# University of Umm Al-Qura

# Computer Science Undergraduate Curriculum

# Academic Year Beginning 1430 2009

## Mission of the Department of Computer Science

The mission of the Department of Computer Science is to engage in education and research in order to serve society and industry in this era of rapidly changing computer technologies. We endeavor to supply graduates -- to the computing industry, government, and academia -- equipped with the skills that will enable them to provide technical leadership, explore new directions in computer technology and its applications, and succeed in the modern electronic age.

## Program Educational Objectives (PEOs)

1. Graduates will be able to apply their strong technical knowledge and skills to design, and implement commercial and research projects as part of a team.
2. Graduates will operate as professionals by using modern tools, their ability to communicate with a range of audiences, and awareness of ethical and social impacts of their work.
3. Graduates will appreciate the changing nature of the field, and the need for life-long learning to stay up to date through self-learning, certification, training courses, or higher education.
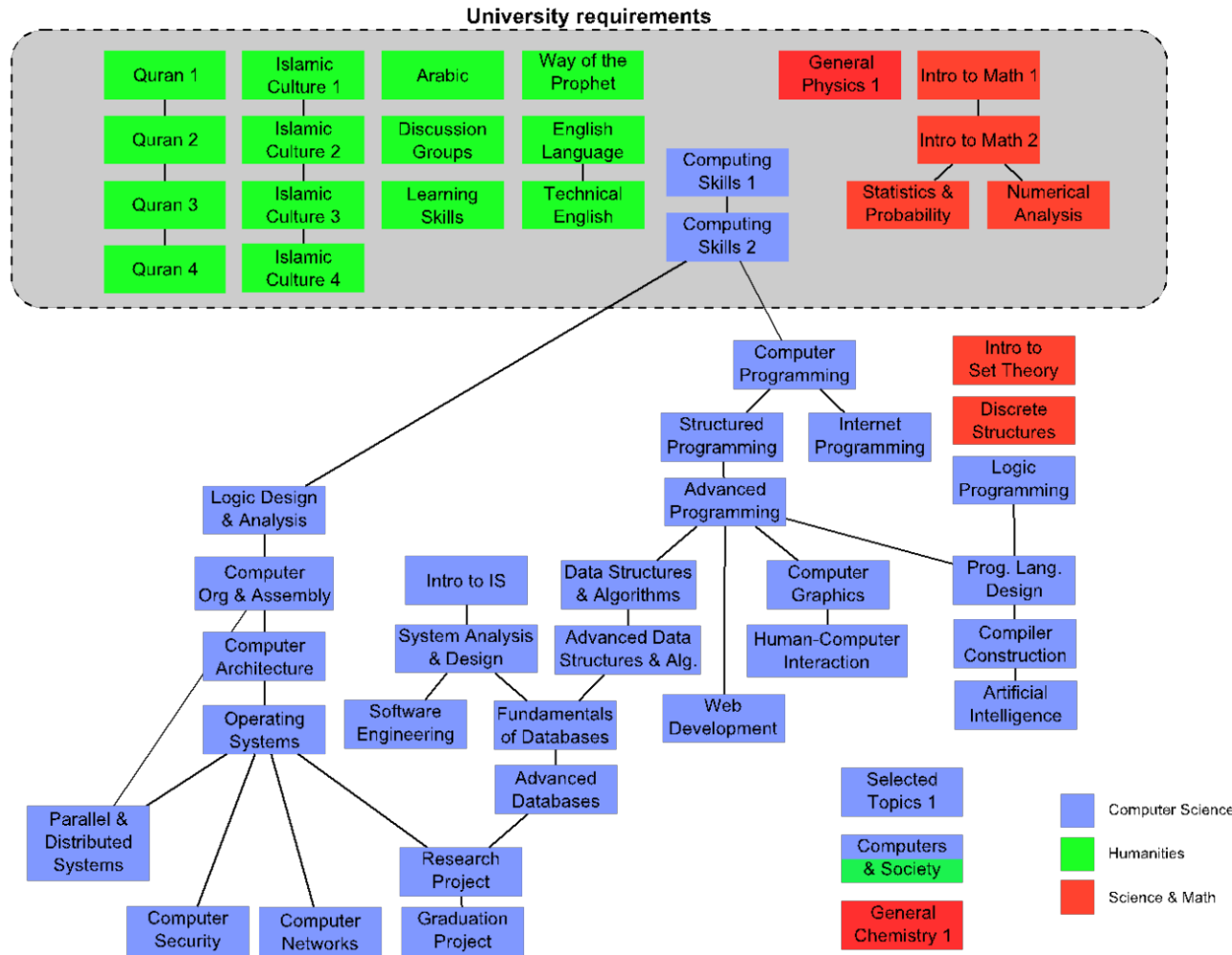
## ABET Student Outcomes (POs)

