
Dr. Al-Najjar, Atef, J.		T061: COE 441, COE 591 T062: COE 593, COE 441	50%	20%	30%
Dr. Elrabaa, Muhammad	FT	T061:COE 360, COE 399 T062: COE 202	70%	10%	20%
Dr. Alkharobi, Talal	FT	T061: COE485, ICS 481 T062: COE 351, COE 449, CSE 551	50%	10%	40%
Dr. Mahmoud, Ashraf S.	FT	T061: COE 543, COE 341 (3-0-3) T062: 2 Sections of COE 202, COE 390	60%	10%	30%
Dr. Mudawar, Muhamed	FT	T061: COE 205, COE 308 T062: 2 Sections of ICS 233	50%	20%	30%
Dr. Naseer, Abdul Rahim	FT	T061 2006-7: COE 308, COE 308 (3-0-3) T062: COE 308, COE 501	50%	25%	25%
Dr. Sheltami, Tarek	FT	T061: COE 390, COE 446, COE 485 T062: COE 344, COE 549	50%	20%	30%
Dr. Sqalli, Mohamma	FT	T061: COE 444, CSE 552			

d		T062: COE 390, 2 Sections of COE 485, CSE 550	50%	20%	30%
Mr. Hakim, Adiche	FT	T061: 2 Sections of COE 344 Lab. T062: 3 Sections of COE 344 Lab.	50%	20%	30%
Mr. Masud-ul-Hasan	FT	T061: COE 203, 2 sections of COE 353 T062: 2 Sections of COE 203 Lab, COE 400 Lab.	100 %	0%	0%
Mr. Kamal, Chenaoua	FT	T061: 4 Sections of COE 205 Lab. T062: 2 Sections of COE 203 Lab,2 Sections of COE 205 Lab.	50%	20%	30%
Mr. Raad, Wasim	FT	T061: 2 Sections of COE 400 Lectures + 2 Sections of COE 400 Labs. T062: COE 400 Lecture, Lab and COE 485 Lec., COE 485 Lab.	50%	20%	30%
Mr. Hazem Selmi	FT	T061 : COE 305, COE 203, COE 305 LAB (3) T062: 2 Sections of COE 203 Lab, 2 Sections of COE 305 Lab.	70%	20%	10%
Mr. Shazli, S.	FT	T061: 2 Sections of COE 203 Lab + 2 Sections of COE 305 Lab.	50%	20%	30%

1. Indicate Term and Year for which data apply.
2. Activity distribution should be in percent of effort. Faculty member's activities should total 100%.

Indicate sabbatical leave, etc., under “Other.”

Table I-4. Faculty Analysis

Bachelor of Science in Computer Engineering

Name	Ralnk	FT or PT	Highest Degree	Institution which Highest Degree Earned & Year	Years of Experience			State in which Registered	Level of Activity (high, med, low none)		
					Govt./Industry Practice	Total Faculty	This Institution		Professional Society (indicate Society)	Research	Consulting/Summer Work in Industry
Dr. Mayez Al-Mouhamed	Professor	FT	PhD	Paris XI University	2	24	24	None	IEEE-Robotics, Saudi Computer Society	Med	None

Dr. Adnan Abdul-Aziz Gutub	Assistant Professor	FT	PhD	Oregon State University		12	12	None	1.Security Research Group and Cryptography Research Group, KFUPM. 2.Bio-Inspired Intelligent Systems Team, Brunel University, UK. 3.Cryptographic Hardware and Embedded Systems (CHES) Research Group.	Med	

Dr. Radwan El-Said Abdel-Aal	Professor	FT	PhD	Strathcyde University, UK		22	22	Chartered Engineer, MIEE, UK	1.Member, IEEE, USA 2.Member, IEE, UK 3.Member, Engineers Syndicate, Egypt	Med	
Dr. Mohammed, Sadiq Sait	Professor	FT	PhD	KFUPM		27	27	None	1.Senior Member, IEEE. 2.Member, IEEE Computer Society, IEEE CAS Society 3.Member, Saudi Computer Society	Med	
Dr. Alaaeldin A. M. Amin	Associate Professo	FT	PhD	University of Utah	8	19	19	Professional Eng in	1.Member, IEEE, 2.Member, IEICE	Med	

Dr. Abdelhafid Bouhraoua	Assistant Profes	FT	PhD	University of Paris	6	2	2	None	Member IEEE	Med	
Dr. Abdul Rahim Naseer	Assistant Professor	FT	PhD	IIT, India		12	6	None	1. Life member, Indian Society for Technical Education (ISTE) since 1987 2. Member, Computer Society of India (CSI), since 1989 3. Member, VLSI Society of India (VSI), since 1991	Med	
Dr. Marwan Hassan Abu-Amara	Assistant Profes	FT	PhD	Texas A&M University	8	4	4	None	None	Med	

Dr. Ahmad A. Al-Yamani	Assistant Professor	FT	PhD	Stanford University		10	10	None	1. Member, IEEE 2. Member, Computer Society, IEEE 3. Member, Saudi Council of Engineers	Med	
Dr. Talal Mousa Alkharobi	Assistant Professor	FT	PhD	Texas A&M University		14	14	None	1. IEEE 2. IEEE, computer society 3. IEEE Industrial Application	Med	
Dr. Aiman Helmi El-Maleh	Assistant Profes	FT	PhD	McGill University		9	9	None	Member, IEEE Computer Society	Med	

Dr. Ashraf S. Hasan Mahmoud	Assistant Professor	FT	PhD	Carleton University	5	5	5	None	1. Member IEEE, 2. Member, Jordan Engineers Assoc.	Med	
Dr. Muhamed Fawzi Mudawar	Assistant Professor	FT	PhD	Syracuse University		12	3	None	1. IEEE Computer Society 2. Academic Computing Machinery 3. International Society for Computers and their Applications. 4. International Association of Science and Technology for Development	Med	

Dr. Muhammad E. S. Elrabaa	Assistant Professor	FT	PhD	University of Waterloo		12	6	None	1. Member of IEEE 2. Saudi Society of Electrical Engineers (SSEE)	Med	
Dr. Mohammed Houssaini Sqalli	Assistant Professor	FT	PhD	University of New Hampshire, USA		5	5	None	1. IEEE, IEEE Communications Society, IEEE Computer Society 2. Saudi Scientific Society for Electrical Engineers (SSSEE) 3. Saudi Engineering Council	Med	

Dr. Tarek Rahil Shelatmi	Assistant Professor	FT	PhD	Queens University		4	3	None	1. The Saudi Scientific Society of Electrical Engineering (SSSEE) 2. The Institute of Electrical and Electronics Engineers (IEEE): IEEE Communications Society and IEEE Computer Society 3. The Society of Electrical Engineers of Libya	Med	
Dr. Uthman Abdulrahman Baroudi	Assistant Profes	FT	PhD	Concordia University	2	5	5	None	Fellow, Syrian Engineering Society	Med	

Mr. Hakim Adiche	Lecturer	FT	MSc	KFUPM		9	9	None	None	Med	
Mr. Hazem Helmi Selmi	Lecturer	FT	MSc	KFUPM		6	6	None	None	Med	
Mr. Masud-ul-Hassan	Lecturer	FT	MSc	KFUPM	1	17	17	None	1. Pakistan Engineering Council 2. Saudi Council of Engineers	Med	
Dr. Muhammad Wasim Raad	Instructor	FT	PhD	University of Bradford,UK		21	21	None	1. IEE 2. Saudi Computer Society	Med	

Instructions: Complete table for each member of the faculty of the program. Use additional sheets if necessary. Updated information is to be provided at the time of the visit. The level of activity should reflect an average over the current year (year prior to visit) plus the two previous years.

Table I.5 – Support Expenditures in SR (1USD = 3.76 SR)

Bachelor of Science in Computer Engineering

Fiscal Year	1	2	3	4
	FY 04	FY 05	FY 06	FY07
Expenditure Category	(*Prior to previous year*)	(*Previous Year*)	(*Current Year*)	(*Year of Visit*)
Operations (not including staff)	268,200.51	392,902.14	501,670.02	
Travel	243,499.52	283,392.66	640,071.3	
Equipment	3,427	195	151,555.4	
Institutional Funds	-	3,272	25,960	
Grants and Gifts	-	-	-	
Graduate Teaching Assistants	-	-	-	
Part-time Assistance (Other than teaching)	-	-	-	

B. Course Syllabi

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 202

   Course Title: Fundamentals of Computer Engineering

2. **Design:** Required Course

3. **Catalog Description**

   Introduction to Computer Engineering. Digital Circuits. Boolean algebra and switching theory. Manipulation and minimization of Boolean functions. Combinational circuits analysis and design, multiplexers, decoders and adders. Sequential circuit analysis and design, basic flip-flops, clocking and edge-triggering, registers, counters, timing sequences, state assignment and reduction techniques. Register transfer level operations.

4. **Prerequisite(s)**

   General Physics II (***PHYS 102***)

5. **Textbook(s) and/or other Required Material**

   Morris Mano and Charles Kime, Logic and Computer Design Fundamentals, Second Edition, Prentice Hall International, 2000.

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Carry out arithmetic computations in various number systems (Binary, Octal, and Hexadecimal).
   - Apply rules of Boolean algebra to simplify Boolean expressions.
   - Translate Boolean expressions into equivalent truth tables and logic gates implementations and vice versa.
   - Design efficient combinational and sequential logic circuit implementations from functional description of digital systems.
   - Carry out simple CAD simulations to verify the operation of logic circuits

7. **Topics Covered**

   - ***Number System and Codes:*** Information Processing, and representation. Digital vs Analog quantities. General Number Systems. Binary, Octal and Hexadecimal systems. Number System Arithmetic (Addition, Subtraction & Multiplication). Number base conversion. Binary Storage & Registers. Signed Binary Number representation (Signed Mag, R's &(R-1)'s Complement). Signed Binary Addition and Subtraction ((R-1)'s, R's Complement Addition and Subtraction). Codes. BCD, Excess-3, Parity Bits, ASCII & Unicode.
   - ***Binary Logic & Gates:*** Boolean Algebra; basic identities, algebraic manipulation, complement of a function. Canonical and Standard forms, minterms and Maxterms, Sum of

products and Products of Sums. Physical properties of gates: fan-in, fan-out, propagation delay, timing diagrams and Tri-state drivers. *Map method of simplification*: Two-, Three-, Four-and Five-variable K-Maps. Essential prime implicants, simplification procedure, SOP & POS simplification, Don't care conditions. Universal gates; *NAND, NOR gates:* 2-level implementations. *Multilevel Circuits.* Exclusive-OR (XOR) and Equivalence (XNOR) gates, Odd and Even Functions, Parity generation and checking.

- ***Combinational Logic:*** Design Procedure & Examples. Half and Full Adders, Binary Adders: *4-Bit* Ripple Carry Adder and *delay* analysis. Carry Look-Ahead Adder, Adder-Subtractor circuit. MSI parts. Decoders, Decoder expansion, combinational logic implementation using decoders, Encoders & Priority Encoders, Multiplexers, Function Implementation using multiplexers, Demultiplexers, Magnitude Comparator. Design Examples.
- ***Sequential Circuits:*** Latches, Clocked latches: SR, D, T and JK. Race problem in clocked JK-Latch. *Function & Excitation Tables of clocked latches:* SR, D, T and JK. *Flip-Flops:* Master-Slave, and edge-triggered. Function & Excitation Tables of T-FF. *Asynchronous/Direct Clear and Set Inputs.* Setup &Hold times. *Sequential Circuit Design*: Excitation Tables. Design procedure, State diagrams and state tables. *Sequential Circuit Analysis:* Input equations, State table. Mealy vs. Moore models of FSMs. Examples. Registers and counters.
- ***Memory & PLDs:*** Memory devices: RAMs & ROMs . Combinational Circuit Implementation with ROM. Programmable Logic Devices: PLAs, PALs, and FPGA'a

8. **Course Contribution to Meet the Professional Component**

   This course emphasizes the design and analysis of combinational as well as sequential digital logic circuits. For this end, the course also emphasizes the ability of students to use Boolean algebra to simplify functions using both the algebraic and the K-map techniques.

9. **Relationship to Program Outcomes**

   This course supports the following three program outcomes out of the outcomes required by ABET Criterion 3 for accrediting computer engineering programs.

   Outcome 1: Ability to apply math and Boolean algebra in performing computations in various number systems and simplification of Boolean algebraic expressions. **[ABET Criterion 3a]**

   Outcome 2: Ability to design efficient combinational and sequential logic circuit implementations from functional description of digital systems. **[ABET Criterion 3c]**

   Outcome 3: Ability to use CAD tools to simulate and verify logic circuits. [**ABET Criterion 3k**]

10. **Prepared by**: Dr. Alaaeldin Amin, November 19, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 203

   Course Title: Digital Logic Laboratory

2. **Design:** Required Course

3. **Catalog Description**

   Review of Digital Logic Design: Design of Combinational Circuits, and Design of Sequential Circuits. Logic implementation using discrete logic components (TTL, CMOS), and programmable logic devices. Introduction to Field Programmable Logic Arrays (FPGAs). The basic design flow: design capture (schematic capture, HDL design entry, design verification and test, implementation (including some of its practical aspects), and debugging. Design of data path and control unit.

4. **Prerequisite(s)**

   Fundamentals of Computer Engineering (COE 202)

5. **Textbook(s) and/or other Required Material**

   Morris Mano and Charles Kime, Logic and Computer Design Fundamentals, Third Edition, Prentice Hall International, 2004.

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Design combinational and sequential circuits using discrete components, EEPROMs, and FPGAs to meet certain specifications.
   - Use basic structural Hardware Description Languages to implement digital circuits.
   - Design and conduct experiments related to digital systems and analyze their outcomes.

7. **Topics Covered**

   - ***Combinational Logic Design Review*:** K-maps, universal gates, and MSI components.

- ***Sequential Logic Design Review*:** Flip-flops, counters and registers, sequential circuits analysis and design.
- ***Prototyping of logic circuits*:** Introduction to ICs and discrete components, logic 74xx and 54xx families, power and ground, implementation of a simple combinational circuit.
- ***EEPROM*:** Introduction to logic prototyping using PLDs, implementation of a sequential circuit using EEPROMs and external registers.
- ***FPGAs and HDL*:** Introduction to FPGAs design flow, design and implementation of a sequential circuit using schematic design entry, introduction to hardware description languages (HDL), structural modeling using verilog, complete design and implementation of a small combinational circuit, Register Transfer Level (RTL) modeling using verilog, complete design and implementation of a simple datapath, sequential circuit implementation using verilog.
- ***Design and implementation of a data path and control unit*:** A small processor implementation, integrating HDL and schematic units, data path and control unit design project.

8. **Class/Laboratory Schedule**

   3 hours per week.

9. **Course Contribution to Meet the Professional Component**

   This course emphasizes the use of FPGAs and HDL to implement combinational and sequential circuits. The students use various software tools to model, simulate and implement digital circuits. They also design test benches to analyze certain parameters of the circuit. Every week they are required to submit a lab report of the previous experiment. The course project is intended to build the students' ability to design, implement, simulate, and verify the operation of a simple datapath and control unit. In the project, the students work in teams. At the end they deliver a presentation and submit a project report.

10. **Relationship to Program Outcomes**

Outcome 1: The ability to design combinational and sequential circuits to meet certain specifications **[ABET Criterion 3c]**
Outcome 2: The ability to use tools and discrete components, EEPROMs, FPGAs, to model, simulate and implement digital circuits. **[ABET Criterion 3k]**
Outcome 3: The ability to design and conduct experiments related to digital systems and to analyze their outcomes. [**ABET Criterion 3b**]
Outcome 4: The ability to work in teams. [**ABET Criterion 3d**]
Outcome 5: The ability to communicate effectively. [**ABET Criterion 3g**]

11. **Prepared by**: Syed Z. Shazli, November 14, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 205

   Course Title: Computer Organization & Assembly Language

2. **Design:** Required Course

3. **Catalog Description**

   Introduction to computer organization. Signed and unsigned number representation, character representation, ASCII codes. Assembly language programming, instruction format and types, memory and I/O instructions, dataflow, arithmetic, and flow control instructions, addressing modes, stack operations, and interrupts. Datapath and control unit design. RTL, microprogramming, and hardwired control. Practice of assembly language programming.

4. **Prerequisite(s)**

   Fundamentals of Computer Engineering (COE 202)

   Introduction to Computing I (ICS 102)

5. **Textbook(s) and/or other Required Material**

   Kip Irvine: Assembly Language for Intel-Based Computers**,** 4th edition, 2002.

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Describe the basic components of a computer system, its instruction set architecture and its basic fetch-execute cycle operation.
   - Describe how data is represented in a computer and recognize when overflow occurs.
   - Recognize the basics of assembly language programming including addressing modes.
   - Analyze, design, implement, and test assembly language programs.
   - Recognize, analyze, and design the basic components of a simple CPU including datapath and control unit design alternatives.
   - Recognize various instruction formats.

7. **Topics Covered**

   - ***Introduction and Information Representation:*** Introduction to computer organization. Instruction Set Architecture. Computer Components. Fetch-Execute cycle. Signed number representation ranges. Overflow.

- ***Assembly Language Concepts:*** Assembly language format. Directives vs. instructions. Constants and variables. I/O. INT 21H. Addressing modes.
- ***Intel x86 Assembly Language Programming:*** Register set. Memory segmentation. MOV instructions. Arithmetic instructions and flags (ADD, ADC, SUB, SBB, INC, DEC, MUL, IMUL, DIV, IDIV). Compare, Jump and loop (CMP, JMP, Cond. jumps, LOOP). Logic, shift and rotate. Stack operations. Subprograms. Macros. I/O (IN, OUT). String instructions. Interrupts and interrupt processing, INT and IRET.
- ***CPU Design:*** Register transfer. Data-path design. 1-bus, 2-bus and 3-bus CPU organization. Fetch and execute phases of instruction processing. Performance consideration. Control steps. CPU-Memory interface circuit. Hardwired control unit design. Microprogramming. Horizontal and Vertical microprogramming. Microprogrammed control unit design.
- ***Instruction Set Formats:*** Fixed vs. variable instruction format. Examples of instruction formats.

