

**COE ABET COMMITTEE**

**Activity Report**

Term T122

**COMPUTER ENGINEERING**

**Program**

at

**King Fahd University of Petroleum & Minerals**

**DHAHRAN, SAUDI ARABIA**

**6 October 2013**

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# Introduction

Section 1 of this report gives a brief summary of the new curriculum adopted starting from semester 121 for the BS program at the COE Department and describes how it enhances the achievement of several student outcomes pertaining to engineering design, professional ethics, Impact of engineering, and contemporary issues. Section 2 presents the results of the direct assessment performed in semester 122 on student outcomes (a) and (b).

# 1. The New COE BS Curriculum

In semester 121, the Computer Engineering department has introduced a new undergraduate program. This new curriculum was motivated by several factors:

1. Computer Engineering (COE) is a very dynamic field and there is a continuous need for updating the COE program to cope with the fast advances in the field. The last curriculum revision was undertaken by the COE department over six years earlier.
2. In 1423 H (2002 G) a National Science, Technology and Innovation Plan (NSTIP) was approved by the Council of Ministers and a budget of 7.9 billion SR[[1]](#footnote-1) was allotted for a five year implementation plan encompassing eight major tracks[[2]](#footnote-2), [[3]](#footnote-3). Two of these tracks are directly related to Computer Engineering, namely; the ***Information Technology* (IT)** track, and ***Electronics, Communication, and Photonics*** (ECP) track. To have any real progress along these tracks, there was a need for strong knowledge-base in electronic systems design and IT supporting technologies (Computers and Networks). As such, the COE department is proposing this revision to better align its program with these NSTIP technology tracks (IT and ECP) and help in the transition to a *knowledge-based* economy in KSA. All the elective courses have been aligned with two main tracks; Computer Systems and Computer Networks that directly address these needs.
3. To better serve the local market needs, where a shortage in IT sectors of 30,000 jobs is expected by the year 2014[[4]](#footnote-4).
4. To provide students with more choices and flexibility within the program.
5. To provide more in-depth knowledge within certain areas of COE deemed to be of critical importance.

The main features of the newly proposed program are:

1. Enhanced flexibility, allowing the student to choose his COE specialization through electives.
2. It provide a rich body of electives for the students in two main areas of specialization (referred to as tracks), which were deemed as most important for the local job market (present and future):
   1. **Computer Systems Engineering (CSYS) Track and**
   2. **Computer Networks Engineering (CNET)Track**

All COE electives are aligned with these two areas. This allows more specialization without any management overhead (i.e. without creating formal tracks within the program). All COE core courses establish the required foundation for these two areas of specializations.

1. The Capstone project course (i.e. the Senior Design Project course) has been made compulsory on all students (coop or non-coop). This rectified the problem of the old curriculum dependency on COOP for the design experience.
2. Based on numerous feedbacks from alumni and industrial partners, there was a need to inject many design skills and non-technical engineering skills and knowledge into the curriculum. These were injected into the new program through the introduction of two new core courses; COE 300 Computer Engineering Design Principles and ISE 307 Engineering Economy. COE 300 provides a solid understanding of the product design process, engineering design tools, and the right mix of professional skills that are critical for project and career success (communication skills, project management, team work, professional ethics …etc.). The SE 307 Engineering Economy course introduces costing, financing, cost amortization, depreciation …etc.

Appendix 1 shows the BS degree plans with summer training and with Coop training. Appendix 2 contains the mapping of the student outcomes to courses for the new curriculum.

# 2. Direct Assessment

Direct assessment was carried out for two student outcomes during the report period, namely Outcome (a) (ability to apply knowledge of mathematics, science, and engineering) and Outcome (b) (ability to design and conduct experiments, as well as to analyze and interpret data). The assessment of each outcome was carried out in a subset of the courses serving the outcome as per the outcome to course mapping in Appendix B. Table 1 gives details of the courses used, number of students, and the method of assessment adopted.