Below is a list of ABET Student Outcomes that are referenced in the course syllabi. An outcome means, "what will a student be able to do", and it is not the same as a course topic. For example, a course topic might be "software requirements", but a course learning outcome could be "a student will have the ability to collect software requirements, and be aware of the different methods available for doing so". Please see my notes in red below as well

*The program enables students to achieve, by the time of graduation:*

(a) *An ability to apply knowledge of computing and mathematics appropriate to the discipline;* *Application of any computing/math "theory", even requirements gathering*
(b) *An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;* *Computing reqmnts = technical (hardware, algorithms)*
(c) *An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;* *Computer-based = a software solution*
(d) *An ability to function effectively on teams to accomplish a common goal;*
(e) *An understanding of professional, ethical, legal, security, and social issues and responsibilities;*
(f) *An ability to communicate effectively with a range of audiences;*
(g) *An ability to analyze the local and global impact of computing on individuals, organizations and society;*
(h) *Recognition of the need for, and an ability to engage in, continuing professional development;*
(i) *An ability to use current techniques, skills, and tools necessary for computing practices.*
(j) *An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;*
(k) *An ability to apply design and development principles in the construction of software systems of varying complexity.*

# 1430 Prerequisites Chart



**University requirements**

| Quran 1 | Islamic Culture 1 | Arabic | Way of the Prophet |
| Quran 2 | Islamic Culture 2 | Discussion Groups | English Language |
| Quran 3 | Islamic Culture 3 | Learning Skills | Technical English |
| Quran 4 | Islamic Culture 4 | | |

General Physics 1 · Intro to Math 1 · Intro to Math 2 · Statistics & Probability · Numerical Analysis

Computing Skills 1 · Computing Skills 2

Computer Programming · Structured Programming · Internet Programming · Advanced Programming

Intro to Set Theory · Discrete Structures · Logic Programming · Prog. Lang. Design · Compiler Construction · Artificial Intelligence

Logic Design & Analysis · Computer Org & Assembly · Computer Architecture · Operating Systems

Intro to IS · System Analysis & Design · Software Engineering · Data Structures & Algorithms · Advanced Data Structures & Alg. · Fundamentals of Databases · Advanced Databases · Computer Graphics · Human-Computer Interaction · Web Development

Parallel & Distributed Systems · Computer Security · Computer Networks · Research Project · Graduation Project

Selected Topics 1 · Computers & Society · General Chemistry 1

**Legend:**
- Computer Science
- Humanities
- Science & Math

# 10 Semester Curriculum (1430/2009) with 2 Semester Preparatory Year – Arabic

## المستوى الأول

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 4800150-2 | مهارات الحاسب الآلي (1) | 1 | 2 | 2 | |
| 4800140-4 | مقدمة في الرياضيات (1) | 4 | | 4 | |
| 4800170-6 | اللغة الانجليزية | 4 | 6 | 6 | |
| 4800130-4 | فيزياء عامة (1) | 3 | 3 | 4 | |
| 4800101-2 | حلقات نقاش | 2 | | 2 | |
| | **Total CH** | | | 18 | |