8. **Class/Laboratory Schedule**

   3 lecture hours. Each lecture hour is 50 minutes. The lab is 3 hours per week.

9. **Course Contribution to Meet the Professional Component**

   This course emphasizes the use of assembly language tools such as the Microsoft Macro Assembler, Linker, and Debugger to develop, analyze, and debug Intel x86 assembly language programs. The lab work emphasizes the use of tools and provides hands on experience in assembly language programming. The course project is intended to make the students apply the concepts learned in the course in designing and implementing a program satisfying a given functionality through team work. The project also involves requirements of self-learning capability.

10. **Relationship to Program Outcomes**

    This course supports the following five program outcomes out of the outcomes required by ABET Criterion 3 for accrediting computer engineering programs.

    Outcome 1: Ability to analyze, design, implement, and test assembly language programs. **[ABET Criterion 3c]**

    Outcome 2: Ability to use tools and skills in analyzing and debugging assembly language programs. **[ABET Criterion 3k]**

    Outcome 3: Ability to design the datapath and control unit of a simple CPU. [**ABET Criterion 3c**]

    Outcome 4: Ability to demonstrate self-learning capability. [**ABET Criterion 3i**]

    Outcome 5: Ability to work in a team. [**ABET Criterion 3d**]

11. **Prepared by**: Dr. Aiman H. El-Maleh, November 12, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 305

   Course Title: Microcomputer System Design

2. **Design:** Required Course

3. **Catalog Description**

   Microprocessor architecture and organization, Bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Practice of the design of a microprocessor system design, testing, debugging and reporting.

4. **Prerequisite(s)**

   Computer Organization and Assembly Language (COE 205)

5. **Textbook(s) and/or other Required Material**

   Barry B. Brey, The Intel Microprocessors, Processor Architecture, Programming, and Interfacing, Seventh Edition, 2006, Prentice Hall

6. **Course Objectives**

After successfully completing the course, students will be able to

- Describe the functions of various pins on the processor and processor Memory/IO Read and Write bus cycle operations.
- Identify the main types of memory technology, describe memory internal organization and design an interface to memory.
- Specify and design simple computer serial and parallel interfaces.
- Describe how interrupts are used to implement I/O control and data transfers, design small interrupt service routines and I/O drivers using assembly language.
- Describe data access from magnetic and optical disk drives using DMA.
- Recognize various types of bus interfaces in a computer system.
- Design and fabricate a medium-sized 8086 based microcomputer system.

7. **Topics Covered**

- 80x86 Processor Architecture :Processor Model, Programmer's model, Designer's Model : 8086 hardware details, Clock generator 8284A, Bus buffering and latching, Processor Read & Write bus cycles, Ready and wait state generation, Coprocessor NDP 8087 interface, 8288 bus controller, Pentium processor architecture.
- Memory Interfacing :80x86 processor-Memory interfacing, Address decoding techniques, Memory Devices – ROM, EPROM, SRAM, FLASH, DRAM devices, Memory internal organization, Memory read and write timing diagrams**,** DRAM Controller
- Basic I/O Interfacing :Parallel I/O, I/O port address decoding, 8255A PPI programming, Operation modes, Interface examples. Timer Interfacing : 8254 PIT, Timing applications. Serial I/O Interface **:**Asynchronous communication, EIA RS232 standard, UART 16650, Interface examples.
- Interrupts :Interrupt driven I/O, Software & Hardware interrupts, Interrupt processing, 8259A PIC programming, cascading, Interrupt examples.
- Direct Memory Access : DMA Controlled I/O, 8237 DMA Controller, Disk Memory Systems- Floppy disk, Hard disk, optical disk memory systems
- Bus Interfaces :PC bus standards & interfaces – PCI, USB, Firewire, AGP

8. **Class/Laboratory Schedule**

3 lecture hours per week. Each lecture hour is 50 minutes. 3 lab hours per week.

9. **Course Contribution to Meet the Professional Component**

This course is tightly integrated with a lab component which exposes the student to various aspects of microprocessor engineering including signal analysis, design & fabrication of medium-sized 80x86 microprocessor based system, manual wiring, testing, and hardware troubleshooting, and conducting I/O interfacing experiments using professional processor kits.

10. **Relationship to Program Outcomes**

This course supports the following seven program outcomes out of the outcomes required by ABET Criterion 3 for accrediting computer engineering programs.

Outcome 1: Ability to apply knowledge of mathematics, probability, and engineering in microprocessor based system design. **[ABET Criterion 3a]**

Outcome 2: Ability to design and conduct experiments related to microprocessor based system design and to analyze their outcomes. **[ABET Criterion 3b]**

Outcome 3: Ability to design, debug and test a small scale microprocessor system. **[ABET Criterion 3c]**

Outcome 4: Ability to function as an effective team member **[ABET Criterion 3d]**

Outcome 5: Ability to identify, formulate, and solve engineering problems in microprocessor based system design. **[ABET Criterion 3e]**

Outcome 6: Ability to use design tools for microprocessor system design, test and evaluation. **[ABET Criterion 3k]**

Outcome 7: Ability to engage in self-learning. **[ABET Criterion 3i]**

Prepared by: Dr. Abdul Rahim Naseer,

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 308

   Course Title: Computer Architecture

2. **Design:** Required Course

3. **Catalog Description**

   Memory management and cache memory. Integer and floating point arithmetic. Instruction and arithmetic pipelining, superscalar architecture. Reduced Instruction Set Computers. Parallel architectures and interconnection networks.

4. **Prerequisite(s)**

   Computer Organization and Assembly Language (COE 205)

5. **Textbook(s) and/or other Required Material**

   David A. Patterson and John L. Hennessy, *Computer Organization & Design: The Hardware/Software Interface*, 3rd Edition, Morgan Kaufmann, 2005

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Analyze MIPS assembly language code.
   - Describe and apply integer and floating-point representations and arithmetic.
   - Compute the execution time, average CPI, and speedup for improvements.
   - Design the datapath and control logic of simple pipelined/non-pipelined CPUs.
   - Analyze and compare the performance of different CPU designs.
   - Analyze the impact of caches and memory organization on performance.

7. **Topics Covered**

   - Instruction set architecture versus Organization, Components, Abstraction, Technology trends, Chip manufacturing process.
   - Instruction set design, Instruction formats, Addressing modes, CISC versus RISC, Writing MIPS assembly language code.

- CPU performance and metrics, CPI, MIPS as a metric, Amdahl's law, Benchmarks, Performance of recent processors.
- Computer arithmetic, Integer multiplication and division, Floating-point and IEEE 754 standard, Floating-point addition and multiplication, Rounding.
- Processor design, Register transfer, Datapath components, Clocking, Single cycle and multicycle datapath, Control signals, Control unit, Performance.
- Instruction pipelining, MIPS 5-stage pipelined datapath, Control, Performance, Hazards, Stall and forwarding, Compiler scheduling, Branch prediction.
- Memory hierarchy, DRAM and SRAM, Locality, Cache memory organization, Cache misses, Write policy, Block replacement, Cache performance.
- Virtual memory, Page tables and TLB, Virtual/physical caches.
- I/O subsystem and devices, Disk operation and performance, RAID, Buses, Bus operation, DMA, I/O performance.
- Introduction to multiprocessors, Shared-memory, Cache coherence, Message-passing, Interconnection networks.

8. **Class/Laboratory Schedule**

   3 lecture hours per week. Each lecture hour is 50 minutes.

9. **Course Contribution to Meet the Professional Component**

   This course emphasizes the use of MIPS assembly language tools such as the SPIM and MARS software simulators to develop, analyze, and debug MIPS assembly language programs. It also emphasizes the use of simulators for the design and the simulation of the datapath and control of a processor. The course project is intended to build the students' ability to design, implement, simulate, and test the operation of a simple pipelined processor.

10. **Relationship to Program Outcomes**

    This course supports the following five program outcomes out of the outcomes required by ABET Criterion 3 for accrediting computer engineering programs.

    Outcome 1: Ability to apply knowledge of mathematics, probability, and statistics in computer performance evaluation. **[ABET Criterion 3a and 3L]**

    Outcome 2: Ability to design the datapath and control of a processor. **[ABET Criterion 3c]**

    Outcome 3: Ability to identify, formulate, and solve computer architecture problems. [**ABET Criterion 3e**]

    Outcome 4: Ability to use simulator tools. [**ABET Criterion 3k**]

    Outcome 5: Ability to engage in self-learning. [**ABET Criterion 3i**]

11. Prepared by: Dr. Muhamed F. Mudawar, November 7, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 341

   Course Title: Data and Computer Communications

2. **Design:** Required Course

3. **Catalog Description**

   Introduction to data communication. Overview of the OSI model. Frequency response, bandwidth, filtering and noise. Fourier series and Fourier transform. Information theory concepts: Nyquist's theorem, Shannon's and Sampling theorems. Analog and digital modulation techniques. Pulse Code Modulation (PCM). Communication systems circuits and devices. Data encoding. Physical layer protocols. Data link control (point to point communication, design issues, link management, error control, flow control). Multiplexing and switching.

4. **Corequisite**

   Probability and Statistics for Engineers and Scientists (STAT 319)

5. **Textbook(s) and/or other Required Material**

   Data and Computer Communication, William Stalling, Prentice Hall International, 7th Edition, 2004.

6. **Course Objectives**

   After successfully completing the course, students will be able to:

   - Appreciate the importance of data communication standards, protocols, and protocol architectures.
   - Describe fundamental concepts in communications, including signal spectrum, power spectral density, effective bandwidth, filtering, signal to noise ratio, channel capacity, and error rate.
   - Compare and contrast various types of transmission media for both guided and guided propagation regarding cost, transmission impairments and applications.
   - Identify trade offs governing the choice of analog/digital and synchronous/asynchronous transmission techniques and different signal encoding and modulation schemes.

- Analyze and design simple communication links using guided and unguided media, hardware for generating CRC error detection codes and performing error detection, HDLC flow and error control mechanisms, and basic PCM and Delta modulation systems.
- Compare and contrast different multiplexing techniques, e.g. FDM, WDM, TDM, and statistical TDM.

7. **Topics Covered**

- ***Communication and Networking Models*:** Communication Model, Data Communications, Networking. The OSI model.
- ***Data Transmission*:** Concepts and terminology, Analog and Digital Data Transmission, FFT Analysis, Impairments, Nyquist and Shannon channel capacities.
- ***Guided and Wireless Transmission*:** Guided transmission media, Wireless transmission.
- ***Signal Encoding Techniques*:** Digital Data – Digital Signals, Digital Data – Analog Signals, AD/DA.
- ***Digital Data Communication Techniques*:** Asynchronous and synchronous data interface, Error types, Error Detection, Flow Control and HDLC.
- ***Multiplexing*:** Frequency division multiplexing, Time division multiplexing (synchronous and statistical), Asymmetric digital subscriber line (ASDL).

8. **Class/Laboratory Schedule:** 3 lecture hours per week.

9. **Course Contribution to Meet the Professional Component**

This course includes a programming assignment where students use software tools to develop skills for the simulation, analysis, and design of communication processes and components.

10. **Relationship to Program Outcomes**

Outcome 1: Ability to apply knowledge of mathematics to establish basic concepts in communication engineering. **[ABET Criterion 3a]**

Outcome 2: Ability to analyze and design communication systems, processes, and components. **[ABET Criterion 3c]**

Outcome 3: Ability to identify, formulate, analyze, and solve communication engineering problems. [**ABET Criterion 3e**]

Outcome 4: Ability to use programming tools and skills for the simulation, analysis, and design of communication systems and components. [**ABET Criterion 3k**]

Outcome 5: Ability to demonstrate self learning skills and aptitudes. [**ABET Criterion 3i**]

11. **Prepared by**: Dr. Radwan E. Abdel-Aal, November 7, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 344

   Course Title: Computer Networks

2. **Design:** Required Course

3. **Catalog Description**

   This course will be taught using the top-down approach. Topics covered include introduction to computer networks, OSI model, WAN and LAN design issues. Application layer design issues and protocols are discussed. Then, Transport layer design issues, protocols as well as congestion control mechanisms are presented. Socket programming is explained. An in-depth analysis is presented of the Network layer design issues, and internetworking. MAC layer design issues and protocols are presented.

4. **Prerequisite(s)**

   Data and Computer Communications (COE 341)

5. **Textbook(s) and/or other Required Material**

   J. Kurose & K. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 3rd Edition, Addison Wesley, 2005

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.
   - Design, implement, and analyze simple computer networks.
   - Identify, formulate, and solve network engineering problems.
   - Use techniques, skills, and modern networking tools necessary for engineering practice.

7. **Topics Covered**

   - Introduction: What is the Internet, What is a protocol?, Network Edge, Network Core, Network Access, Physical Media, Delay and Loss in Packet-Switched Networks, Protocol Layers and their Service Models, Internet Backbones, NAPs and ISPs, Brief History of Computer Networking and the Internet.

- Application Layer: Principles of Application Layer Protocols, HTTP, FTP, Electronic Mail in the Internet, DNS, P2P File Sharing.
- Transport Layer: Services and Principles, Multiplexing and Demultiplexing Applications, UDP, Principles of Reliable of Data Transfer: TCP case study, Principles of Congestion Control.
- Network Layer: Service Models, What is Inside a Router?, IP: the Internet Protocol, Routing Algorithms, Hierarchical Routing, Routing in the Internet.
- Link Layer & LANs: Link Layer: Services, Multiple Access Protocols and LANs, LAN Addresses and ARP, Ethernet, Hubs, Bridges and Switches, PPP.
- Wireless & Mobile Networks: Wireless Links & Network Characteristics, CDMA, Wireless LANs: IEEE 802.11, WPAN & Bluetooth, Introduction to mobile networking.

8. **Class/Laboratory Schedule**

   3 lecture hours and 3 laboratory hours per week. Each lecture hour is 50 minutes.

9. **Course Contribution to Meet the Professional Component**

   This course lays the ground for subsequent courses in the program on networking. It includes a laboratory where students use software and hardware tools to develop skills for the design, implementation, and analysis of computer networks.

10. **Relationship to Program Outcomes**

    This course supports the following five program outcomes out of the outcomes required by ABET Criterion 3 for accrediting computer engineering programs.

    Outcome 1: Ability to apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols. **[ABET Criterion 3a]**

    Outcome 2: Ability to design, implement, and analyze simple computer networks. **[ABET Criterion 3b]**

    Outcome 3: Ability to identify, formulate, and solve network engineering problems. [**ABET Criterion 3e**]

    Outcome 4: Knowledge of contemporary issues in computer networks. [**ABET Criterion 3j**]

    Outcome 5: Ability to use techniques, skills, and modern networking tools necessary for engineering practice. [**ABET Criterion 3k**]

11. **Prepared by**: Dr. Marwan H. Abu-Amara, November 11, 2006.

COURSE SYLLABUS

1. **Department, Number and Course Title**

   Department: Computer Engineering

   Course Number: COE 360

   Course Title: Principles of VLSI Design

2. **Design:** Required Course

3. **Catalog Description**

   MOS Transistor operation and limitations, MOS digital logic circuits (NMOS & CMOS), static & dynamic logic, combinational and sequential circuits, propagation delay, transistor sizing, MOS IC fabrication, layout and design rules, stick diagrams, IC Design and Verification Tools, subsystem design and case studies, and practical considerations.

4. **Prerequisite(s)**

   Electronics I (EE 203)

5. **Textbook(s) and/or other Required Material**

   S.-M. Kang and Y. Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 2nd ed., 1999. Also some handouts on various topics will be used insha'Alla.

6. **Course Objectives**

   After successfully completing the course, students will be able to

   - Apply knowledge of mathematics, science, and engineering in the design, analysis and modeling of digital integrated circuits.
   - Design and conduct experiments using SPICE to characterize and optimize digital integrated circuits.
   - Design, Verify, Analyze and Evaluate the performance (speed, Power, Area, Noise margins) of different MOS digital integrated circuits for different design specifications.
   - Use various CAD tools in the design and verification of digital integrated circuits.
   - Function as an effective team member in digital integrated circuits design projects.
   - Document and communicate the design efforts effectively using written reports.

7. **Topics Covered**

   - Review of basic semiconductors properties
   - Structure, behavior and modeling of PN-junctions (Diodes)

- Structure, behavior and modeling of Metal-Oxide-Semiconductor Transistors (MOSFETs)
- Scaling and scaling effects of MOS transistors
- Design of digital MOS Circuits; NMOS inverter, CMOS inverter, CMOS logic gates, CMOS sequential circuits
- Modeling and Simulation of CMOS integrated circuits with SPICE
- CMOS Processing Technology and Fabrication
- CMOS design rules and layout techniques, floor planning, and parasitics
- CMOS IC Design, Design styles and Case Studies

8. **Class/Laboratory Schedule**

   3 lecture hours per week. Each lecture hour is 50 minutes.

9. **Course Contribution to Meet the Professional Component**

   This course emphasizes the use of CAD tools for the design and verification of digital integrated circuits. The course project is intended to build the students' ability to design, and verify a digital integrated circuit. It also helps developing the student's ability to plan, work within a team and to communicate his design efforts.