Table 1. Courses used, number of students and method adopted for the direct assessment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student Outcome | Course | Number of Sections | Number of Students | Total # of students | Method used |
| (a) Use of Math | COE 202 | 4 | 33 | 76 | Major 2 Q |
| COE 241 | 2 | 17 | Qs in Majors 1, 2, Final, HWs, Quizzes |
| COE 301 | 1 | 7 | Qs in Majors 1, 2, Final, Quizzes |
| COE 344 | 1 | 19 | Qs in Major 1, Final, HWs, Quizzes |
| (b) Design of Exp | COE 203 | 3 | 22 | 40 | Dedicated Experiment |
| COE 301 lab | 1 | 7 | Dedicated Experiment |
| COE 306 lab | 1 | 11 | Dedicated Experiment |

Table 2 lists the overall scores obtained for the two outcomes assessed.

Table 2 Overall assessment scores obtained for student outcomes (a) and (b).

|  |  |  |
| --- | --- | --- |
| Direct Assessment Data for T122 | | |
|  | Student Outcome | |
| **(a)**  **Math** | **(b)**  **Exp** |
| **Overall Score (out of 4)** | **2.83** | **2.85** |
| **Level of achievement** | **A** | **A** |

The COE department adopts the following criteria for judging the level of achievement of the student outcomes:

* Achieved (A): Score > 2.5,
* Marginally Achieved (M): Score: ≈ 2.5
* Need Improvement (NI): Score < 2.5

Based on the above criteria, the assessment scores above indicate that both outcomes have achieved performance levels (A) with a comfortable margin. Compared to the assessment results reported in the COE ABET Committee Activity Report T 112, Outcome (a) performance has improved from Marginally Achieved (M).

Following is a summary of observations, comments and suggestions for improvement collected from faculty teaching the courses and labs contributing to the assessment. These recommendations will be discussed further for determining appropriate corrective actions to be implemented.

**Outcome (a):**

* COE 202 coordination and the use of a common syllabus ensured better coverage of all necessary course material.
* Outcome (a) learning can benefit from problem solving sessions organized out of class for the students or in-class by the students in groups.

**Outcome (b):**

* New labs such as the COE 301 and COE 306 require their syllabi and lab manuals enhanced.
* Documentation, reporting, and presentation skills of students need improvement.