## المستوى الثاني

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 4800151-2 | مهارات الحاسب الآلي (2) | 1 | 2 | 2 | 4800150-2 |
| 4800141-4 | مقدمة في الرياضيات (2) | 4 | | 4 | 4800140-4 |
| 4800171-6 | اللغة الانجليزية التقنية | 4 | 6 | 6 | 4800170-6 |
| 4800102-4 | مهارات التعلم | 4 | | 4 | |
| | **Total CH** | | | 16 | |

## المستوى الثالث

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401102-3 | برمجة الحاسب الآلي | 2 | 2 | 3 | 4800151-2 |
| 404151-4 | المدخل إلى نظرية المجموعات | 4 | | 4 | |
| 1401213-3 | تحليل وتصميم منطقي | 3 | | 3 | 4800151-2 |
| 1402101-3 | مقدمة في نظم المعلومات | 3 | | 3 | |
| 404231-3 | مبادئ الإحصاء والاحتمالات | 3 | | 3 | 4800141-4 |
| | **Total CH** | | | 16 | |

## المستوى الرابع

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401104-3 | البرمجة الهيكلية | 2 | 2 | 3 | 1401102-3 |
| 1401210-3 | هياكل متقطعة | 3 | | 3 | 404151-4 |
| 1401214-3 | تنظيم الحاسبات والبرمجة بلغة التجميع | 3 | | 3 | 1401213-3 |
| 601101-2 | الثقافة الإسلامية (1) | 2 | | 2 | |
| 605101-2 | القرآن الكريم (1) | 2 | | 2 | |
| 1401211-3 | البرمجة على الشبكة العنكبوتية | 3 | | 3 | 1401102-3 |
| | **Total CH** | | | 16 | |

## المستوى الخامس

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401105-3 | برمجة متقدمة | 2 | 2 | 3 | 1401104-3 |
| 1401217-3 | برمجة منطقية | 3 | | 3 | 1401210-3 |
| 1401215-3 | عمارة الحاسب | 3 | | 3 | 1401214-3 |
| 601201-2 | الثقافة الإسلامية (2) | 2 | | 2 | 601101-2 |
| 605201-2 | القران الكريم (2) | 2 | | 2 | 605101-2 |
| 1401431-3 | الحاسب والمجتمع | 3 | | 3 | |
| | **Total CH** | | | 16 | |

## المستوى السادس

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401231-3 | لغات البرمجة | 3 | | 3 | 1401105-3 / 1401217-3 |
| 1401311-3 | نظم التشغيل | 3 | | 3 | 1401215-3 |
| 1401218-4 | هياكل بيانات و خوارزميات | 2 | 2 | 4 | 1401105-3 |
| 1401330-3 | الرسومات بالحاسب | 3 | 2 | 3 | 1401105-3 |
| 601301-3 | الثقافة الإسلامية (3) | 3 | | 3 | 601201-2 |
| | **Total CH** | | | 16 | |

## المستوى السابع

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401310-3 | تركيب المترجمات | 3 | | 3 | 1401231-3 |
| 1401222-3 | تحليل وتصميم النظم | 3 | | 3 | 1402101-3 |
| 605301-2 | القران الكريم (3) | 2 | | 2 | 605201-2 |
| 102101-2 | السيرة النبوية | 2 | | 2 | |
| 1401227-3 | تنظيم ومعالجة الملفات | 3 | | 3 | 1401218-4 |
| 1401417-3 | نظم شبكات الحاسب | 3 | | 3 | 1401311-3 |
| | **Total CH** | | | 16 | |

## المستوى الثامن

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401233-3 | تطوير تطبيقات الانترنت | 3 | 1 | 3 | 1401105-3 |
| 1401312-3 | مبادئ قواعد البيانات | 3 | | 3 | 1401222-3 |
| 1401313-3 | هندسة البرمجيات | 3 | | 3 | 1401222-3 |
| 1401333-3 | اتصال الإنسان بالحاسب | 3 | | 3 | 1401330-3 |
| 501101-2 | اللغة العربية | 2 | | 2 | |
| | **Total CH** | | | 14 | |