10. **Relationship to Program Outcomes**

    Outcome 1: Ability to apply knowledge of mathematics, science, and engineering in the design, analysis and modeling of digital integrated circuits **[ABET Criterion 3a]**

    Outcome 2: Ability to design and conduct experiments using SPICE to characterize and optimize digital integrated circuits **[ABET Criterion 3b]**

    Outcome 3: Ability to Design, Verify, Analyze and Evaluate the performance (speed, Power, Area, Noise margins) of different MOS digital integrated circuits for different design specifications [**ABET Criterion 3c**]

    Outcome 4: Ability to use CAD tools in the design and verification of digital integrated circuits [**ABET Criterion 3k**]

    Outcome 5: Ability to function as an effective team member [**ABET Criterion 3d**]

    Outcome 6: Ability to document and communicate design efforts effectively using written reports [**ABET Criterion 3g**]

11. **Prepared by**: Dr. Muhammad E. Elrabaa, November 12, 2006.

COURSE SYLLABUS

11. **Department, Number and Course Title**

Department:	Computer Engineering
Course Number:	COE 485
Course Title:	Senior Design Project

12. **Design:** Required Course

13. **Catalog Description**
This course is designed to give students the experience of tackling a realistic engineering problem. The intent is to show how to put theoretical knowledge gained into practical use by starting from a word description of a problem and proceeding through various design phases to end up with a practical engineering solution. Various projects are offered by COE faculty in their respective specialization areas. The project advisor guides the student in conducting feasibility study, preparation of specifications, and the methodology for the design. Detailed design and implementation of the project are carried out followed by testing, debugging, and documentation. An oral presentation and a final report are given at the end of the semester.

14. **Prerequisite(s)**
Senior Standing

15. **Textbook(s) and/or other Required Material**

There is no textbook for this course. The following book is used as a reference: Robert Angus and Norman Gundersen, "Planning, Performing, and Controlling Projects: Principles and Applications", Prentice-Hall, First Edition, 1997.

16. **Course Objectives**
After successfully completing the course, students will be able to:

- Define formal specifications from the problem statement.
- Examine different approaches.
- Develop new solutions that utilize fundamental scientific concepts.
- Describe a system design from high level specifications.
- Describe a detailed design of the required components.
- Implement a prototype, design and conduct experiments
- Document clearly the work by presenting original work.
- Communicate effectively the project details orally.
- Demonstrate team work skills, meet deadlines, and plan properly.
- Understand the impact of a solution on the society.
- Understand the impact of contemporary issues on a design.

17. **Topics Discussed**

- *Project management*

- *Engineering approach to design*
- *Design verification and testing*
- *Work habits*
- *Project Documentation*
- *Oral Presentation*

18. **Class/Laboratory Schedule:** One lecture hour (50 minutes) per week.

19. **Course Contribution to Meet the Professional Component**

    The course allows the students to learn more about the methodology and phases of conducting a design project. Students examine different approaches, conduct a feasibility study, and prepare specifications. They also carry out a detailed design and implementation of the project, followed by testing, debugging, and documentation, and oral presentation.

20. **Relationship to Program Outcomes**

    Outcome 1: Ability to apply knowledge of mathematics, science, and engineering. **[ABET Criterion 3a]**

    Outcome 2: Ability to design and conduct experiments, as well as to analyze and interpret data. **[ABET Criterion 3b]**

    Outcome 3: Ability to design a system, component, or process to meet desired needs. [**ABET Criterion 3c**]

    Outcome 4: Ability to identify, formulate, and solve engineering problems. [**ABET Criterion 3e**]

    Outcome 5: Understanding of professional and ethical responsibility. [**ABET Criterion 3f**]

    Outcome 6: Ability to communicate effectively. [**ABET Criterion 3g**]

    Outcome 7: The broad education necessary to understand the impact of engineering solutions in a global and societal context. [**ABET Criterion 3h**]

    Outcome 8: Recognition of the need for, and an ability to engage in life-long learning. [**ABET Criterion 3i**]

    Outcome 9: Knowledge of contemporary issues. [**ABET Criterion 3j**]

    Outcome 10: Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. [**ABET Criterion 3k**]

    Outcome 11: Ability to function as an effective team member[**ABET Criterion 3d**]

21. **Prepared by**: Dr. Mohammed H. Sqalli, April 10, 2007.

C. **Faculty Resumes**

Curriculum Vitae

1. Name : Adnan Abdul-Aziz Gutub
2. Rank : Chairman and Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Electrical Engineering, KFUPM, January 1995.

M.Sc. in Computer Engineering, KFUPM, June 1998.

Ph.D. in Electrical & Computer Eng., Oregon State University, Sept. 2002.

4. Number of years of service at KFUPM: 11 years
   Original appointment: 1995, Graduate Assistant
   Dates of advancement in rank: 1999, Lecturer
   2002, Assistant Professor

5. Other related experiences – teaching, industrial etc.
   -COE 200: Fundamentals of Computer Engineering, -COE 205: Computer Organization & Assembly Language Programming, - COE 305: Microcomputer System Design, - COE 360: Principles of VLSI Design, - COE 485: Senior Design Project – Coordinator and Supervisor, - COE 390: Seminar,

   - PYP 003: University Study Skills

6. Consulting, patents etc: None
7. State(s) in which registered: None

8. Principal publications in last five years:
   1. A.Gutub, "Fast 160-Bits GF(p) Elliptic Curve Crypto Hardware of High-Radix Scalable Multipliers)", *International Arab Journal of Information Technology (IAJIT),* Vol. 3, No. 4, Pages: 342-349, Oct.2006.
   2. A.Gutub, "Merging GF(p) Elliptic Curve Point Adding and Doubling on Pipelined VLSI Cryptographic ASIC Architecture" , *International Journal of Computer Science and Network Security (IJCSNS)*, Vol.6, No.3A, Pages: 44 – 52, March 2006.
   3. A.Gutub and A.Tenca, "Efficient Scalable VLSI Architecture for Montgomery Inversion in GF(p)", *Integration, the VLSI Journal*, Vol. 37, No. 2, pages 103-120, May 2004.
   4. A.Gutub, E.Savas, and T.Kalganova, "Scalable VLSI Design for Fast GF(p) Montgomery Inverse Computation", *IEEE International Conference on Computer & Communication Engineering (ICCCE '06)*, International Islamic University Malaysia, Kuala Lumpur, Malaysia, 9-11 May 2006.
   5. A.Gutub, M.Ibrahim, and A.Kayali., "Pipelining GF(P) Elliptic Curve Cryptography Computation", *The 4th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA-06),* American University of Sharjah (AUS), Sharjah, United Arab Emirates, March 8-11, 2006,
   6. A.Gutub, M.Ibrahim, and M.Araman., "Super Pipelined Digit Serial Adders for Multimedia and e-Security", *IEEE 1st International Computer Engineering Conference on New Technologies for the Information Society (ICENCO 2004),* Cairo University, pages 558-561, EGYPT, December 27-30, 2004.
   7. A.Gutub and A.Tenca, "Efficient Scalable Hardware Architecture for Montgomery Inverse Computation in GF(P)", *IEEE Workshop on Signal Processing Systems (SIPS'03)*, pages 93-98, Seoul, Korea, August 27-29, 2003.

8. A.Gutub and M.Ibrahim., "High Performance Elliptic Curve GF(2^k) Cryptoprocessor Architecture for Multimedia", *IEEE International Conference on Multimedia & Expo, ICME 2003*, pages 81- 84, Baltimore, Maryland, USA, July 6-9, 2003.
9. A.Gutub and M.Ibrahim., "Power-time flexible architecture for GF(2^k) elliptic curve cryptosystem computation", *Proceedings of the 13th ACM Great Lakes Symposium on VLSI* , pages 237-240, Washington, D. C., USA, April 28 - 29, 2003
10. A.Gutub, A.Tenca, E.Savas, and C.Koc, "Scalable and Unified Hardware to Compute Montgomery Inverse in GF(p) and GF(2^n)", *Workshop on Cryptographic Hardware and Embedded Systems CHES'2002*, pages 485-500, San Francisco Bay (Redwood City), USA, August 13-15, 2002.

9. Scientific and professional societies of which a member
   1. Security Research Group and Cryptography Research Group, KFUPM.
   2. Bio-Inspired Intelligent Systems Team, Brunel University, UK.
   3. Cryptographic Hardware and Embedded Systems (CHES) Research Group.

10. Honors and awards.
    1. Awarded Ten Years Certificate of Service by the Rector of KFUPM, 2005.
    2. Awarded the 2005 Summer British Council Grant on a research project held in Brunel University at the United Kingdom.

11. Institutional and professional service in the last five years
    Delivered Summer Workshops on:
    1. Webpage Design and Applications, 2005.
    2. Microprocessor interfacing using Assembly Programming, 2004.
    3. Designing a simple calculator using logic gates, 2003.

12. Institutional Professional development activities in the last five years.
    Attended several specialized development workshops, such as:
    1. Improving teaching skills in KFUPM at Sept. of 2002,2003,2004,2005, 2006.
    2. The Role of Academic Chairman in the 21st Century, 2006.
    3. Research Enhancement for Junior Faculty Members, 2006.
    4. Preparing Programs for Gifted Students, 2005.
    5. Using WebCT in Teaching 2003.

Curriculum Vitae

1. Name : Radwan El-Said Abdel-Aal
2. Rank : Professor, Computer Engineering Department

3. Degrees with fields, institution, and date:

B.Sc. in Electrical Engineering, Electronics & Communications, Cairo University, June 1972

M.Sc. in Aviation Electronics, Canfield Institute of Technology, UK, October 74

Ph.D. in Acoustical Imaging, Strathcyde University, UK, June 1983

4. Number of years of service at KFUPM: 21 years

Original appointment: November, 1985, Research Scientist III, Research Institute

Dates of advancement in Rank: May, 90, Research Scientist II, Research Institute

June, 95, Research Scientist I, Research Institute

November,2006, Professor, Computer Eng. Dept.

5. Other related experiences – teaching, industrial etc.:

Sep 04 - Aug 05 Physics Dept, KFUPM, Associate Professor

Sep 83 - March 85 Strathclyde University, Research Fellow, Glasgow, UK
Sep 79 - July 83 Strathclyde University, Research Assistant Glasgow, UK
June 78 -Aug 79 Sunderland Polytechnic, Research Assistant, Tyne and Wear, UK

6. Consulting, patents etc.: None

7. State(s) in which registered: Chartered Engineer, MIEE, UK, 1984

8. Principal publications in last five years:

1. Abdel-Aal, R. E., Abdel-Halim, M. R. E. and Abdel-Aal, S., "Improving the classification of multiple disorders with problem decomposition," Journal of Biomedical Informatics (2006), In Press.

2. Abdel-Aal, R. E., "Modeling and forecasting electric daily peak loads using abductive networks," Elec. Power and Energy Systems, Vol. 28 (2006), pp. 133-141.

3. Abdel-Aal, R. E., "Improved classification of medical data using abductive network committees trained on different feature subsets," Computer Methods and Programs in Boimedicine, Vol. 80 (2005), pp. 141-153.

4. Abdel-Aal, R. E., "GMDH-based feature ranking and selection for improved classification of medical data," J. of Biomedical Info., Vol. 38 (2005), pp. 456-468.

5. Abdel-Aal, R. E., "Improving electric load forecasts using network committees", Electric Power Systems Research. Vol. 74 (2005), pp. 83–94.

6. Abdel-Aal, R. E., "Hourly temperature forecasting using abductive networks," Engineering Applications of Artificial Intelligence, Vol. 17 (2004), pp. 543-556.

7. Abdel-Aal, R. E., "Abductive network committees for improved classification of medical data," Methods of Information in Medicine, Vol. 43 (2004), pp. 192-201.

8. Abdel-Aal, R. E., "Short term hourly load forecasting using abductive networks," IEEE Transactions on Power Systems, Vol. 19 (2004), pp. 164-173.

9. Abdel-Aal, R. E., "Experimental evaluation of performance improvements in

abductive network classifiers with problem decomposition," Neurocomputing, Vol. 61 (2004), pp. 193-215.
10. Abdel-Aal, R. E., "Direct estimation of noisy sinusoids using abductive networks," Eng. Applications of Artificial Intelligence, Vol. 16 (2003), pp. 615-627.
11. Abdel-Aal, R. E., "Comparison of algorithmic and machine learning approaches for the automatic fitting of Gaussian peaks," Neural Computing and Applications, Vol. 11 (2002), pp. 17-29.
12. Ahmed, O. A., Abdel-Aal, R. E., and AlMustafa, H., "Predicting Log Properties from Seismic Data Using Abductive Networks," GEO 2006 Middle East Conference and Exhibition, Manama, Bahrain, March 27-29, 2006

9. Scientific and professional societies of which a member
   - Member, IEEE, USA, since 1984 - Member, IEE, UK, 1984-1996
   - Member, Engineers Syndicate, Egypt, since 1993
10. Honors and awards.
   - Listed in Marquis Who's Who in the World, 2007.
   - The British Council Fees Award, UK, 1973/74.
   - The British Royal Aeronautical Society Prize for best marks in the MSc Aviation Electronics course at the Cranfield Institute of Technology, UK, 1973.
11. Institutional and professional service in the last five years
   - "Predicting log properties from seismic data using abductive networks", Funded research project completed for Saudi Aramco, Value SR 250,000, 2005-6, Co-investigator.
   - Developed a WebCT-based course for COE 342/341.
   - Led a work group for developing ABET learning outcomes and assessment form for the course COE 342/341.
   - Developed a new lab manual for PHYS 303 lab (Semester 041) containing 14 new experimental setups and procedures.
   - Reviewed research papers for several journals, including: IEEE Trans. Power Systems, Energy, Neural Computing and Applications, Electrical Power and Energy Systems, Artificial Intelligence in Medicine, and Medical Engineering and Physics.
12. Professional development activities in the last five years.
   - Attended/contributed to several conferences, see Item 7.2. above.
   - Attended several workshop organized by the Deanship of Academic
   -Development (DAD) on improving the quality of teaching and learning.

Curriculum Vitae

4. Name : Mayez Abdullah Al-Mouhamed
5. Rank : Professor, Computer Engineering Department
6. Degrees with fields, institution, and date

   B.Sc. in Electrical Engineering, ___ University of Paris XI, France, May 1975

   M.Sc. in Electrical Engineering, ___University of Paris XI, France, Sep 1977

   Ph.D. in Electrical Engineering, ___ University of Paris XI, France, Jan 1982

4. Number of years of service at KFUPM: 23 years

   Original appointment: January, 1983, Assistant Professor

   Dates of advancement in: January, 1990, Associate Professor

   June, 2000, Professor

   Visiting Asso. Prof. Univ. of California Irvine, Comp. Science, 1993

5. Other related experiences – teaching, industrial etc.
   Taught Computer Architecture, Parallel Algorithms and Architectures, Computer networks and Data Communication, Computer Vision, and Robotics.
6. Consulting, patents etc.
   1. "A Closed Loop Robotic Control", European Patent Office, No 83400154.7, 1983
   2. "A Robotics Force Sensor", European Patent Office, No 83400153.9, 1983
7. Professional Engineer in New York State (if not applicable, say 'none'): None
8. Principal publications in last five years
   1. M. Al-Mouhamed, O. Toker, and A-K Al-Harthy, A 3D Vision-Based Man-Machine Interface For Hand-Controlled Telerobot, IEEE T. on Industrial. Electronics, 52:1, 2005, pp. 306-319.
   2. M. Al-Mouhamed, Array Organization in Parallel Memories, Inter. J. of Parallel Programming (IJPP), Vol 32, No.2, April, 2004, pp.123-163.
   3. M. Al-Mouhamed, O. Toker, A. Iqbal, A Multi-Threaded Distributed Telerobotic Framework, IEEE T.on Mechatronics, February, 2006
   4. Mayez A. Al-Mouhamed, Mohammad Nazeeruddin, and Nesar Merah, Design and Analysis of Force Feedback in Telerobotics, under review with the IEEE T. on Industrial Electronics, March, 2006.
   5. M. Al-Mouhamed, O. Toker, A-K Al-Harthy, "A 3D Vision-Based Man-Machine Interface For Hand-Controlled Telerobot", IFAC Conf on ICSSP, Portugal, 2003, pp. 586-591.
   6. M. Al-Mouhamed, A Scalable Family of High-Speed Switch Architectures, IEEE Inter. Conf. On Electronics, Circuits and Systems (2003), pp. 32-35.
   7. M. Al-Mouhamed, O. Toker, A. Iqbal, A Distributed Framework for Relaying Stereo Vision for Telerobotics, IEEE Inter. Conf. on Pervasive Services, Lebanon, 2004, pp. 221-225.
   8. M. Al-Mouhamed, O. Toker, A. Iqbal, Evaluation of Real-Time Delays for Networked Telerobotics, IEEE Conf. on Ind. Informatics, 2005, Australia.

9. M. Al-Mouhamed, M. Nazeeruddin, and N. Merah, Design and Analysis of Force Feedback in Telerobotics, AUS Inter. Symp. on Mecha., 2006, UAE.

9. Scientific and professional societies

Member, IEEE Robotics and Automation society.

Member, Editorial Board, the Inter. Journal of Parallel Programming (IJPP), USA.

10. Honors and awards.
    - Recipient of KACST First Degree, Golden Certificate for Excellence in Research, K.S.A., January 2007.
    - Recipient of the Winning Award of the CCSE Student Project Innovation Award on the "Design of an Internet Robot", KFUPM, June, 2006.
    - Recipient of the "College of Computer Science and Engineering Excellence Award in Teaching for the COE Department", KFUPM, Dhahran 31261, K.S.A., June 2006.
    - Recipient of the "College of Computer Science and Engineering Excellence Award in Student Project", KFUPM, Dhahran 31261, K.S.A., June 2006.
    - Recipient of the "College of Computer Science and Engineering Excellence Award in Muti-Disciplinary Research", KFUPM, Dhahran 31261, K.S.A., June 2003.
    - Recipient of the "King Fahd University of Petroleum and Minerals Distinguished Short Course Award", KFUPM, Dhahran 31261, K.S.A., June 2002.