# Appendix A: New at COE BS in Computer Engineering Curriculum (Summer Training Option)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COURSE** | **TITLE** | **LT** | **LB** | **CR** | **COURSE** | **TITLE** | **LT** | **LB** | **CR** |
| **Preparatory Year** | | | | | | | | | |
| ENGL 001 | Prep. English I | 15 | 5 | 8 | ENGL 002 | Prep. English II | 15 | 5 | 8 |
| MATH 001 | Prep. Math I | 3 | 1 | 4 | MATH 002 | Prep. Math II | 3 | 1 | 4 |
| PYP 001 | Prep. Physical Science | 2 | 0 | 2 | PYP 002 | Prep. Computer Science | 0 | 2 | 1 |
| PYP 003 | University Study Skills | 0 | 2 | 1 | ME 003 | Prep. Eng. Technology | 0 | 2 | 1 |
| PE 001 | Prep. Health and Physical Educ. I | 0 | 2 | 1 | PE 002 | Prep. Health and Physical Educ. II | 0 | 2 | 1 |
|  | | **20** | **10** | **16** |  | | **18** | **12** | **15** |
| **Total credit hours required in Preparatory Program: 31** | | | | | | | | | |
| **First Year (Freshman)** | | | | | | | | | |
| 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 |
| ENGL 101 | Intro. to   Academic Discourse | 3 | 0 | 3 | ENGL 102 | Intro. to Report Writing | 3 | 0 | 3 |
| CHEM 101 | General Chemistry I | 3 | 4 | 4 | ICS 102 | Intro. to Computing I | 2 | 3 | 3 |
| IAS 111 | Belief and its Consequences | 2 | 0 | 2 | IAS 101 | Practical Grammar | 2 | 0 | 2 |
| PE 101 | Health and Physical Educ. I | 0 | 2 | 1 | PE 102 | Health and Physical Educ. II | 0 | 2 | 1 |
|  | | **15** | **9** | **18** |  | | **14** | **8** | **17** |
| **Second Year (Sophomore)** | | | | | | | | | |
| COE 202 | Digital Logic Design | 3 | 0 | 3 | ICS 202 | Data Structures | 3 | 3 | 4 |
| COE 203 | Digital Logic Design Lab | 0 | 3 | 1 | EE 203 | Electronics I | 3 | 3 | 4 |
| ICS 201 | Intro. to Computing II | 3 | 3 | 4 | IAS 212 | Professional Ethics | 2 | 0 | 2 |
| EE 202 | Electric Circuits I | 3 | 0 | 3 | COE 241 | Data and Comp. Communications | 3 | 0 | 3 |
| EE 212 | Electric Circuits Laboratory | 0 | 3 | 1 | STAT 319 | Prob. & Stat. for Eng. & Sci. | 2 | 3 | 3 |
| MATH 201 | Calculus III | 3 | 0 | 3 |  |  |  |  |  |
| IAS 201 | Objective Writing | 2 | 0 | 2 |  |  |  |  |  |
|  |  | **14** | **9** | **17** |  |  | **13** | **9** | **16** |
| **Third Year (Junior)** | | | | | | | | | |
| MATH 260 | Intro. to Diff. Eqs. & Lin. Alg. | 3 | 0 | 3 | COE 306 | Intro. to Embedded Systems | 3 | 3 | 4 |
| ICS 253 | Discrete Structures I | 3 | 0 | 3 | IAS 301 | Language Comm. Skills | 2 | 0 | 2 |
| ENGL 214 | Academic & Professional Comm. | 3 | 0 | 3 | COE 4xx | COE Depth Elective | 3 | 0 | 3 |
| COE 301 | Computer Organization | 3 | 3 | 4 | XE xxx | Technical Elective I | 3 | 0 | 3 |
| COE 344 | Computer Networks | 3 | 3 | 4 | COE 300 | Principles of Comp. Eng. Des. | 1 | 3 | 2 |
|  |  |  |  |  | ISE 307 | Eng. Economic Analysis | 3 | 0 | 3 |
|  | | **15** | **6** | **17** |  | | **15** | **6** | **17** |
| **Summer Session** | | | | | COE 399 | Summer Training | **0** | **0** | **0** |
| **Fourth Year (Senior)** | | | | | | | | | |
| ICS 431 | Operating Systems | 3 | 3 | 4 | COE 485 | Senior Design Project | 1 | 6 | 3 |
| COE 4xx | COE Elective I | 3 | 0 | 3 | IAS 322 | Human Rights in Islam | 2 | 0 | 2 |
| COE 4xx | COE Elective II | 3 | 0 | 3 | COE 4xx | COE Elective III | 3 | 0 | 3 |
| XE xxx | Technical Elective II | 3 | 0 | 3 | COE 4xx | COE Elective IV | 3 | 0 | 3 |
| GS xxx | GS Elective 1 | 3 | 0 | 3 | GS xxx | GS Elective II | 3 | 0 | 3 |
|  | | **15** | **3** | **16** |  | | **12** | **6** | **14** |
| **Total credit hours required in Degree Program : 132** | | | | | | | | | |