## المستوى التاسع

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401332-3 | مقدمة في الذكاء الاصطناعي | 3 | | 3 | 1401310-3 |
| 1401335-3 | قواعد البيانات متقدمة | 3 | | 3 | 1401312-3 |
| 1401419-4 | مشروع بحث | 4 | | 4 | 1401311-3 / 1401335-3 |
| 605401-2 | القران الكريم (4) | 2 | | 2 | 605301-2 |
| 402101-4 | الكيمياء العامة (1) | 3 | 3 | 4 | |
| 1401XXX-3 | اختيارية في العلوم للحاسب | 3 | | 3 | |
| | **Total CH** | | | 16 | |

## المستوى العاشر

| رقم المقرر | اسم المقرر | وحدات نظري | وحدات عملي | وحدات معتمدة | متطلب سابق |
|---|---|---|---|---|---|
| 1401334-3 | نظم الحاسبات الموزعة والمتوازية | 3 | | 3 | 1401214-3 / 1401311-3 |
| 1401432-3 | نظم امن الحاسبات | 3 | | 3 | 1401311-3 |
| 1401439-4 | مشروع تخرج | 4 | | 4 | 1401419-4 |
| 601401-2 | الثقافة الإسلامية (4) | 2 | | 2 | 601301-2 |
| 404322-4 | تحليل عددي | 3 | | 3 | 4800141-4 |
| 1401XXX-3 | اختيارية في العلوم للحاسب | 3 | | 3 | |
| | **Total CH** | | | 16 | |

# 10 Semester Curriculum (1430/2009) with 2 Semester Preparatory Year – English

| First Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 4800150-2 | Computing Skills (1) | 1 | 2 | 2 | |
| 4800140-4 | Intro to Mathematics (1) | 4 | | 4 | |
| 4800170-6 | English Language | 4 | 6 | 6 | |
| 4800101-2 | Discussion Groups | 2 | | 2 | |
| 4800130-4 | General Physics (1) | 3 | 3 | 4 | |
| | **Total CH** | | | 18 | |

| Second Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 4800151-2 | Computing Skills (2) | 1 | 2 | 2 | 4800150-2 |
| 4800141-4 | Intro to Mathematics (2) | 4 | | 4 | 4800140-4 |
| 4800102-2 | Learning Skills | 4 | | 4 | |
| 4800171-6 | Technical English | 4 | 6 | 6 | 4800170-6 |
| | | | | | |
| | **Total CH** | | | 16 | |

| Third Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401102-3 | Computer Programming | 2 | 2 | 3 | 4800151-2 |
| 404151-4 | Introduction to Set Theory | 4 | | 4 | |
| 1401213-3 | Logic Analysis & Design | 3 | | 3 | 4800151-2 |
| 1402101-3 | Intro to Information Systems | 3 | | 3 | |
| 404231-3 | Elementary Statistics & Probability Theory | 3 | | 3 | 4800141-4 |
| | **Total CH** | | | 16 | |

| Fourth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401104-3 | Structured Programming | 2 | 2 | 3 | 1401102-3 |
| 1401210-3 | Discrete Structures | 3 | | 3 | 404151-4 |
| 1401214-3 | Computer Organization and Assembly Programming | 3 | | 3 | 1401213-3 |
| 601101-2 | Islamic Culture I | 2 | | 2 | |
| 605101-2 | The Holy Qur'aan I | 2 | | 2 | |
| 1401211-3 | Web Programming | 3 | | 3 | 1401102-3 |
| | **Total CH** | | | 16 | |

| Fifth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401105-3 | Advanced Programming | 2 | 2 | 3 | 1401104-3 |
| 1401217-3 | Logic Programming | 3 | | 3 | 1401210-3 |
| 1401215-3 | Computer Architecture | 3 | | 3 | 1401214-3 |
| 601201-2 | Islamic Culture II | 2 | | 2 | 601101-2 |
| 605201-2 | The Holy Qur'aan II | 2 | | 2 | 605101-2 |
| 1401431-3 | Computers and Society | 3 | | 3 | |
| | **Total CH** | | | 16 | |