11. Institutional and professional service in the last five years
    1. Coordinator for PhD Preliminary and Comprehensive Exams in Computer Architecture.
    2. Member of COE Curriculum Self-Assessment Committee, COE, KFUPM, 2002.
    3. Chairman of the COE ABET committee for Preparing the Self-Study Report and implementing EC 2K at the COE department, 2006-2007.

12. Professional development activities in the last five years.
    a. Attended the Intel Workshop on "High Performance Computing Software Training". KFUPM, May 21-24, 2006.
    b. Attended the Workshop on "Engineering Design", by McMahon, Knecht, Baluch, Loughlin, Al-Qutub, and Youcef-Toumi. KFUPM, April 11-12, 2006.
    c. Attended a 2-day Workshop on "Developping the Communication Skills of Students", presented by Prof. Sergio Piccinin, Univ. of Ottawa, Organized by the DAD, KFUPM, 4-5 September, 2004.
    d. Attended a 1-day Workshop on "Active Learning to Foster Critical Thinking", presented by Prof. Sergio Piccinin, Univ. of Ottawa, Organized by the DAD, KFUPM, September 6, 2004.

1. Name: Mohammed, Sadiq Sait
2. Rank : Professor, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.E. in Electronics Engineering, Bangalore University, India, May 1981

   M.S. in Electrical Engineering, KFUPM, Saudi Arabia, August 1983

   Ph.D. in Electrical Engineering, KFUPM, Saudi Arabia, November 1986

4. Number of years of service at KFUPM: 26 years

Original appointment:	1981-1983,	Research Assistant
Dates of advancement in rank:	1983-1986,	Lecturer
	1987-1992,	Assistant Professor
	1992-1998,	Associate Professor
	1998-present,	Professor
	2000-2004,	Chairman,Com. Engg. Dept.
	2005-Present,	Director, ITC

5. Other related experiences – teaching, industrial etc.

   Teaching: Taught several undergrad and graduate courses in COE Department related to Digital Logic, VLSI CAD, Internet Information Systems, Synthesis, and Computer Communication.

6. Consulting, patents etc.

   Patent (Pending): Sadiq M. Sait (with Rehan Sami and Abdul Waheed): "Content-Aware Congestion Control for Software MPLS Routers"

7. State(s) in which registered: none
8. Principal publications in last five years
   1. Sadiq M. Sait and Junaid A. Khan, "Fast Fuzzy Force-Directed Simulated Evolution metaheuristic for Multiobjective VLSI cell placement", European Journal of Operational Research (Submitted October 2004).
   2. Sadiq M. Sait, Khalid M. Al-Tawil, and Syed Ali Hussain, "E-Commerce in Saudi Arabia: Adoption and Perspectives", Australian Journal of Information (AJIS) Systems, Vol. 12 (1), pages 54-74, September 2004.
   3. Sadiq M. Sait, Khalid M. Al-Tawil, Salman A. Khan and Mohammed Faheemuddin, "The Use and Effect of Internet on General Education in Saudi Arabia", Journal of Technology, Pedagogy and Education (TPEd), UK. (Submitted, March 2004).
   4. Aiman H. El-Maleh, S. Saqib Khursheed, and Sadiq M. Sait, "Efficient Static Compaction Techniques for Sequential Circuits based on Reverse Order Restoration Based and Test Relaxation", Submitted to IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (June 2005).
   5. Sadiq M. Sait, and Mahmood R. Minhas, "SimE/TS fuzzy hybrid for multiobjective VLSI placement", Electronics Letters, Volume 42, Issue 6, 16 March 2006 Page(s):364 - 365.

6. Sadiq M. Sait, Mahmood R. Minhas, and Junaid A. Khan. ``Performance and Low Power Driven VLSI Standard Cell Placement using Tabu Search", IEEE Congress on Evolutionary Computation", May 2002, Honolulu, Hawaii, USA, pp 372-377.
7. Sadiq M. Sait, Syed Hussain Ali, Khalid M. Al-Tawil and Syed Sanaullah, "Trends in Internet Usage & its effects in Saudi Arabia", ICASE World Conference on Science & Technology Education, pp 692-700, Penang Malaysia, April 2003.
8. Aamir A. Farooqui, Vojin G. Oklobdzija, Sadiq M. Sait. Area-Time Optimal Adder with Relative Placement Generator. IEEE International Symposium on Circuits and Systems", Vol V, 141-144, Bangkok, Thailand, May 2003.
9. Sadiq M. Sait and Muhammad Al-Ismail, "Enhanced Simulated Evolution algorithm for Digital Circuit Design yielding faster execution in a larger solution space", IEEE Congress on Evolutionary Computation (CEC), Portland, Oregon, USA, June 2004.
10. Sadiq M. Sait, Mustafa I. Ali and Ali M. Zaidi, "Multiobjective VLSI Cell Placement using Distributed Simulated Evolution Algorithm", International Symposium on Circuits and Systems, (ISCAS 05), Kobe, Japan, May 2005.

9. Scientific and professional societies of which a member
    1. Senior Member, IEEE.
    2. Member, IEEE Computer Society, IEEE CAS Society
    3. Member, Saudi Computer Society
10. Honors and awards.
    1. Nominee for the ‘Distinguished Teacher Award’ three times, and received the award once (from ‘King Fahd University of Petroleum & Minerals’), in 1995.
    2. Received the ‘Distinguished Researcher Award’ three times from ‘King Fahd University of Petroleum & Minerals’, in 1990, 1994, and 1999.
    3. Nominated by the Department of Computer Engineering for the ‘Best Advisor Award’ two times.
    4. Editor of ‘Arabian Journal for Science and Engineering (AJSE)’ for Computer Science & Engineering 1992-present.
11. Institutional and professional service in the last five years

    Director: ITC Department, COE Department Plan Committee, Academic Committee, Member: KASP (King Abdullah Science Park), ERP (Raed Project) and Aafaq project

12. Professional development activities in the last five years.

    Aiman El-Maleh and Sadiq M. Sait. ‘Efficient Test Relaxation-Based Static Test Compaction Techniques for Combinational and Sequential Circuits’. Co-Investigator of KFUPM Research Committee sponsored. Proposal accepted, August 2004, Two year Project, IP.

Curriculum Vitae

7. Name : Alaaeldin A. M. Amin
8. Rank : Associate Professor, Computer Engineering Department
9. Degrees with fields, institution, and date

   B.Sc. in Electrical Engineering, Cairo University, July 1974

   M.Sc. in Electrical Engineering, Cairo University, June 1977

   Ph.D. in Computer Engineering, University of Utah, June 1987

4. Number of years of service at KFUPM: 18 years

   Original appointment: September, 1988, Assistant Professor

   Dates of advancement in: October 1993, Assoc. Professor

5. Other related experiences –

   1. Over 8 years of industrial experience at National Semiconductor Corporation, a large and leading multi-national Integrated Circuit manufacturer with headquarters in Santa Clara California (Silicon Valley) 1980 - 1988.
   2. Wide experience in the field of VLSI Integrated Circuit design in general and in MOS Memory Design in particular.
   3. Have been involved in all phases of the design cycle of VLSI Integrated Circuits, including product performance specification, process technology definition, circuit design and layout, logic and device level simulation, test requirements, circuit debugging and troubleshooting as well as final testing.

   Projects Accomplished / worked on:

   1. Design of a CMOS SRAM-Based FPGA Test chip,
   2. Design of 32K CMOS EPROM,
   3. Design of 64K NMOS EPROM,
   4. Design of 256K NMOS DRAM,
   5. Design of 256K CMOS EPROM, (Took over as team leader)
   6. Design of 1MB EPROM, and (Took over as team leader)
   7. Design of 256K CMOS *FLASH EEPROM* (Team Leader)

6. Consulting and Patents
   i. Amin, A. and Brennan, J. “Electrically reprogrammable EPROM cell with merged transistor and optimum area,” US Patent No. 5,455,793, October 3, 1995
   ii. Amin, A. and Brennan, J. “Electrically reprogrammable EPROM cell with merged transistor and optimum area,” US Patent No. 5,293,328, March 8, 1994 and European Patent Office; No. 2310776.7-, February 1993 , and.
   iii. Amin, A. and Emoto, Bernard "A High Speed Sense Amplifier for EPROM Single Transistor Memory Cell," US Patent No. 5,117,394, May 26, 1992; European Patent No. 89121444.7-, December 1989.

iv. Amin, A. "A Novel Architecture for Flash Erase EPROM Memory," US. Patent No. 4,999,812, March 1991; European Patent No. 89121391.0-, December 1989.
v. Amin, Alaaeldin and Mahmoud, Muhammad "Apparatus And Method For High-Speed Modulo Multiplication And Division," final revised version sent to patent lawyer to be filed soon.
vi. Amin, Alaaeldin and Shinwari, M. W. "A Novel High-Radix Multiplier-Divider," manuscript sent to patent lawyer for patent-style re-write.
vii. Al-Somani Turki F. and Amin, Alaaeldin "An Efficient Elliptic Curve Scalar Multiplication with Multilevel Resistant Against Power Analysis" initial patentability search under way

7. State(s) in which registered

Professional Engineer in New York State

8. Principal publications in last five years

Alaaeldin Amin, "A High-Speed Self-Timed Carry-Skip Adder," IEE Proceedings - Circuits, Devices and Systems, Volume 153, Issue 6 , December 2006, pp. 574-582.

T. Al-Somani, and A. Amin, "Hardware Implementations of GF(2^m) Arithmetic using Normal Basis," Journal of Applied Sciences Vol. 6, No. 6, 2006, pp. 1362-1372.

M. Mahmoud and Alaaeldin Amin, "An Asynchronous Modulo Multiplier for Cryptosystems," The 2nd IEEEGCC "Advancing Technology in the GCC: *Challenges and Solutions*" NOVEMBER 23-25, 2004, Manama, Bahrain.

Alaaeldin Amin and Feras Maadi, "Double-Rail encoded Self-Timed Adder with Matched delays", The 10th IEEE International Conference On Electronic Circuits And Systems (ICECS2003), December 14-17, 2003, pp. 1172-1175.

9. Scientific and professional societies of which a member

1. Member, IEEE, 2. Member, IEICE

10. Honors and awards.

Two-times winner of College of Computer Science and Engineering *Distinguished Teaching Award*

11. Industrial and professional services during the last five years.

See related experience

12. Professional development activities in the last five years.

1 Principal investigator for 500,000SR externally-funded research grant
2 Supervised 1- PhD and served as committee member of another dissertation.
3 Supervised 3 MS theses and served as committee member on many others

Curriculum Vitae

1. Name : Abdelhafid Bouhraoua
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.Sc. in Computer Engineering, INI, Algeria, October 1989

   M.Sc. in Computer Engineering, University of Paris, June 1993

   Ph.D. in Computer Engineering, University of Paris, May 1998

4. Number of years of service at KFUPM: 01 years

   Original appointment: Feb., 2005, Assistant Professor

6. Other related experiences – teaching, industrial etc.

Jan. 04 – Feb. 05	Director of Systems Integration and Test; Lambda Optical Systems Corp.; Reston, VA, USA
Oct. 01 – Nov. 03	Senior ASIC Designer and Chip Architect; Zarlink Semiconductor;
June 00 – Oct. 01	Applied Microcircuits Coproration; Senior ASIC Design Engineer
Nov. 99 – June 00	Celox Networks; System Verification Lead
April 98 – Oct. 99	Software Architect; Sprint Corp.; Kansas City, KS, USA
Oct. 93 – Dec. 97	Research and Teacher Assistant; ASIM Lab; University of Paris VI; Paris, France.
Oct. 92 – June 93	Teacher Assistant; ASIM Lab; University of Paris VI; Paris, France

7. Consulting, patents etc.

8. State(s) in which registered

9. Principal publications in last five years none

10. Scientific and professional societies of which a member Member IEEE.

11. Honors and awards.: None

Curriculum Vitae

1. Name : Dr. Abdul Rahim Naseer
2. Rank : Asst. Professor, Computer Engineering Department

3. Degrees with fields, institution, and date:
   B.Sc., Mysore University, India, May 1980

   M.Sc. in Electronics, Mangalore University, India, June 1982

   M. Tech. in Industrial Electronics, Mangalore University, India, June 1985

   Ph.D. in Computer Sc. & Engg., Indian Institute of Tech. (IIT), Delhi, India, August 96

4. Number of years of service at KFUPM: 5 years

   Original appointment: Sept. 2001, Assistant Professor

5. Other related experiences – teaching, industrial etc.:

   Visiting Faculty Glasgow Caledonian Univ., Scotland /Head of the Dept. Electronics & Computer Engg,, Caledonian College of Engg., Oman (Jan. 98 - Aug. 2001)

   Visiting Faculty, Department of Computation, University of Manchester Science & Technology (UMIST), Manchester, UK (Jan. – Dec. 1997)

   Asst. Professor, Dept.. of Computer Engg., KREC, Surathkal, India (Oct. 95 to Dec.96)

   Research Scholar, Dept. of Computer Sc. & Engg., Indian Institute of Technology (IIT), Delhi, India (Aug. 1991 – Sept. 1995)

   Senior Lecturer, Dept. of Computer Engg., KREC, Surathkal, India (Aug. 90 to July 91)

   Lecturer, Dept. of Computer Engg., KREC Surathkal, India (Aug. 1986 – July 1990)

6. Consulting, patents etc.:
   - Consultant, Computerization of Mangalore Chemicals & Fertilizers, India, 1986-1990
   - Coordinator, Consultancy project on Manpower Training of Engineer recruits, Wipro Academy of Software Excellence, Wipro Systems, Bangalore, India, 1996
   - Consultant & Honorary Director, Pals Microsystems, Mangalore, India, since 1986
   - Chief Coordinator, Hardware-Software Co-design project, Sponsored by MHRD, Govt. of India, 1996.
   - Project Coordinator, Record management System, Sponsored by Ministry of Commerce & Industry, Oman, 1999-2000

7. State(s) in which registered: None

8. Principal publications in last five years:

- A.R. Naseer, K. Qureshi, “Adaptive Pre-Task Assignment scheduling strategy for Heterogeneous distributed raytracing system”, Journal IEICE EE , vol. 1, No. 13, October 2004, pp 373-379.

- I. K. Maarouf, A. R. Naseer and F. Azzedin, "GETAR : Geographic, Energy and Trust Aware Routing Protocol for Wireless Sensor Networks", submitted to Springer Journal Special issue of Telecommunications Systems on Security, Privacy and Trust for beyond 3G Networks, 2006 (under review)
- A.R. Naseer, Ismat K. Marouf, Ashraf Mahmoud "Routing security in Wireless Sensor Networks", Book chapter (under review) in Handbook of Research on Wireless Security, Idea Group Reference, USA to be published in 2007
- Ismat K. Marouf, A.R. Naseer, "SNARE : Sensor Node Attached Reputation Evaluator", in Proc. of 2nd CONEXT Conference on Future Networking Technologies, Lisboa, Portugul, 4-7 Dec. 2006
- I. K. Maarouf and A. R. Naseer, "WSNodeRater: An optimized Reputation System Framework for Security Aware Energy Efficient Geographic Routing in WSNs", Accepted for publication in ACS/IEEE International Conference on Computer Systems and Applications, AICCSA '2007, May 13-16, 2007 Amman, Jordan

9. Scientific and professional societies of which a member

- Life member, Indian Society for Technical Education (ISTE) since 1987
- Member, Computer Society of India (CSI), since 1989
- Member, VLSI Society of India (VSI), since 1991

10. Honors and awards:

- Recipient of Special Award for major contribution to the development of Labs and Curricula of Computer Engg., CCSE Annual Day, 2003
- Recipient of BEST PAPER AWARD at the IEEE/ACM 7th International Conference on VLSI Design, Jan. 1994 for the paper, "FAST -FPGA Targeted RTL Structure Synthesis Technique"
- Recipient of IIT Delhi Institute BEST AWARD for significant Contribution to Students' Affairs Council, IIT Delhi, 1994

11. Institutional and professional service in the last five years

-Chairman, COE Dept. Labs Committee (2002-2006), COE Dept. Safety Committee (since 2002), CCSE Standing Committee on "Budgeting, Planning and Coordination"(2003), CCSE Standing Committee on "Advisory and Coordination", (2004-2006),

- Member, CCSE Standing Committee on Labs and Common Resources, (2001- 2003), COE Dept. Labs Committee (2006-07), CCSE Strategic Planning Committee(2006-07)
- Reviewer of KACST Project proposals, University Patent proposals, Text book on " Computer Architecture", by Prof. M. AbdelBarr, Handbook on "Security in Wireless Mesh Networks", to be published by Auerbach Publications, CRC Press

12. Professional development activities in the last five years :

- Attended several workshop organized by the Deanship of Academic Development (DAD) on improving the quality of teaching and learning

Curriculum Vitae

1. Name : Marwan Hassan Abu-Amara
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Computer Engineering, Kuwait University, May 1989

   M.Sc. in Elect. & Computer Eng., Texas A&M University, December 1991

   Ph.D. in Electrical & Computer Eng., Texas A&M University, May 1995
4. Number of years of service at KFUPM: 3 years

   Original appointment: September, 2003, Assistant Professor
5. Other related experiences – teaching, industrial etc.
   Senior Technical Advisor for Wireless Network Engineering, Nortel Networks, January 1998 – August 2003

   Wireless CDMA System Design Architect, Nortel Networks, June 1995 – December 1997

   Lecturer, Electrical Engineering Department, Texas A&M University, January 1992 – May 1995
6. Consulting, patents etc.
   "CDMA Inter–Mobile Switching Center Soft Hand–Off," with S. Sides, A. Jalali, J. Boppana, S. Doctor, US Patent # (6,173,183), 2001, US Patent # (5,930,714), 1999
7. State(s) in which registered: none

8. Principal publications in last five years

T. Landolsi and M. Abu-Amara, "CDMA Access Channel Performance under Idle–Mode Ping–Pong Effect in Inter–MSC Handoffs," Proceedings of the 3rd International Symposium on Wireless Communication Systems (ISWCS), September 5–8, 2006, Valencia, Spain.

