



COE ABET COMMITTEE

Activity Report

Term T122

COMPUTER ENGINEERING

Program

at

King Fahd University of Petroleum & Minerals
DHAHRAN, SAUDI ARABIA

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Table of Contents

Introduction	3
1, COE New Curriculum	5
2. Direct Assessment	5
Appendix A: - Degree Plan for the new COE BS Program (Summer Training Option)	7
- Degree Plan for the new COE BS Program (Coop Option)	8
Appendix B: Courses and their Coverage of Student Outcomes in the new COE Curriculum	9

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 SR¹ was allotted for a five year implementation plan encompassing eight major tracks^{2, 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 2014⁴.
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 The Government Expenditure on R&D is planned to be 1.6% of the GDP by 1438 AH (2017 AD).

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>)

³ “Strategic Priorities for Electronics, Communications and Photonics Technology Program,” <http://www.kacst.edu.sa/en/research/Documents/ECP.pdf>

⁴ “السعودية ستعاني نقص 30 ألفا من كوادرات تقنية المعلومات بحلول 2014” <http://international.daralhayat.com/internationalarticle/139679>

a. Computer Systems Engineering (CSYS) Track and

b. 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.

3. 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.
4. 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: \approx 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

Course	Outcome	(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	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	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	X
Depth Elective Courses:													
COE 444 Inter. Design and Management	X		X		X							X	
COE 405 Des. and Modeling of Digital Sys.	X		X		X							X	