# Appendix A, Contd.: New COE BS in Computer Engineering Curriculum (Coop Option)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COURSE** | **TITLE** | **LT** | **LB** | **CR** | **COURSE** | **TITLE** | **LT** | **LB** | **CR** |
| **Preparatory Year** | | | | | | | | | |
| ENGL 001 | Prep. English I | 15 | 5 | 8 | ENGL 002 | Prep. English II | 15 | 5 | 8 |
| MATH 001 | Prep. Math I | 3 | 1 | 4 | MATH 002 | Prep. Math II | 3 | 1 | 4 |
| PYP 001 | Prep. Physical Science | 2 | 0 | 2 | PYP 002 | Prep. Computer Science | 0 | 2 | 1 |
| PYP 003 | University Study Skills | 0 | 2 | 1 | ME 003 | Prep. Eng. Technology | 0 | 2 | 1 |
| PE 001 | Prep. Health and Physical Educ. I | 0 | 2 | 1 | PE 002 | Prep. Health and Physical Educ. II | 0 | 2 | 1 |
|  | | **20** | **10** | **16** |  | | **18** | **12** | **15** |
| **Total credit hours required in Preparatory Program: 31** | | | | | | | | | |
| **First Year (Freshman)** | | | | | | | | | |
| 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 |
| ENGL 101 | Intro. to   Academic Discourse | 3 | 0 | 3 | ENGL 102 | Intro. to Report Writing | 3 | 0 | 3 |
| CHEM 101 | General Chemistry I | 3 | 4 | 4 | ICS 102 | Intro. to Computing I | 2 | 3 | 3 |
| IAS 111 | Belief and its Consequences | 2 | 0 | 2 | IAS 101 | Practical Grammar | 2 | 0 | 2 |
| PE 101 | Health and Physical Educ. I | 0 | 2 | 1 | PE 102 | Health and Physical Educ. II | 0 | 2 | 1 |
|  | | **15** | **9** | **18** |  | | **14** | **8** | **17** |
| **Second Year (Sophomore)** | | | | | | | | | |
| COE 202 | Digital Logic Design | 3 | 0 | 3 | ICS 202 | Data Structures | 3 | 3 | 4 |
| COE 203 | Digital Logic Design Lab | 0 | 3 | 1 | ICS 253 | Discrete Structures I | 3 | 0 | 3 |
| ICS 201 | Intro. to Computing II | 3 | 3 | 4 | EE 203 | Electronics I | 3 | 3 | 4 |
| EE 202 | Electric Circuits I | 3 | 0 | 3 | IAS 212 | Professional Ethics | 2 | 0 | 2 |
| EE 212 | Electric Circuits Laboratory | 0 | 3 | 1 | COE 241 | Data and Comp. Communications | 3 | 0 | 3 |
| MATH 201 | Calculus III | 3 | 0 | 3 | STAT 319 | Prob. & Stat. for Eng. & Sci. | 2 | 3 | 3 |
| IAS 201 | Objective Writing | 2 | 0 | 2 |  |  |  |  |  |
|  |  | **14** | **9** | **17** |  |  | **16** | **9** | **19** |
| **Third Year (Junior)** | | | | | | | | | |
| MATH 260 | Intro. to Diff. Eqs. & Lin. Alg. | 3 | 0 | 3 | COE 306 | Intro. to Embedded Systems | 3 | 3 | 4 |
| ENGL 214 | Academic & Professional Comm. | 3 | 0 | 3 | COE 4xx | COE Depth Elective | 3 | 0 | 3 |
| IAS 301 | Language Comm. Skills | 2 | 0 | 2 | GS xxx | GS Elective I | 3 | 0 | 3 |
| COE 301 | Computer Organization | 3 | 3 | 4 | COE 300 | Principles of Comp. Eng. Des | 1 | 3 | 2 |
| COE 344 | Computer Networks | 3 | 3 | 4 | ICS 324 | Database | 3 | 3 | 4 |
| ISE 307 | Eng. Economic Analysis | 3 | 0 | 3 | IAS 322 | Human Rights in Islam | 2 | 0 | 2 |
|  | | **17** | **6** | **19** |  | | **15** | **9** | **18** |
| **Summer Session** | | | | | COE 350 | Begin Cooperative Work | **0** | **0** | **0** |
| **Fourth Year (Senior)** | | | | | | | | | |
| COE 351 | Cooperative Work | 0 | 0 | 9 | COE 485 | Senior Design Project | 1 | 6 | 3 |
|  |  |  |  |  | ICS 431 | Operating Systems | 3 | 3 | 4 |
|  |  |  |  |  | COE 4xx | COE Elective I | 3 | 0 | 3 |
|  |  |  |  |  | COE 4xx | COE Elective II | 3 | 0 | 3 |
|  |  |  |  |  | GS xxx | GS Elective II | 3 | 0 | 3 |
|  | | **0** | **0** | **9** |  | | **13** | **9** | **16** |
| **Total credit hours required in Degree Program : 133** | | | | | | | | | |