M. Abu-Amara, S. Sait, Abdul Subhan, "A Heuristics Based Approach for Cellular Mobile Network Planning," Proceedings of the 2006 International Wireless Communications & Mobile Computing Conference, July 3–6, 2006, Vancouver, Canada, p. 79.

A. Mahmoud, M. Abu-Amara, T. Sheltami, E. Rahman, J. Jaffar, "WLAN Integration For Future Generation Mobile Network Operators – A Case Study," Proceedings of 18th National Computer Conference (NCC 18), March 26–29, 2006, Riyadh, Saudi Arabia, pp. 47–54.

T. Sheltami, A. Mahmoud, M. Abu-Amara, "Warning and Monitoring System using Sensor Networks," Proceedings of 18th National Computer Conference (NCC 18), March 26–29, 2006, Riyadh, Saudi Arabia, pp. 63–68.

A. Mahmoud, T. Sheltami, M. Abu-Amara, "Wireless Sensor Network Implementation for Mobile Patient," Proceedings of 3rd IEEE–GCC Conference, March 19–22, 2006, Bahrain.

T. Sheltami, A. Mahmoud, M. Abu-Amara, "Telecare Monitoring System Based on Wireless Sensor Network," with T. Sheltami, A. Mahmoud, International Journal of Computer Science and Network Security, Vol. 5, No. 12, December 2005, pp. 66–74.

A. Mahmoud and M. Abu-Amara, "Performance of Inter–Base Station Handoff for 3G CDMA Networks," Proceeding of the First International Conference on Modeling, Simulation and Applied Optimization, Sharjah, U.A.E. February 2005.

M. Abu-Amara, "Minimum Traffic Inter–BS SHO Boundary Selection Algorithm for CDMA–Based Wireless Networks," Proceedings of the 2004 IEEE Radio and Wireless Conference, Atlanta, Georgia, September 2004, pp. 51–53.

9. Scientific and professional societies of which a member: none

10. Honors and awards.

CCSE Award of Merit for the category of Distinguished Innovation Project ("E–Tourism Promoter – An Internet Assisted Location Tracker and Map Reader for Tourists"), King Fahd University of Petroleum & Minerals, 2006.

President and CEO's Top Talent Award, Nortel Networks, 2000 and 2001.

Circle of Excellence – Sales Support Award, Nortel Networks, 1999.

Wireless Networks President's Award of Excellence in Technology, Nortel Networks, 1998.

Award of Merit – CDMA Product Positioning, Nortel Networks, 1998.

11. Institutional and professional service in the last five years

Chairman, COE Labs Committee, 2006–2007

Chairman, CCSE Continuing Education Committee, 2005–2006

Member, COE Graduate Committee, 2005–2006

Chairman, CCSE Infrastructure Committee, 2004–2005

Member, COE Publicity & Information, 2003–2004 and 2004–2005

Member, COE Research, 2003–2004 and 2004–2005

Member, CCSE Research, 2003–2004

12. Professional development activities in the last five years.

DAD Workshop on Developing Educational Objectives & Learning Outcomes, King Fahd University of Petroleum & Minerals, September 19, 2006.

Curriculum Vitae

1. Name : Ahmad A. Al-Yamani
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Computer Engineering, KFUPM, May 1997
   M.Sc. in Computer Engineering, KFUPM, May 1999
   M.Sc. in Management Sciences and Engineering, Stanford University, April 2004
   Ph.D. in Electrical Engineering, Stanford University, June 2004
4. Number of years of service at KFUPM: 9 years
   Original appointment: June, 1997, Graduate Assistant
   Dates of advancement in rank: June, 1999, Lecturer
   Oct, 2005, Assistant Professor
5. Other related experiences – teaching, industrial etc.

June 04 – Aug 06, Consulting Assistant Prof., Elect. Engg, Stanford University
April 04 – Aug 06, Adjunct Faculty, Electrical Engg, Santa Clara University, CA
June 04 – July 05, Staff Engineer, Advanced Dev. Labs, LSI Logic, Milpitas, CA

6. Consulting, patents etc.

- Grinchuk, M., A. A. Al-Yamani, and E. Chmelar, "System And Method For Implementing Postponed Quasi-Masking Test Output Compression In Integrated Circuit," Filed with USPTO, Dec 16, 2004, Application number 20060156128.
- Al-Yamani, A. A., M. Grinchuk, and E. Chmelar, "Segmented addressable scan architecture and method for implementing scan-based testing of integrated circuits," Filed with USPTO, March 31, 2005, Application number 20060236176.
- Al-Yamani, A. A., N. Devta-Prasanna, and A. Gunda, "Systematic Scan Reconfiguration," Filed with USPTO, April 26, 2005, Application number 20060242515.

7.State(s) in which registered: None

8.Principal publications in last five years

- Al-Yamani, A.A., S. Sait and H. Youssef, "Parallelizing Tabu Search on a Cluster of Heterogeneous Workstations," Journal of Heuristics on Parallel Metaheuristics, 8(3), pp. 277-304, May 2002.
- Al-Yamani, A.A., S. Mitra, and E.J. McCluskey, "Optimized Reseeding by Seed Ordering and Encoding," IEEE Transactions on Computer-Aided Design (TCAD'05), 24(2), pp. 264-271, February 2005.
- Al-Yamani, A.A, and E.J. McCluskey, “Test Chip Experimental Results on High Level Structural Test,” ACM Transactions on Design Automation of Electronic Systems (TODAES’05), October 2005. (INVITED)
- Al-Yamani, A., N. Devta-Prasanna, E. Chmelar, M. Grinchuk, and A. Gunda, “Scan Test Cost and Power Reduction through Systematic Scan Reconfiguration,” Accepted for IEEE Trans. on Computer-Aided Design
- Al-Yamani, A.A., and E.J. McCluskey, "Seed Encoding for LFSRs and Cellular Automata," 40th ACM/IEEE Design Automation Conference (DAC'03), Anaheim, CA, June 2-6, 2003.
- McCluskey, E.J., A. A. Al-Yamani, C.-M. Li, C.W. Tseng, E. Volkerink, F. Ferhani, E. Li, and S. Mitra,"ELF-Murphy Data on Defects and Test Sets," 22nd IEEE VLSI Test Symposium (VTS’04), Napa Valley, CA, Apr. 25-28, 2004.

- Al-Yamani, A.A., and E.J. McCluskey, "BIST-Guided ATPG," 6th IEEE International Symp. on Quality Electronics Design (ISQED'05), San Jose, CA, March 21-23, 2005.
- Al-Yamani, A.A., Erik Chmelar and Mikhail Grinchuk, "Segmented Addressable Scan Arch.," 23rd IEEE VLSI Test Symp .(VTS'05), Palm Springs, CA, May 1-5, 2005.
- Al-Yamani, A., N. Devta-Prasanna, and A. Gunda, "Should Illinois-Scan Architectures be Centralized or Distributed," IEEE Int'l Symposium on Defect and Fault Tolerance (DFT'05), Monterey, CA, Oct 05.
- Al-Yamani, A "DFT for Controlled-Impedance IO Buffers," 43rd ACM/IEEE Design Automation Conference (DAC'06), San Francisco, CA, July 24-26, 2006
- Al-Yamani, A., N. Devta-Prasanna, and A. Gunda, "Systematic Scan Reconfiguration," 12th IEEE Asia and South Pacific Design Automation Conference (ASPDAC'07), Yokohama, Japan, Jan 23-26, 2007

9. Scientific and professional societies of which a member
    - Member, Institute of Electrical and Electronics Engineers, IEEE
    - Member, Computer Society, IEEE
    - Member, Saudi Council of Engineers

10. Honors and awards.
    - Selected to appear in Who's Who of Emerging Leaders
    - Winner of the British Council summer research award for 2006.
    - Patent champion of LSI Logic, 2005.
    - First recipient of Gerald Gordon international award from the test technology technical council, 2003;
    - Two awards for contribution to pacific northwest test workshop 2002, and 2003
    - Over 15 research publication awards from the Saudi Cultural Mission in Washington, 2000 – 05.

11. Institutional and professional service in the last five years
    - Aafaq (Strategic plan for higher education in Saudi Arabia)
    - Information and tommunication technology committee (University)
    - E-government committee (University)
    - IT client companies committee (University)
    - The organizing committee for the 12th and the 13th IEEE Pacific Northwest Test Workshop (BAST'03 and BAST'04).
    - The program committee for 14th IEEE Pacific Northwest Test Workshop.
    - The organizing committee for the special workshop in honor of Ed McCluskey in conjunction with the International Conference on Computer Design'04.
    - The program committee for the 1st IEEE International Design and Test workshop.
12. Professional development activities in the last five years.
    See related experiences

Curriculum Vitae

1. Name : Talal Mousa Alkharobi

2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.Sc. in Computer Engineering, _____ KFUPM, 1993

   M.Sc. in Computer Engineering, _____ KFUPM, 1998

   Ph.D. in Computer Engineering, _____ Texas A&M, 2004

4. Number of years of service at KFUPM: 13 years

   Original appointment: 1993, Graduate Assistant

   Dates of advancement in: 1998, Lecturer

   Rank : 2004, Assistant Professor

5. Other related experiences – teaching, industrial etc.

   None

6. Consulting, patents etc.

   None

7. State(s) in which registered

   None

8. Principal publications in last five years
   1. Syed M.S. Islam, M. Al-Mouhamed, S.M. Buhari, and Talal Al-Kharoubi, "A Hierarchical Design Scheme for Application of Augmented Reality in a Telerobotic Stereo-Vision System", the Saudi 18th National Computer Conference (NCC18), March 26-29, 2006. Riyadh, KSA.
   2. Syed M.S. Islam, Mayez A. Al-Mouhamed, Talal Al-Kharoubi, Seyed M. Buhari, "Augmentation of a Telerobotic Stereo-Vision System Using Graphical Overlays", First International Conference on Industrial and Information Systems [ICIIS 2006], Srilanka, 8 – 11 August, 2006.

9. Scientific and professional societies of which a member
   1. IEEE
   2. IEEE, computer society
   3. IEEE Industrial Application

10. Honors and awards.
    3. Best Student in computer field in Saudi Arabia, KACST 1992
    4. High honor, KFUPM 1993
    5. Best Graduate Assistant, KFUPM 1998
    6. Distinguished service award, CCSE-KFUPM, 2006

11. Institutional and professional service in the last five years

    Chairman of technical committee for the 1st eServices symposium

    Chairman of technical committee for the 2nd eServices symposium

12. Professional development activities in the last five years.

None

Curriculum Vitae

1. Name : Aiman Helmi El-Maleh
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.Sc. in Computer Engineering, King Fahd Univ. of Petroleum & Minerals, April 1989

   M.A.Sc. in Electrical Engineering, University of Victoria, July 1991

   Ph.D. in Electrical Engineering, McGill University, August 1995

4. Number of years of service at KFUPM: 8 years

   Original appointment: Sep., 1998, Assistant Professor

5. Other related experiences – teaching, industrial etc.
   Member of Scientific Staff
   05/95 to 08/98, Mentor Graphics Corporation, Wilsonville, USA.

6. Consulting, patents etc.

   Aiman H. El-Maleh, Wojciech Maly, Thomas E. Marchok, Janusz Rajski, "Test Pattern Generation for an Electronic Circuit Using a Transformed Circuit Description," US Patent 5,528,604.

7. State(s) in which registered: None.

8. Principal publications in last five years
   1. Aiman El-Maleh, "An Efficient Test Vector Compression Technique Based on Block Merging," IEEE Int. Symp. on Circuits and Systems, pp. 1447-1450, May 2006.
   2. Aiman El-Maleh, Sadiq M. Sait and Faisal Nawaz Khan, "Finite State Machine State Assignment for Area and Power Minimization," IEEE Int. Symp. on Circuits and Systems, pp. 5303-5306, May 2006.
   3. Aiman El-Maleh, Saqib Khursheed, and Sadiq Sait, "Static Compaction Techniques for Sequential Circuits Based on Reverse Order Restoration and Test Relaxation" IEEE Trans. on Computer-Aided Design of Integrated Circuits and Systems, VOL. 25, NO. 11, pp. 2556-2564, Nov. 2006.
   4. Sadiq M. Sait, Aiman H. El-Maleh, and Raslan H Al-Abaji, "Evolutionary Algorithms for VLSI Multiobjective Netlist Partitioning," Engineering Applications of Artificial Intelligence 19 (3): 257-268 APR 2006.
   5. Aiman El-Maleh, Sadiq Sait, and Syed Shazli, "Evolutionary Algorithms for State Justification in Sequential Automatic Test Pattern Generation,"

Engineering Intelligent Systems for Electrical Engineering and Communications 13 (1): 15-21, Mar. 2005.

6. Aiman El-Maleh and Khaled Al-Utaibi, “An Efficient Test Relaxation Technique for Synchronous Sequential Circuits,” IEEE Transactions on Computer Aided Design of Integrated Circuits, Vol. 23, No. 6, pp. 933-940, June 2004.
7. Aiman El-Maleh and Yahya Osais, "Test Vector Decomposition Based Static Compaction Algorithms for Combinational Circuits", ACM Transactions on Design Automation of Electronic Systems, Volume 8, No. 4, pp. 430-459, October 2003.
8. Aiman El-Maleh and Ali Al-Suwaiyan, "An Efficient Test Relaxation Technique for Combinational and Full-Scan Sequential Circuits" Proc. of the 20’th IEEE VLSI Test Symposium (VTS), pp. 53-59, 2002.

9. Scientific and professional societies of which a member

   Member, IEEE Computer Society.

10. Honors and awards.

    Distinguished Teaching & Advising Award**:** College of Computer Sciences & Engineering, 2001/2002.

    DATE Best Paper Award: Winner of the best paper award for the most outstanding contribution in the field of Test at the Design Automation and Test in Europe (DATE) Conference, 1995.

11. Institutional and professional service in the last five years

    I supervised nine Master computer engineering students. I have five funded research projects. I served as a member of University Research committee and I participated in the evaluation process of research proposals. I was a chairman and a member of Joint COE/ICS Programs Coordination Committee and I participated in the preparation of PHD comprehensive exam. I was also a member of Curriculum revision committee revising the computer engineering curriculum. I chaired the assessment committee responsible for the assessment of computer engineering courses. I have acted as a technical reviewer for many international journals and conferences.

12. Professional development activities in the last five years.

    I attended a workshop on Peer Consultation program to get the necessary training to act as a peer consultant. I also attended several workshops on course design and good teaching and learning.

Curriculum Vitae

1. Name : Ashraf S. Hasan Mahmoud
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Electrical and Computer Engineering, Kuwait University, May 1990
   M.ENG. in Eng. Physics (Computer Systems), McMaster Univ., June 1992
   Ph.D. in Systems and Computer Engineering, Carleton University, Feb 1997

4. Number of years of service at KFUPM: 4 years

   Original appointment: Sept, 2002, Assistant Professor

5. Previous experiences:
   May 1997 – Aug 2002: Senior radio systems designer – Research and development division at Nortel Networks – Ottawa, Canada

   Dec 96 – May 97: TRIO research fellow – Carleton University, Ottawa – Canada

   Sept 1992-Dec 1996: Teaching/Research assistant – Systems and Computer Engineering Department, Carleton University, Ottawa – Canada

   Sept 1990-Aug 1992: Teaching/Research assistant –Engineering Physics Department, McMaster University, Hamilton – Canada

6. Consulting, patents etc.
   1997-1998 – Consultation for Bell South through Nortel Networks – Design and performance evaluation for voice traffic over wireless ATM network.

   2001-2002 – Consultation for systems division at Nortel Networks – performance evaluation of radio resource allocation algorithms for 3G mobile network

   2006-present – Consultation for Saudi Telecom Company – Network Simulation Tools (OPNET).

7. States in which registered: None

8. Principal publications in last five years

A. Mahmoud, S. Al-Qahtani, "A Framework of Call Admission Control Procedures for Integrated Services Mobile Wireless Networks," (in press) Arabic Journal for Science and Engineering (AJSE), 2006.

S. Al-Qahtani, A. Mahmoud, and A. Sheikh, "Adaptive Radio Resource with Borrowing for Multi-Operators 3G+ Wireless Networks with Heterogeneous Traffic," Elsevier's Computer Communications Journal, Vol. 29, Issue 15 ,pp. 2945-2951, Sept. 2006.

S. Al-Qahtani, A. Mahmoud, "Dynamic Radio Resource Allocation for 3G and beyond Mobile Wireless Networks," (in press) Elsevier's Computer Communications Journal, Feb 2006.

S. Al-Gahtani, A. Mahmoud, "A Prioritized Uplink Call Admission Control Algorithm for 3G WCDMA Cellular Systems with Multi-Services," Proceedings of 6th IEE International Conference on 3G & Beyond (3G 2005), London, UK, 5-7 November 2005, pp. 173-178

M.G. Kaosar, A. Mahmoud, T. Sheltami, "Performance Improvement of Dynamic Source Routing Protocol Considering the Mobility Effect of Nodes in Cache Management," 3rd IEEE and IFIP International Conference on Wireless and Optical Communications Networks (WOCN 2006), Bangalore , India, April 11-13, 2006.