| Sixth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401231-3 | Programming Languages | 3 | | 3 | 1401105-3 1401217-3 |
| 1401311-3 | Operating Systems | 3 | | 3 | 1401215-3 |
| 1401218-4 | Data Structures & Algorithms | 2 | 2 | 4 | 1401105-3 |
| 1401330-3 | Computer Graphics | 3 | 2 | 3 | 1401105-3 |
| 601301-3 | Islamic Culture III | 3 | | 3 | 601201-2 |
| | **Total CH** | | | 16 | |

| Seventh Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401310-3 | Compiler Construction | 3 | | 3 | 1401231-3 |
| 1401222-3 | System Analysis and Design | 3 | | 3 | 1402101-3 |
| 605301-2 | The Holy Qur'aan III | 2 | | 2 | 605201-2 |
| 102101-2 | Biography of Prophet Muhammad (pbuh) | 2 | | 2 | |
| 1401227-3 | File Processing and Organization | 3 | | 3 | 1401218-4 |
| 1401417-3 | Computer Network Systems | 3 | | 3 | 1401311-3 |
| | **Total CH** | | | 16 | |

| Eighth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401233-3 | Internet Application Development | 3 | 1 | 3 | 1401105-3 |
| 1401312-3 | Fundamentals of Database Systems | 3 | | 3 | 1401222-3 |
| 1401313-3 | Software Engineering | 3 | | 3 | 1401222-3 |
| 1401333-3 | Human-Computer Interaction | 3 | | 3 | 1401330-3 |
| 501101-2 | Arabic Language | 2 | | 2 | |
| | | | | | |
| | **Total CH** | | | 14 | |

| Ninth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401332-3 | Artificial Intelligence | 3 | | 3 | 1401310-3 |
| 1401335-3 | Advanced Database Systems | 3 | | 3 | 1401312-3 |
| 1401419-4 | Graduation Project | 4 | | 4 | 1401311-3 1401335-3 |
| 605401-2 | The Holy Qur'aan IV | 2 | | 2 | 605301-2 |
| 402101-4 / 1401XXX-3 | General Chemistry (1) / CS Elective | 3 / 3 | 3 | 4 / 3 | |
| | **Total CH** | | | 16 | |

| Tenth Semester | | | | | |
|---|---|---|---|---|---|
| Course Number | Course Name | Lec Hours | Lab Hours | Credit Hours | Prereq |
| 1401334-3 | Parallel & Distributed Computer Systems | 3 | | 3 | 1401214-3 1401311-3 |
| 1401432-3 | Computer Security Systems | 3 | | 3 | 1401311-3 |
| 1401439-4 | Graduation Project | 4 | | 4 | 1401419-4 |
| 601401-2 | Islamic Culture IV | 2 | | 2 | 601301-2 |
| 404322-4 / 1401XXX-3 | Numerical Analysis / CS Elective | 4 / 3 | | 4 / 3 | 4800141-4 |
| | **Total CH** | | | 16 | |