Appendix B: Courses and their Coverage of Student Outcomes in the new COE Curriculum

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Outcome**  **Course** | **(a) apply knowledge of mathematics, science** | **(b) design and conduct experiments, analyze data** | **(c) design a system, c to meet desired needs** | **(d) function on multi-disciplinary teams** | **(e) identify, formulate, and solve engineering problems** | **(f) understanding of professional ethics** | **(g) effective communications** | **(h) understanding impact of engineering solutions** | **(i) life-long learning** | **(j) knowledge of contemporary issues** | **(k) use of techniques, skills, and modern tools in design** | **(l) design a system by integrating hardware & software** |
| **MATH 101, MATH 102, MATH 201, MATH 260, PHYS 101, PHYS 102 and CHEM 101** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| **STAT 319** **Prob. & Stat. for Engineers** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| **ENGL & IAS courses** |  |  |  |  |  |  | **X** |  |  |  |  |  |
| **IAS 212 Professional Ethics** |  |  |  |  |  | **X** |  |  |  |  |  |  |
| **ICS 102, ICS 201, ICS 202 and ICS 431** |  |  | **X** | **X** |  |  |  |  |  |  | **X** |  |
| **ICS 253 Discrete Structures I** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| **EE 201 Electric Circuits I** | **X** | **X** |  |  |  |  |  |  |  |  |  |  |
| **EE 203 Electronics I** | **X** | **X** | **X** | **X** |  |  |  |  |  |  | **X** |  |
| **SE 307** **Eng. Economics Analysis** |  |  |  |  |  |  |  |  |  |  | **X** |  |
| **COE 202 & 203 Digital Logic Design** | **X** | **X** | **X** | **X** |  |  | **X** |  |  |  | **X** |  |
| **COE 300 Principles of Comp. Eng. Design** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| **COE 301 Computer Organization** |  | **X** | **X** | **X** |  |  |  |  |  |  | **X** |  |
| **COE 306 Introduction to Embedded Systems** | **X** | **X** | **X** | **X** | **X** |  |  |  | **X** |  | **X** | **X** |
| **COE 241 Data & Comp. Communications** | **X** |  | **X** |  | **X** |  |  |  |  |  | **X** |  |
| **COE 344 Computer Networks** | **X** | **X** |  |  | **X** |  |  |  |  | **X** | **X** |  |
| **COE 351 COE Coop Training** | **X** |  | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| **COE 399 COE Summer Training** |  |  |  | **X** |  | **X** | **X** |  | **X** |  | **X** |  |
| **COE 485 Senior Design Project** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| **Depth Elective Courses:**  **COE 444 Inter. Design and Management**  **COE 405 Des. and Modeling of Digital Sys.** | **X**  **X** |  | **X**  **X** |  | **X**  **X** |  |  |  |  |  | **X**  **X** |  |

1. *The Government Expenditure on R&D is planned to be 1.6% of the GDP by 1438 AH (2017 AD).* [↑](#footnote-ref-1)
2. “*Kingdom of Saudi Arabia: Toward Knowledge-Based Economy*,” Mohammed I. Al-Suwaiyel, President, KACST, 2008 Global Competitiveness Forum, 20-22 January 2008, Riyadh (<http://www.hightrusted.com/GCF2009/media/p/12/download.aspx>) [↑](#footnote-ref-2)
3. “*Strategic Priorities for Electronics, Communications and Photonics Technology Program,*” <http://www.kacst.edu.sa/en/research/Documents/ECP.pdf> [↑](#footnote-ref-3)
4. **“السعودية ستعاني نقص 30 ألفاً من كوادر تقنية المعلومات بحلول 2014”** [**http://international.daralhayat.com/internationalarticle/139679**](http://international.daralhayat.com/internationalarticle/139679) [↑](#footnote-ref-4)