U. Baroudi, Y. Mohammed, A. Mahmoud, "On the Performance of Slotted CDMA Networks," to appear in the proceedings of The 64th IEEE Vehicular Technology (VTC 2006), Montreal, Canada.

9. Scientific and professional societies of which a member

Member, Institute of Electrical and Electronics Engineers (IEEE).
Member, Jordan Engineers Association.

10. Honors and awards.

•Designated as a member of the top talent segment (5%) within Nortel Networks world wide.

•Receiver of several innovation awards for patenting and influencing Nortel Networks products - Nortel Networks, Ottawa, Canada

11. Institutional and professional service in the last five years

2002-2006: Actively participating in program assessment and curriculum design and revision for the computer engineering department at KFUPM - Dhahran, Saudi Arabia.

1997-2002: Provided technical support and consultations for external and internal customers for Nortel Networks – Ottawa, Canada.

12. Professional development activities in the last five years.

Sept 2006: : Teaching & Learning Center of the Deanship of Academic Development - Using Course Design to Create more Significant Learning Experiences for Students (Workshop).

Sept 2006: Teaching & Learning Center of the Deanship of Academic Development -Good Learning and Good Teaching: How do we promote more of it? (Workshop).

Sept 2005: Teaching & Learning Center of the Deanship of Academic Development - Evaluating the quality teaching: An institutional framework (Workshop).

Curriculum Vitae

1. Name : Muhamed Fawzi Mudawar
2. Rank : Assistant Professor, Computer Engineering Department

3. Degrees with fields, institution, and date
   B.E. in Electrical Engineering, American University in Beirut, June 1986
   M.Sc. in Computer Engineering, Syracuse University, June 1988
   Ph.D. in Computer Engineering, Syracuse University, June 1993

4. Number of years of service at KFUPM: 2 years
   Appointment: September 2004 – Present , Assistant Professor

5. Other related experiences – teaching, industrial etc.
   American University in Cairo: 1993 – 2004, Assistant Professor

   Prime Computer, USA: 1988 – 1989, Software Engineer

6. Consulting, patents etc: None
7. State(s) in which registered: None
8. Principal publications in last five years:

- Hossam I., El-Ayat K., and Mudawar M., A Locked Cache-Based Synchroniztion Protocol for CMP, *in Proceedings of the 2006 International Conference on Parallel and Distributed Processing Techniques and Applications*, June 26-29, 2006, Las Vegas, Nevada.

- Zaghloul S., Mudawar M., and Darwish M., Development of a Simultaneously Threaded Multi-Core Processor, *in proceedings of the ITI/IEEE 3rd International Conference on Information & Communication Technology*, December 5-6, 2005, Cairo, Egypt.

- Mudawar M. and Wani J., One-Level Cache Memory Design for Scalable SMT Architectures, in *Proceedings of the 17th ISCA International Conference on Parallel and Distributed Computing Systems*, September 15-17 2004, San Francisco, California.

- Mudawar M., Scalable Cache Memory Design for Large-Scale SMT Architectures, *ACM International Conference Proceedings Series, Vol 68*; also in *Proceedings of the 3rd Workshop on Memory Performance Issues: in conjunction with 31st IEEE/ACM International Symposium on Computer Architecture*, June 20-23 2004, Munich, Germany.

- Amer I., Badawy W., and Mudawwar M., Towards Low-Power Synthesis: A Common Subexpression Extraction Algorithm Under Delay Constraints, in *Proceedings of the 46th IEEE Midwest Symposium on Circuits and Systems,* December 27 – 30, 2003, Cairo, Egypt.

- Haddad H. and Mudawwar M., Corner-First Tree-Based Region Broadcasting in Mesh Networks, in *Proceedings of the 21st IASTED International Conference on Parallel and Distributed Computing and Networks*, February 10-13, 2003, Innsbruck, Austria, pages 615-620.

9. Scientific and professional societies of which a member
    - Institute of Electrical and Electronic Engineers: Computer Society.
    - Academic Computing Machinery.
    - International Society for Computers and their Applications.
    - International Association of Science and Technology for Development.
10. Honors and awards

    None

11. Institutional and professional service over the past two years: 2004 – 2006
    - KFUPM Housing committee: policies and faculty housing allocation.
    - CCSE Automation committee, chairman: new dynamic website for CCSE.
    - COE Assessment committee: self assessment for Computer Engineering.
    - COE Architecture group: revising and improving courses.

12. Professional development activities in the last five years.

    International Conference on Parallel and Distributed Processing Techniques and Applications, June 26-29, 2006, Las Vegas, Nevada.

    31st Annual IEEE/ACM International Symposium on Computer Architecture, June 19-23, 2004, Munich, Germany.

    Thesis Supervision of the following students:

    Khaja M. Mohammed, "The Quadra Network: A New Topology for Interconnection Networks and New Broadcasting Schemes", Master Thesis, Computer Engineering department, KFUPM, December 2005.

    Soha S. Zaghloul, "Development of a Simultaneously Threaded Multi-Core Processor", Ph.D. Thesis, Cairo University, December 2005.

    Ihab Mostafa Amin Amer, "Synthesis and Optimization of Digital Systems for Low Power at Logical Level of Abstraction", Master Thesis, Computer Science Department, AUC, May 2003.

    Hadeel Youssef Samaan Haddad, "Tree-Based Regional Broadcasting in Mesh Directed Networks", Master Thesis, Computer Science Department, AUC, December 2002.

Curriculum Vitae

1. Name : Muhammad E. S. Elrabaa
2. Rank : Assistant Professor, Computer Engineering Department

3. Degrees with fields, institution, and date

B.Sc. in Computer Engineering, Kuwait University, Kuwait, May 1989

M.Sc. in Electrical & Computer Engineering, University of Waterloo,

Waterloo, CANADA, October 1991

Ph.D. in E& CE, University of Waterloo, October 1995

4. Number of years of service at KFUPM: 5 years

Original appointment: Sept., 2001, Assistant Professor

5. Other related experiences – teaching, industrial etc.:

Sept. 1998 – August 2001: Assistant Professor, Electrical Eng. Dept., United Arab Emirates University, Al-Ain, UAE.
Sept. 1995 – Aug. 1998: Senior Component Design Engineer, Intel Corporation, Portland, Oregon, USA.

Sept. 1989 - Sept. 1995: Research Assistant, VLSI Research Group, University of Waterloo, Waterloo, Ontario, CANADA.

May 1990 - Dec. 1994: Teaching Assistant, University of Waterloo.

May 1989 - Sept. 1989: Research Assistant, Kuwait University, Kuwait.

6. Consulting, patents etc.:

United States Patent # 5,602,774, awarded in Feb. 11th, 1997: M. S. Elrabaa and M. I. Elmasry, "Low-Power BiCMOS/ECL SRAM"

United States Patent # 5,966,032, awarded in Oct. 12th, 1999: M. S. Elrabaa, M. I. Elmasry, and D. S. Malhi, "A BiCMOS Transceiver for Gigahertz Operation"

Jan. 1992 - Dec. 1994: **As a** contracted Researcher, with the Microelectronics Center, NorTel Ltd., Ottawa, CANADA.

May 1992-Apr. 1993: As a contracted Circuit Designer, with the Canadian Microelectronics Corporation (CMC), CANADA.

7. State(s) in which registered:none

8. Principal publications in last five years:

1. M. Elrabaa, "A New Static Differential CMOS Logic with Superior Low Power Performance," Analog Int. Cir. and Sig. Proc., P. 183, May 2005.

2. M. Elrabaa, "An All-Digital Clock Recovery and Data Retiming Circuitry for High Speed NRZ Data Communications," IEICE Trans. on Elect., P. 1170, May, 2002.
3. M. Elrabaa, *et al*., "A Contention-Free DOMINO Logic For Scaled-Down CMOS," IEICE Trans. on Elect., P. 1177, May, 2002.
4. M. Elrabaa, "An All-Digital Clock Frequency Capturing Circuitry For NRZ Data Communications," Accepted in the13th IEEE International Conference on Electronics, Circuits and Systems (ICECS 2006), Dec. 2006, Nice, France
5. M. Elrabaa, "A Portable Clock Recovery Circuit (CRC) For Systems-On-Chip Serial Data Communication," Accepted in ICM06.
6. M. Elrabaa, "A Digital Clock Re-Timing Circuit for On-Chip Source-Synchronous Serial Links," Accepted in ICM06.
7. A. Bouhraoua and M. Elrabaa, "An Efficient Network-on-Chip Architecture Based on Modified Bidirectional Multi-Stage Interconnection Network (MIN) Topology," Accepted in ICM06.
8. A. Bouhraoua and M. Elrabaa, "A High-Throughput Network-on-Chip Architecture for Systems-on-Chip Interconnect," Accepted in the Int. Symp. on System-on-Chip (SOC06), November 2006, Tampere, Finland.
9. M. Elrabaa, "A New Static Differential CMOS Logic With Superior Low Power Performance," *Proceedings of the 10th IEEE International Conference on Electronics, Circuits, and Systems,* Dec. 2003.
10. M. Elrabaa, "REVIEW OF HIGH-SPEED DIGITAL CMOS CIRCUITS," *Proceedings of the 6th Saudi Engineering Conference*, Dhahran, Dec. 2002.

9. Scientific and professional societies of which a member
   Member of Institute of Electrical and Electronics Engineers (IEEE)
   Saudi Society of Electrical Engineers (SSEE)

10. Honors and awards: N/A

11. Institutional and professional service in the last five years:
    Delivered the following seminars in the period 2002-2007 for KFUPM students, faculty and high school students; "Assigning Letter Grades Based on Clustering: A Relative Grading Approach", "Design of VLSI Integrated Circuits", "Introducing Multi-Phase Design into a Junior-Level Course" and "Product Development: A Short Guide"

12. Professional development activities in the last five years:
    Attended several workshop on developing teaching skills at KFUPM given by international experts on the subject.

Curriculum Vitae

1. Name : Mohammed Houssaini Sqalli
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date

   "Ingenieur d'Etat" in Computer Science, Ecole Mohammadia d'Ingenieurs, Morocco, July 1992.

   M.Sc. in Computer Science, University of New Hampshire, USA, December 1996.

   Ph.D. in Engineering – Systems Design, University of New Hampshire, USA, May 2002.

4. Number of years of service at KFUPM: 4 years

   Original appointment: August, 2002, Assistant Professor

5. Other related experiences – teaching, industrial etc.

- Senior Automation Testing Specialist, Siemens - Mobile - Telecom Innovation Centre, Ottawa, Canada, (Sept. 1999 – July 2002).
- Research and Project Assistant at the ATM Consortium, InterOperability Lab, University of New Hampshire, Durham, NH, USA, (May 1996 – August 1999).
- Software Engineer, Computer Science Department, Ministry of Finance, Rabat, Morocco, (1992-1994).

6. Consulting, patents etc.

Saudi Telecom Company (STC), Data Network Infrastructure and Management, 2003

7. State(s) in which registered: 'none'

8. Principal publications in last five years

[1] Sadiq M. Sait, Mohammed H. Sqalli, and Mohammed Aijaz Mohiuddin, "An Evolutionary algorithm to Multi-objective OSPF Weight Setting Problem", the 19th ACS Australian Joint Conference on Artificial Intelligence (*AI-2006*), Hobart, Tasmania, Australia, December 4-8, 2006.

[2] Shaik Sirajuddin, and Mohammed H. Sqalli, "Distributed XML-based Network Management using JPVM". International Journal of Network Management (IJNM), John Wiley & Sons, Inc. Volume 16, Issue 4, July/August 2006, Pages: 263-277.

[3] Syed M. S. Islam, Mohammed H. Sqalli, and Sohel Khan, "Modeling and Formal Verification of DHCP Using SPIN". International Journal of Computer Science & Applications (IJCSA), Volume 3, No. 2, June 2006, Pages: 145-159.

[4] Mohammed H. Sqalli, Sadiq M. Sait, and Mohammed Aijaz Mohiuddin, "An Enhanced Estimator to Multi-objective OSPF Weight Setting Problem". The 10th

IEEE/IFIP Network Operations and Management Symposium (*NOMS-2006*), April 3-7, 2006, Vancouver, Canada.

[5] Mohammed H. Sqalli, and Shaik Sirajuddin, "An Adaptive Load-balancing Approach to XML-based Network Management using JPVM". The 13th IEEE International Conference on Networks (*ICON 2005*), November 16-18, 2005, Kuala Lumpur, Malaysia.

[6] Mohammed H. Sqalli, and Shaik Sirajuddin, "Static Weighted Load-balancing for XML-based Network Management using JPVM". The 8th IFIP/IEEE International Conference on Management of Multimedia Networks and Services (*MMNS 2005*), J. Dalmau and G. Hasegawa (Eds.): LNCS 3754, pp. 228 – 241, October 24-26, 2005, Barcelona, Spain.

[7] Syed M. S. Islam, Mohammed H. Sqalli, and Sohel Khan, "Simulation and Formal Verification of DHCP". Information and Communication Technologies International Symposium (*ICTIS-2005*), June 3-6, 2005, Tetouan, Morocco.

[8] Shaik Sirajuddin, and Mohammed H. Sqalli, "Comparison of CSV and DOM Tree Approaches in XML-based Network Management". The 12th IEEE International Conference on Telecommunications (*ICT 2005*), May 3 - 6, 2005, Cape Town, South Africa.

[9] Mohammed H. Sqalli, and Eugene C. Freuder, "Case-Based Reasoning to Enhance Diagnosis and CSP Model Debugging in Interoperability Testing: ADIOP". The IASTED International Conference on Intelligent Systems & Control (*ISC-2003*), June 25-27, 2003, Salzburg, Austria.

[10] Cynthia Marling, Mohammed Sqalli, Edwina Rissland, Hector Muñoz-Avila, and David Aha, "Case-Based Reasoning Integrations". *AI Magazine,* Volume 23, Issue 1, Spring 2002, 69-86.

9. Scientific and professional societies of which a member
   IEEE, IEEE Communications Society, IEEE Computer Society
   Saudi Scientific Society for Electrical Engineers (SSSEE)
   Saudi Engineering Council

10. Honors and awards.
    - Fulbright Scholarship (1994-1998) sponsored by the Moroccan-American Commission for Education and Cultural Exchange (MACECE).

    - Second prize student paper award at the Seventh International Workshop on Principles of Diagnosis (DX-96), Canada.

11. Institutional and professional service in the last five years
    TPC member of GIIC-07, ICIT-07, SSI-06.
    Refereeing of publications for journals and conferences, including: AJSE, IJNM, Elsevier Computer Communications, Wiley Publishers, SSI-06, ICT-06, ICCNMC-05, IEEE-GCC-05, and ICICS-04.
    Cisco Certified Network Academy (CCNA) instructor, 2005-2006
    Sponsoring Professor for OPNET at KFUPM, 2002-2006

12. Professional development activities in the last five years.

Curriculum Vitae

1. Name : Tarek Rahil Shelatmi
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Electrical Engineering, University of Garyounis, Libya, June 1990

   M.Sc. in Electrical Engineering, University of Garyounis, June 1996

   Ph.D. in Electrical and Computer Engineering, Queens University, May 2003
4. Number of years of service at KFUPM: 2 years

   Original appointment: September, 2004, Assistant Professor
5. Other related experiences – teaching, industrial etc.

June 2002-Aug. 2004 GamaEng Inc, Ottawa, Canada, *Consultant on Wireless Networks*

May 2003- August 2004 University of Ottawa SITE, Ottawa, Canada

Research Associate and Adjunct Professor

January 2000 – April 2003 Computer Networks Laboratory, Queen's University

Research Assistant

September 1998 – December 1999 SDE , University of Waterloo

Research Assistant

September 96 – May 1998 University of Garyounis, Benghazi, Libya

Lecturer

August 94 – May 1998 JOEEF Oil Corporation, Benghazi Libya

Head of Telecommunication Department

February 91 – July 1994 JOEEF Oil Corporation, Benghazi Libya

Project Engineer in Telecommunication Department

6. Consulting, patents etc.

P1. T. Sheltami, "Voice over IP using the Warning Energy Aware Clusterhead Routing Protocol," filed by KFUPM May 2005, Pending

P2. T. Sheltami, "Wireless Monitoring System: SMS and IP based," filed by KFUPM July 2005, Pending

P3. T. Sheltami, "Smart Shopping Cart and Value Added Services using RFID," filed by KFUPM July 2005, Pending

7. State(s) in which registered: None

8. Principal publications in last five years

1. T. Sheltami and H.T. Mouftah, "Routing Protocols in Wireless Mobile Ad Hoc Networks," Handbook of Algorithms and Protocols for Wireless Mobile Networks,

, Series: Chapman & Hall/CRC Computer & Information Science Series Volume: 8, Cat. #: C4657, ISBN: 1584884657, Publication Date: 11/28/2005, Number of Pages: 1040

2. Tarek Sheltami, "Gateway Selection Review in Ad hoc Networks," The Journal of Computers, VOL. 1, No.2, May 2006, pp. 8-14
3. Tarek Sheltami, Ashraf Mahmoud, Marwan Abu-Amara, "Telecare Monitoring System Based on Wireless Sensor Network," The International Journal of Computer Science and Network Security, IJCSNS 2005, VOL. 5 No. 12, December 2005, pp. 66-74.
4. T. R. Sheltami and H. T. Mouftah, "Average waiting time of Clusterhead Controlled Token for Virtual Base Station On-demand in MANETs," ACM 'Ad Hoc Networks' of the journal 'Cluster Computing', Vol. 8, 157-165, 2005
5. Tarek Sheltami and Hafiz M. Asif "H.264 Compression Based Improvement in Hop Count and Power Consumption of MANETs," to appear The Australian Telecommunication Networks and Applications Conference ATNAC 2006, Australia, December 2006
6. T. Sheltami "Investigation on Transmit Power Estimation and Gateway Selection on Ad hoc Networks," The 30th Annual IEEE Conference on Local Computer Networks (LCN), 15-17 November 2005. Sydney, Australia, pp. 488-292
7. T. Sheltami and H.T. Mouftah, "Power Issues on WEAC and VBS-O Protocols for Wireless Mobile Ad Hoc Networks, Proceedings of International Conference on Wireless Networks (ICWN'04), Monte Carlo Resort, Las Vegas, Nevada, June 21-24, 2004

9. Scientific and professional societies of which a member

1. The Saudi Scientific Society of Electrical Engineering (SSSEE) 2004.

2. The Institute of Electrical and Electronics Engineers (IEEE): IEEE Communications Society and IEEE Computer Society, 2000.

3. The Society of Electrical Engineers of Libya, 1990.

10. Honors and awards.: None

11. Institutional and professional service in the last five years

TPC in the following: IEEE Globecom 2002, Taipei, Taiwan, 17-21 November 2002, IEEE EWCN 2003, Phoenix, Arizona, USA, 9-11 April 2003, IEEE VTC 2003, Orlando, Florida, USA, 4-9 October, 2003., IEEE Globecom 2003, Dallas Texas, November 29 - December 3, 2004, IEEE CCNC 2004, Las Vegas, Nevada USA, January 5-8, 2004, IEEE EWCN 2004, Phoenix, Arizona, USA, 14-17 April 2004, 22nd Biennial Symposium on Communications, June 1–3, 2004 Queen's University, Kingston, ON, Canada, IEEE ICC 2005, Seoul Korea, 16-20 May 2005, IEEE ISCC 2005, La Manga del Mar Menor, Cartagena, Spain June 27- 30, 2005, IEEE ICC 2006 Istanbul , Turkey 11-15 June, 2006, IEEE GLOBECOM 2006, San Francisco, California, USA. Nov 27th-Dec 1st, 2006, IEEE ICC 2007 Glasgow, Scotland, June24-28, 2007

12. Professional development activities in the last five years.

Curriculum Vitae

1. Name : Uthman Abdulrahman Baroudi
2. Rank : Assistant Professor, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Electrical Engineering from KFUPM, June 1988

   Msc. in Electrical Engineering from KFUPM, June 1990

   Ph.D. in Electrical Engineering, Concordia University, October 2000
4. Number of years of service at KFUPM: 10 years

   Original appointment: September, 1990, Lecturer

   Dates of advancement in: January, 2002, Assistant Professor

   rank :

5. Other related experiences – teaching, industrial etc.
   - Network Designer Sep. 2000 – Dec. 2001 Nortel Networks, Ottawa, Canada
   - System Designer March 2000 – Aug. 2000 SR Telecom, Montreal, Canada

6. Consulting, patents etc.
   - Method of radio resource management for integrated voice and data CDMA networks (pending US patent)

7. State(s) in which registered
   None

8. Principal publications in last five years
   1. S. Al-Qahtani and U. Baroudi, “Dynamically Prioritized Call Admission Control for RAN-Based Multi-Operators 3G/4G Cellular Wireless Networks”, submitted to Computer Communications Journal.
   2. U. Baroudi and Mohammad Mohuddin, "Performance Analysis of Internet Applications over an Adaptive IEEE 802.11 MAC Architecture" the Special Conference Issue of J Franklin Institute, 2006.
   3. U. Baroudi and A. Elhakeem, “A Simulation Study for Adaptive Admission /Congestion Control Policies for CDMA Based Wireless Internet” in Wireless Communications and Mobile Computing (WCMC) Journal, online edition May 2005.
   4. U. Baroudi, “EQOSA: Energy and QoS Aware MAC for Wireless Sensor Networks,” submitted to the 20th International Symposium on Signal Processing and its Applications (ISSPA 2007).

5. U. Baroudi, Y. Mohammed and A. Mahmoud, "On the Performance of Downlink Power-Based Scheduling for Slotted CDMA Networks," 64th IEEE-VTC 2006, Montreal, Canada.
6. Yaser Al-Jarbou and U. Baroudi, "Performance of Heterogeneous Traffic in Roaming Based Sharing Multi Operator 4G WCDMA," the 2nd International Symposium on Wireless Communication Systems 2005 (ISWCS'05), Siena, Italy.
7. Salman Al-Qahtani and U. Baroudi, "An Uplink Performance Evaluation for Roaming-Based Multi-Operator WCDMA Cellular Networks," The 4th ACS/IEEE International Conference on Computer Systems and Applications, Sharjah, UAE.
8. Adel AlAkeel, Ashraf Mahmoud, and U. Baroudi, "On Optimizing Backoff Procedure to Enhance Throughput and Fairness for Wireless LANs", *IEEE 2nd ICTTA*, April 24 - 28, 2006, Damascus, Syria.
9. U. Baroudi, Yousuf Mohammed, and Ashraf Mahmoud "Adaptive QoS-Based Scheduler for 4G CDMA Wireless Networks", *IEEE 2nd CITTA* April 24 - 28, 2006, Damascus, Syria.
10. U. Baroudi, Yousuf Mohammed and Ashraf Mahmoud, "On the Performance of Slotted CDMA Networks," submitted to IEEE-VTC 2006.
11. U. Baroudi and A. Elhakeem, Adaptive Admission/Congestion Control Policy for Hybrid TDMA/MC-CDMA Integrated Networks with Guaranteed QoS, IEEE ICECS'03, Sharjah, UAE, December 14-17, 2003, pp. 1014-1017.

9. Scientific and professional societies of which a member
    1. Fellow, Syrian Engineering Society
10. Honors and awards.
    - FCAR Postgraduate Scholarship (1998)
    - Concordia University Fellowship (1996 – 1998)
11. Institutional and professional service in the last five years
    Referee for following scientific journals
        1. Journal of Computer Communications a Special issue on "Internet Monitoring and Measurement"
        2. ACM Mobile Networking and Applications (MONET) Special Issue on "Integration of Heterogeneous Wireless Technologies"
        3. Wiley WCMC journal's Special Issue on "Radio Resource Management for Wireless Internet"

    Referee for following scientific conferences

    INFOCOM 2006, IEEE VTC 2006, IEEE ICC 2005, 2007, IEEE GLOBECOM 2003, 2004

12. Professional development activities in the last five years.
    1. Laboratory development for COE 445 (Internet Information Services)
    2. Laboratory development for COE 344 (old name: COE 442) (Computer Networks)

Curriculum Vitae

1. Name : Hakim Adiche
2. Rank : Lecturer, Computer Engineering Department
3. Degrees with fields, institution, and date
   B.Sc. in Computer Engineering, National Institute of Electricity and Electronics, Algeria, June 1993

   M.Sc. in Computer Engineering, King Fahd University of Petroleum and Minerals, Saudi Arabia, October 1997
4. Number of years of service at KFUPM: 8 years

   Original appointment: March, 1998, Lecturer

5. Other related experiences – teaching, industrial etc.
   Teaching computer networks laboratory COE 344

   Teaching preparatory computer science PYP002

   Teaching Cisco networking courses for CCNA level.

   Taught network management laboratory COE 444

   Taught digital circuits laboratory COE 200

   Developed laboratory experiment for the computer networks laboratory.

   Developed laboratory experiment for the network management laboratory.

   Developed laboratory experiments for the Multimedia course COE 445

6. Consulting, patents etc.
   Consultant for one month for Sci-Tech-Khobar, on the issue of Audio/Video traffic.

   Consultant for one month for ITC, KFUPM on the issue of structured cabling.

7. State(s) in which registered
   none

8. Principal publications in last five years
   H.Adiche, *Analytic Modeling of Mpeg-4 and H.263 Encoded Video Traces*, Accepted for presentation at the ACS/IEEE International Conference on Computer Systems and Applications, 2003.

9. Scientific and professional societies of which a member
   None

10. Honors and awards

None

11. Institutional and professional service in the last five years

Design and implementation of a computer network laboratory system.

Developed activities for Cisco regional academy hosted in KFUPM

Trained students and instructors on Cisco networking technology.

Developed activities for the computer networks laboratory.

Issued several purchase requests for networking equipment to be used in the computer networks laboratory.

12. Professional development activities in the last five years.

- Attended Cisco training for the CCNA level and obtained the certifications for the purpose of academy teaching
- Obtained the Cisco certified Academy Instructor certificate
- Obtained the Cisco CCNA industrial certificate
- Certified Internet Professional BCIP Web Administrator
- Certified Information Security Administrator
- Certified Network Support Specialist
- Certified Unix System Administrator
- Certified Linux System Administrator
- Certified Network Administrator
- Certified Telecommunication Specialist

1. Name : Hazem Helmi Selmi
2. Rank : Lecture, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.Sc. in Electrical Engineering, KFUPM, August 1991

   M.Sc. in Electrical Engineering, KFUPM, May 2000

4. Number of years of service at KFUPM: 6 years

   Original appointment: May, 2001,Lectuter

5. Other related experiences – teaching, industrial etc.
   1992-1999 Electronic Engineer an IT supervisor in various Saudi Companies.

6. Consulting, patents:
   None

7. State(s) in which registered
   None

8. Principal publications in last five years
   None

9. Scientific and professional societies of which a member
   Jordanian Engineers Associations

10. Honors and awards.
    Special Achievement Award (CCSE), 2003-034

11. Institutional and professional service in the last five years: None

12. Professional development activities in the last five years.

1. Attended a workshop on “How to be an Effective University Teacher”, DAD, ,KFUPM 7-8 Sept. 2002;
2. Workshop on “Critical Thinking”, KFUPM, 7-10 September 2003;
3. Workshop on “Publishing Content and Quizzes in WebCT”,DAD, KFUPM, 2004;
4. Workshop on Effective use of Collaborative Learning in the Class Room, DAD,KFUPM, Sept.20, 2006;

Curriculum Vitae

1. Name : Masud-ul-Hassan
2. Rank : Lecturer, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.E. in Electronics Engineering, NED University, Pakistan, January 1988

   M.S. in Computer Engineering, KFUPM, Dhahran, July 1993

4. Number of years of service at KFUPM: 17 years

   Original appointment: September, 1993, Lecturer

   Dates of advancement in rank: None

12. Other related experiences – teaching, industrial etc.

    1. January 1989 to December 1989 - Worked as an Electronic Design Engineer, Pakistan Steel Mills, Karachi, Pakistan.

    2. January 1990 to August 1993 - Worked as a Research Assistant in Computer Engineering Department, KFUPM, Dhahran, Saudi Arabia.

13. Consulting, patents etc.

    List as appropriate

14. State(s) in which registered

    None

15. Principal publications in last five years

    None

16. Scientific and professional societies of which a member

    4. Member - Pakistan Engineering Council.
    5. Member - Saudi Council of Engineers

17. Honors and awards.

    Best Teaching Award (CCSE), 2005-06

18. Institutional and professional service in the last five years

19. Professional development activities in the last five years.

Attended seminars/workshops arranged by Deanship of Academic Development, KFUPM.

Curriculum Vitae

1. Name : Muhammad Wasim Raad
2. Rank : Instructor Computer Eng
3. Degrees with fields, institution, and date

B.Sc. in Electrical Engineering, _____KFUPM_____ , 1981
M.Sc. in Electrical Engineering, _____KFUPM, 1985
Ph.D. in Electrical & Electronic Engineering, ____University of Bradford,UK , July 2005

4. Number of years of service at KFUPM: 20 years
Original appointment: May, 1986, Lecturer

5. Other related experiences – teaching, industrial etc.
I taught microcontroller and digital system design courses and the labs and upgraded them to comply with IEEE & ABET international requirements. I have introduced lecture notes and engineering design content to senior design course. I authored lab manual for digital system design lab as well as for microprocessor based systems lab. I won the best project supervision and the best services award. I was involved in the smart card project for the KFUPM campus (2003-2005). I got distinguished evaluation in teaching and research all throughout my period of service. I am involved right now in a funded King Abdulaziz City for Science and Technology project titled' A Smart Card Management System. I was invited to give talks in a number of regional and international conferences.
I Got approval lately for the two following innovation projects under preparation for being commercialized: 'Design of a mobile patient medical alert system' and 'Design of a Smart System for Safeguarding children from hazardous appliances in the Kitchen'.

6. Consulting, patents etc: None

7. State(s) in which registered: None

8. Principal publications in last five years
M.W. Raad & L. Cheded, 'Novel Peak detection Algorithms for Pile-up Minimization in Gamma Ray spectroscopy', 2006 IEEE Instrumentation And measurement Technology Conference, Sorrento, Italy, 24-27 April 2006.

M.W.Raad, A Smart Card Based Identification and E-payment System, in the Smart Card Conference, Bahrain Information Technology Society (BITS),Bahrain, Jan. 2005.

M. W. Raad and M. Mohandes, A Smart Card Based Driving License System, 2nd IEEE GCC 2004 conference 'Advancing Technology in the GCC: Challenges and Solutions', Bahrain, 23-25 November 2004.

M.W. Raad, J.M. Noras, M. Shafiq and A. Aksoy, 'Gamma-Ray Peak Detection Algorithms Using Embedded DSP', ESS Conference, October 2004, UK.

M.W. Raad, J.M. Noras and M. Deriche, 'Parameter Estimation and Digital Peak Localization Algorithms For Gamma Ray Spectroscopy', In the proceedings of the fourth International Symposium on Communication systems, Networks and Digital Signal Processing, University of Newcastle, UK,20-22 July 2004.

J.M. Noras, M.W. Raad and M. Deriche, 'Pileup free parameter estimation and digital online peak localization algorithms for Gamma Ray Spectroscopy', 10th Annual IEEE technical exchange meeting, March 23-24, 2003, KFUPM, Dhahran, Saudi Arabia.

9. Scientific and professional societies of which a member
IEE member since 1998.
Saudi Computer Society member since 2000.

10. Honors and awards.
I won the best project supervision and the best services award.

I got distinguished evaluation in teaching and research all throughout my period of service.

11. Institutional and professional service in the last five years
As a member of CCSE Publicity & Information Committee, in addition to Departmental Information & Library Committee I coordinated visits to department and college, coordinated department open day and exhibitions, student-faculty meetings, and publicized student projects in exhibitions held throughout the kingdom. I reviewed and edited departmental brochures, in addition to CCSE part of the KFUPM booklet, Submitted the information committee part of the tactical COE plan, coordinated the yearly program of awareness for orientation students, prepared statistics reports on department, coordinated career day of COE department, worked with students on project competition contests, upgraded COE 400 Digital System Design Lab, prepared Purchase orders for labs, taught in girls college Dammam. Contributed in upgrading the syllabus of COE400 and COE205 courses according to ACM requirements as a member in Ad-hoc committees. Prepared the COE labs according to ABET requirements.

12. Professional development activities in the last five years.

I helped students to improve their presentation skills. I had coordinated students/faculty get together meetings. I edited departmental graduate and undergraduate brochures, in addition to coordinating departmental open day and career day on a yearly basis.
I offered consultation to industry on a part-time basis in smart card technology.
I participated in ad-hoc committees to review COE curriculum and safety issues in labs.
I was one of the few people who participated in establishing the curriculum for COE department. I was actively involved in student computer club activities and social parties.

Curriculum Vitae

1. Name : Syed Zafar Shazli
2. Rank : Lecturer, Computer Engineering Department
3. Degrees with fields, institution, and date

   B.Sc(H) in Physics, Maths, University of Karachi, Feb 1995

   M.C.S. in Computer Science, University of Karachi, Feb 1997

   M.S. in Computer Engineering, KFUPM, June 2001

4. Number of years of service at KFUPM: 8 years

Original appointment: Sep, 1998, Research Assistant

Dates of advancement in rank: Sep, 2001, Lecturer :

5. Other related experiences – teaching, industrial etc.
   List in chronological order

   Lecturer, Department of Computer Science, Aligarh Institute of Technology, Karachi, Pakistan. Jan 1998-Sep 1998

6. Consulting, patents etc.
   None

7. State(s) in which registered
   None

8. Principal publications in last five years

S.Z.Shuja, S.M.Zubair, and S.Z.Shazli, "*Optimization of a finned heat sink array based on Thermoeconomic Analysis"*. Accepted for publishing in International Journal of Energy Research, 2006.
Aiman El-Maleh, Sadiq Sait, and Syed Shazli, "*Evolutionary Algorithms for state justification in sequential Automatic Test Pattern Generation"*. Journal of Engineering Intelligent Systems, Vol 13, No.1, March 2005.

9. Scientific and professional societies of which a member
   6. Member, Saudi Scientific Society of Electrical Engineers

10. Honors and awards.
    Certificate of Merit for services to the Computer Engineering Department, 2004

11. Institutional and professional service in the last five years
    - Conducted a seminar series on 'Windows Internals' at Jehat Training Institute, Dammam, June 2005.
    - Member, CCSE Graduate Committee, 2003-2004
    - Member, COE Assessment Committee 2004-2006
    - Member, COE Curriculum Revision – Architecture Sub-Group, since 2004 Member, COE Adhoc Committee on designing a course on Digital Logic Design, 2005-2006

12. Professional development activities in the last five years.

5. Attended a workshop on "How to be an Effective University Teacher", DAD, ,KFUPM 7-8 Sept. 2002;
6. Workshop on "Critical Thinking", KFUPM, 7-10 September 2003;
7. Workshop on "Publishing Content and Quizzes in WebCT",DAD, KFUPM, 2004;
8. Workshop on Effective use of Collaborative Learning in the Class Room, DAD,KFUPM, Sept.20, 2006;

Appendix II- Program Outcomes Assessment Rubrics

(a) *Ability to apply knowledge of mathematics, science, and engineering*

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
ability to apply mathematics, science, and engineering	Always uses the proper mathematical, and scientific formulation to solve problems	Uses the proper mathematical, and scientific formulation to solve problems most of the times	Uses the proper mathematical, and scientific formulation to solve problems some of the times	Rarely uses the proper mathematical, and scientific formulation to solve problems

(b) Ability to design and conduct experiments, as well as to analyze and interpret data

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Ability to design and conduct an experiment to identify/quantify/evaluate performance of system or part of a system (Hardware, software or both):				
1. Identifying clear goals for the experiment	Clearly identify the objectives of the experiment, the expected results, and possible pitfalls to watch for.	Clearly identify the objectives of the experiment and some of the expected results but does not think of the possible pitfalls.	Identify some of the objectives of the experiment but omits the expected results and possible pitfalls	Does not identify any objectives for the experiment and/or expected results
2. Choosing the appropriate experimental test bed (Hardware, Software, Emulation, Simulation or hybrid) to achieve the identified objectives of the experiment	Chooses the best test bed suitable for achieving the objectives with proper justification	Chooses the best test bed suitable for achieving the objectives with no justification	Chooses a test bed that is not optimum but somehow achieves the identified objectives	Chooses a test bed that does not achieve the objectives at all
3. Designing and conducting the experiment	Student groups design and conduct the experiment with no	Student groups design and conduct the experiment with	Student groups design and conduct the	Student groups design and conduct the experiment with major

	errors at all	some minor errors that do not adversely affect the objectives	experiment with some errors that affect the results and the objectives	conceptual or procedural errors that render the results useless and leave the objectives unachieved
Ability to analyze and interpret the data	Analysis and interpretation of results exceed requirements of experiment and demonstrate significant higher-order thinking ability.	Analysis and interpretation of results meet requirements of experiment and demonstrate some higher-order thinking ability.	Results are analyzed but not interpreted; very limited evidence of higher-order thinking ability.	No evidence of significant analysis and interpretation of results; fail to meet requirements of the experiment; demonstrate only lower-level thinking ability

(c) an ability to design a system, component, or process to meet desired needs

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Translate general requirements into specific system behavior and features	Requirements are translated accurately and with great precision into system behavior and features clearly described without ambiguity and without entering into any design details	Requirements are translated accurately into system behavior and features clearly described with some ambiguity. The description of behavior and features enters into some details and proposes design solutions thinking it is just translating the requirements	Requirements are not translated accurately into system behavior and features. Some features not clearly described. Some consistency errors.	Specification does not follow the requirements consistently. Several consistency errors. No clear difference between system behavior description and features and design solutions
Identify and formulate any problem that need to be addressed before being able to start designing (design feasibility)	Potential conceptual problems are addressed and properly formulated. Some system behavior is translated into some mathematical formulas describing necessary conditions for the system to function	Potential conceptual problems are addressed but not properly formulated. Some system behavior is translated into some mathematical formulas describing necessary conditions	Potential conceptual problems are recognized but not properly formulated. No system behavior is translated into some mathematical formulas describing necessary	Potential conceptual problems are not identified in any way.

	properly or alike	for the system to function properly with some errors on the assumptions.	conditions for the system to function properly.	
List different design alternatives for the overall system (design feasibility)	Different design alternatives are proposed and clearly discussed and compared. The comparison is rigorous and accurate.	Different design alternatives are proposed and clearly discussed and compared. Some rigor missing in the comparison although accurate statements are made.	A small subset of the possible design alternatives is considered. No thorough comparison is performed and statements are not accurate.	No design alternatives are proposed.
Choose the appropriate design solution using technical and economic criteria	The analysis of the technical and economic constraints leads to the optimal design solution. The justification and argumentation is thorough, accurate and consistent.	The analysis of the technical and economic constraints leads to the optimal design solution. The justification and argumentation is accurate and consistent but not thorough. Missing justifications for some aspects.	The analysis of the technical and economic constraints does not lead to the optimal design solution. The justification and argumentation are a little accurate and superficial.	The design solution is presented without any analysis. Some inappropriate justification and argumentation is present with a lot of inconsistencies.

(e) Ability to identify, formulate, and solve engineering problems

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Applying concepts, governing math or physics equations and algorithms to solve a problem	Applies correct concepts, chooses correct governing equations and optimum algorithms (or methods) to solve a problem.	Applies correct concepts, chooses correct governing equations but use sub-optimum algorithms (or methods) to solve a problem.	Applies some correct concepts and chooses some correct governing equations but makes mistakes	Applies incorrect concepts and/or chooses incorrect governing equations → can not solve problems
Demonstrating effective open-ended problem solving techniques (including the debugging of a faulty design; hardware, software or both)	Always solves problems using step-by-step logical procedure and obtain correct solution	Mostly solves problems using step-by-step logical procedure. Sometimes he solves problems in an ad-hoc manner, but still he obtains correct solutions	Mostly solves problems using step-by-step logical procedure but some times makes minor procedural errors that lead to incorrect solution of the problem	Solves problems without logical step-by-step logical procedure and makes procedural errors resulting in incorrect solution

(f) an understanding of professional and ethical responsibility

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Understanding of ethical and professional issues	Deep understanding of the professional issues involved and the ethical implications of the solution; careful, convincing analysis of all relevant factors.	Good understanding of all the professional/ethical issues related to the solution; reasonable analysis of the relevant issues	Some consideration of professional, ethical issues raised directly by the solution	Little or no understanding of professional/ethical issues even where there are serious questions involved

(g) an ability to communicate effectively

Writing Skills Assessment

Report Quality and Writing Skills:	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
1. Spelling and Grammar	Almost no spelling and/or grammatical mistakes (≤ 0.2 mistake/page)	Rare spelling and/or grammatical mistakes (≤ 0.5 mistake/page)	Makes noticeable frequent spelling and/or grammatical mistakes (≤ 1 mistake/page)	Makes frequent spelling and/or grammatical mistakes (≥ 1 mistake/page)
2. Punctuation	Proper use of punctuation, sentences are not too long, no repetition of words, proper use of paragraphs	Proper use of punctuation, sentences are sometimes too long, some repetition of words, proper use of paragraphs	Some improper use of punctuation, sentences are usually too long, many repetition of words, some improper use of paragraphs	No use of punctuation at all … Sentences seems to go on and on for ever … No apparent usage of paragraphs

3. Structure and Organization (choice of fonts, titles, sub-titles, chapters, sub-chapters, sections, sub-sections to enhance the readability and understanding of the report), having a table of content, list of Figures and tables	Superb structure of the report, everything makes sense (understand templates and can follow them exactly), perfect table of content, list of Figures and tables	Good Structure and organization with some departure from the ideal template, good table of content, list of Figures and tables	The structure and organization are not good … noticeable departure from template, poor table of content, list of Figures and tables	The structure and organization of the report seem to be random ... Does not follow the template at all … missing table of content, list of Figures or tables
4. Use of visual illustrations, other than plain text, (graphs, charts, flow diagrams, tables …) to enhance the understanding of the report	**All** information that can be represented graphically is presented as such with **proper** choice of the illustration method that suits the information being presented the most	**Most** information that can be represented graphically is presented as such with **Good** choice of the illustration method that suits the information being presented the most	Most information that can be graphically illustrated is presented as plain text. Some information is illustrated graphically with some wrong illustration methods	Information is rarely illustrated graphically with improper choice of illustration methods

5. Formulae and equations	**All** formulae and equations used are properly written, numbered and referenced	**Most** formulae and equations used are properly written, numbered and referenced	**Most** formulae and equations used are properly written but many are not numbered and referenced	**Many** formulae and equations used are improperly written and most of them are not numbered and referenced
6. Proper use of References	All information obtained from others is properly referenced. The list of references is properly documented (source name, publication name, page numbers, …etc.)	Most information obtained from others is properly referenced. The list of references is properly documented (source name, publication name, page numbers, …etc.)	Some use of references, most information is not referenced. List of references is not properly documented (some information is missing, like page numbers ….etc.)	No referencing at all
7. Proper use of appendices (to reduce the size of the main body of the report)	All the information that is not critical to the understanding of the report but might be of some interest to some of the readers is put in	Most of the information that is not critical to the understanding of the report but might be of some interest to some of	Most of the information that can be put in appendices are spread through the main body of the report. Only one (or	No use of appendices at all. Everything is in the main body of the report

	the appendices. Appendices are properly organized (multiple appendices are used for different information)	the readers is put in the appendices. Appendices are properly organized (multiple appendices are used for different information)	few) appendices are included containing many, unrelated, information	

Technical Contents	**Exemplary (4)**	**Proficient (3)**	**Apprentice (2)**	**Novice (1)**
1. The abstract	Precise, completely conveys what has been accomplished, provide performance numbers with a good first punch line	Completely conveys what has been accomplished, provide performance numbers, no punch line, too many words	Somehow conveys what has been accomplished … No performance numbers	No abstract at all or what is provided as an abstract is not an abstract!
2. Problem description and motivation	The problem being tackled is clearly described with proper usage of statistics, market	Clear problem description but vague (or little support) motivation	Somehow vague problem description, no motivation or justification for	Vague problem description (one can not tell exactly what he is trying to do or why)

	surveys, news articles …etc. to support the motivation for tackling this problem		tackling this problem at all	
3. Objectives & Deliverables	Measurable objectives and deliverables are clearly and precisely stated	Objectives and Deliverables are stated with some vagueness (making them less measurable)	Some objectives and deliverables are provided (many are missing), however they are not clear nor measurable	Objectives 7 deliverables are not stated at all
4. Project Management Plan	A **well** written work plan is provided detailing phases or milestones, tasks, task assignment, task duration, critical path analysis and contingency plans, required resources, and discrepancies between planned and achieved tasks. Tasks are clearly and precisely stated (**one can** tell what is the expected outcome of	A work plan is provided with some details about tasks (no phases or milestones), tasks, task assignment, task duration, required resources, and discrepancies between planned and achieved tasks. **No critical path analysis and contingency plans**. Some tasks are vaguely stated (one	A very brief work plan is provided with very little description of tasks. Tasks are very vague.	No work plan is provided at all

	a task just by reading the task)	**<u>can not</u>** tell what is the expected outcome of a task just by reading the task)		
5. Quality of Engineering Documentation	Engineering principles are well developed, Possible solutions are well documented, Proper description of solution, Proper Documentation of experimental setup , data acquisition, Analysis, results, testing, benchmarking (all that apply) and conclusions	Generally sufficient documentation of possible solutions, adopted solution, experimental setup , data acquisition, Analysis, results, testing, benchmarking (all that apply) and conclusions Some items might not be sufficiently documented	Some documentation is provided but some major components are missing	Documentation is generally inadequate

ORAL PRESENTATION ASSESSMENT

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Audience awareness (interacts with audience: e.g. stepping toward audience and speaking to them, not at them), looking at them, making eye contact	Interacts with audience throughout presentation	Some interaction with audience	Little interaction with audience … Most of the time looks elsewhere	Does not interact with audience at all … Does not look at the audience … Look at PC, screen, or elsewhere
Focus: goal, evidence, conclusion (gives audience a roadmap and follows it)	Gives audience very clear road map of goal, evidence and conclusion and follows it well	Gives audience an adequate road map of goal, evidence and conclusion and follows it adequately	Gives audience some road map of goal, evidence and conclusion but does not follow it well	Does not give audience an adequate road map of goal, evidence and conclusion
Transitions (phrases smoothly link one	Very smooth	Transitions are	Some transition is provided though	Abruptly transitions from one phase to

part to next)	Transitions	generally smooth	not smooth	the next … No linking
Use of visual aids (to tell the story and enhance the quality of the presentation)	Uses visual aids very effectively to tell the story; visual aids enhance presentation	Overall, uses visual aids effectively to tell the story; visual aids add to presentation	There is some use of visual aids effectively to tell the story	Either does not use visual aids at all; or too much dependency on visual aids

Mechanics	**Exemplary (4)**	**Proficient (3)**	**Apprentice (2)**	**Novice (1)**
	Very effectively uses (e.g.'s):	Effectively uses (e.g.'s):	Sometimes effectively use (e.g.'s):	Does not effectively use (e.g.'s):
Body position (e.g., facing audience or screen)	Body position (always facing audience)	Body position (faces audience most of the time)	Body position (faces audience some of the time)	Body position (faces screen or board all the time)
Eye contact: (e.g., scanning entire audience)	Eye contact (excellent scanning of audience, looking at people)	Eye contact (some scanning of audience, looking at people)	Some eye contact (not enough, looking down a lot)	No eye contact
Visual aids (e.g., clear, not too busy, readable size font)	Visual Aids (clear, right amount on each slide)	Visual Aids (can read clearly, usually not too much material)	Visual Aids (a little bit busy, sometimes not clear)	Visual Aids (too busy, blurry)
Delivery (e.g., fluency, pace, voice projection, um's, uh's)	Delivery (excellent pace, projects voice, great enthusiasm)	Delivery (good pace, usually projects voice, some enthusiasm)	Delivery (a little bit fast, sometimes um's, little projecting voice,	Delivery (too fast, too many um's, not projecting voice, lack of enthusiasm)

			little enthusiasm)	

Questions	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Asks audience for questions	Effectively opens ("I'd be happy to answer questions")	Asks for questions	rarely ask for questions	Does not ask for questions
Answers questions effectively and smoothly	Answers questions effectively and smoothly	Answers questions adequately	Rarely answer questions adequately	Does not answer questions adequately

(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Awareness of global effects of engineering solutions (product, practice, event)	Deep understanding of the immediate and	Good understanding of the widespread	Some awareness of the more extended effects of	Seems to have considered only effects on

	long-term issues involving the solution on users and non-users locally and globally	effects of the solution but with somewhat limited perspective about long-term factors	the solution	immediate users
Understanding of economic factors	Deep understanding of economic factors applied to this and related solutions and the impact they may have on the economy at large as well as long term trends	Good understanding of economic factors as applied to this solution and how it affects other related solutions	Some understanding of economic factors as applied to the solution	Little or no understanding of economic factors involved in the creation and/or use of the solution
Awareness of implications to society at large	Deep understanding of the immediate and long term implications to society in the creation and/or use of the solution, and the overall potential benefits and risks to society.	Good understanding of the implications to society in the creation and/or use of the solution, as well as its relation to general societal issues	Moderate understanding of the implications to society in the creation and/or use of the solution	Little or no understanding of (or interest in?) implications to society involved in the creation and/or use of the solution

(j) knowledge of contemporary issues

	Exemplary (4)	**Proficient (3)**	**Apprentice (2)**	**Novice (1)**
Awareness of (other) contemporary issues (political, cultural, ...)	Deep understanding of all the relevant contemporary issues related to the creation and/or use of the solution, as well as of issues that may be only tangentially related; good analysis of all these issues and how they might impact the general acceptance of the solution and how this might affect the future development of similar solutions.	Good understanding of all the relevant contemporary issues directly related to the creation and/or use of the solution.	Moderate understanding of the main relevant contemporary issues directly related to the creation and/or use of the solution	Little or no understanding of (or interest in?) contemporary issues directly related to the creation and/or use of the solution

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Tool Selection	Selection of tools is based on sound technical criteria. Relevant industry standard class tools (software CAD, simulation, test equipment, emulators, measurement and lab equipment, planning and project management tools) are selected for carrying out specific tasks	Selection of tools is based on prior knowledge of the tools. Relevance of the selected tools is close to the standard practices.	Selection of tools is not based on technical criteria. Tools are selected based on personal preference	Selection of tools is not discussed. Use of the wrong set of tools is commonly noticed.
Tool Usage	Usage of the tools shows a good awareness of the tools capabilities and features. Tools are used correctly and in a consistent way with the stated objectives. Any issue with the tools is resolved using the tools documentation, FAQs or the customer support. Accurate description of credible problems encountered is noticed.	Usage of the tools is shows a fair awareness of the tools capabilities and features. Tools are used correctly and in a consistent way with the stated objectives. Some issues with the tools where the answers are present in the documentation are not properly resolved. Accurate description of credible problems encountered is not	Usage of the tools is shows a little awareness of the tools capabilities and features. Tools are used correctly and in a consistent way with the stated objectives. Improper use of the tools documentation. Several issues with the tools where the answers are present in the	Usage of the tools is shows no awareness of the tools capabilities and features. Tools are used incorrectly and in an inconsistent way with the stated objectives. Improper use of the tools documentation. Most issues with the tools

		always seen.	documentation are not properly resolved. Accurate description of credible problems encountered is missing.	where the answers are present in the documentation are not properly resolved. Accurate description of credible problems encountered is missing.

(n)The ability to design a system that involves the integration of hardware and software components

Outcome	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Selection of hardware equipment and software	Selection of hardware equipment and software follows a thorough approach where many criterions are used: performance, compatibility, standard compliance, protocol support, interoperability, manufacturer strength.	Selection of hardware equipment and software follows a thorough approach where few criterions are used: performance, compatibility, standard compliance. One or more relevant important criterions are ignored.	Selection of hardware equipment and software is based on the selection of a single manufacturer already integrated solution among several candidates.	Selection of hardware equipment and software is based on the suggestions of the marketing team of one single vendor
Integration Methodology	The integration methodology	The integration	The integration	An ad-hoc

	is well described and followed. Interfaces are well defined and their compatibility discussed. Use of an integration plan featuring integration phases and a test plan for each phase.	methodology is well described and followed. Interfaces are mentioned but their compatibility is not considered. No use of an integration plan. Some mention of a test plan.	methodology is not described properly and not always followed. Interfaces are not mentioned. No use of an integration plan. Tests are carried out without a plan.	integration (No) methodology is followed but not described. No use of an integration plan. Tests are carried out without a plan.