| | Computer Science Student Outcomes (a)-(i) CAC Outcomes, (j)-(k) CAC CS Outcomes | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| 1401102 | ✔ | ✔ | ✔ | | | | | | | ✔ | ✔ |
| 1401213 | ✔ | ✔ | ✔ | | | ✔ | | | | ✔ | |
| 1401104 | ✔ | ✔ | ✔ | | | | | | | ✔ | ✔ |
| 1401214 | ✔ | | ✔ | ✔ | | ✔ | | | | | |
| 1401210 | ✔ | | | | | | | | | ✔ | |
| 1401211 | ✔ | | | ✔ | | | | | ✔ | ✔ | |
| 1401105 | ✔ | | ✔ | ✔ | | | | | ✔ | | ✔ |
| 1401217 | | | | | | | | | | | |
| 1401215 | ✔ | | | | | | ✔ | ✔ | | ✔ | |
| 1401218 | ✔ | ✔ | ✔ | | | | | | ✔ | ✔ | |
| 1401231 | | ✔ | | ✔ | | ✔ | | ✔ | ✔ | | |
| 1401222 | ✔ | ✔ | | ✔ | | ✔ | | ✔ | | | ✔ |
| 1401233 | | | ✔ | ✔ | | ✔ | | | ✔ | | |
| 1401227 | ✔ | | ✔ | | | | | | | ✔ | ✔ |
| 1401310 | | | ✔ | ✔ | | ✔ | | | ✔ | | |
| 1401312 | ✔ | | ✔ | ✔ | | ✔ | | | ✔ | | ✔ |
| 1401311 | ✔ | | | ✔ | | | | | ✔ | ✔ | |
| 1401313 | ✔ | | ✔ | ✔ | | ✔ | | ✔ | ✔ | ✔ | ✔ |
| 1401330 | ✔ | | ✔ | | | | | | ✔ | ✔ | |
| 1401333 | | | ✔ | | | | | | ✔ | | |
| 1401335 | ✔ | | ✔ | ✔ | | | | ✔ | ✔ | ✔ | ✔ |
| 1401332 | | | ✔ | | | | | | | ✔ | |
| 1401334 | ✔ | ✔ | ✔ | ✔ | | | | | ✔ | ✔ | ✔ |
| 1401417 | ✔ | | ✔ | ✔ | | | | | ✔ | ✔ | ✔ |
| 1401432 | ✔ | | | | ✔ | | ✔ | | ✔ | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1401419 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ |
| 1401439 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ |
| 1401431 | | | | | ✔ | ✔ | ✔ | ✔ | | | |

# 1401102-3 - Computer Programming (3 credits)
## Coordinator: Mohamed Darieby

Catalog Description

| |
|---|
| Introduce students to the basics of writing software programs including variables, types, arrays, procedures, control structures, input/output, and general rules for writing good code. |

Prerequisites

| |
|---|
| 4800151-2 – Computing Skills 2 |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Basic concepts of writing code, compilation, and execution | 1-2 |
| Variables, types, assignment, and expressions | 3-4 |
| Defining methods: parameters, return values | 5-6 |
| Conditional execution (if/else, case) | 7 |
| Iteration (for, while) | 8 |
| Arrays (one-dimensional) | 9-10 |
| Input/output: console, file | 11-12 |
| Procedural decomposition of problems | 13 |
| Programming style: eliminating redundancy, localizing variables, constants, commenting, use of parameters and return values to increase flexibility. | 14 |

Weekly Hours

| |
|---|
| 2 x 50 mins lectures, 2 x 50 mins labs |

Textbook/References/References

| |
|---|
| Head First Java, 2nd Edition by Kathy Sierra and Bert Bates |

Assessment Methods

| |
|---|
| Weekly exercises to be completed outside of class<br>Midterm<br>Final Exam |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will see how programming languages have developed, appreciating their continuous development, and realise the need for life-long learning.<br>2. They will be able to write and debug small programs (50-100 lines) using a range of procedural techniques using a variety of input sources (console, file) and a variety of output destinations (console, file).<br>3. Students will learn basic design principles that are relevant to this style of "programming in the small" including decomposition, elimination of redundancy, detailed documentation, and use of parameters and return values to create flexible components. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs |
|---|

| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CLO 1 | | | | | | | | | | | |
| CLO 2 | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |
| CLO 3 | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of procedural computing concepts to design  a project*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *Students learn the basics of gathering requirements for solving a problem*
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a small software project*
> **d. an ability to function effectively on teams to accomplish a common goal**
> ---
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f. an ability to communicate effectively**
> ---
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> ---
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a small procedural program.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> *The students are required to use standard design and development principles on a software project*

Approvals

| *Course Coordinator* | *Mohamed Darieby* | *11 Nov 2011* |
|----------------------|-------------------|---------------|
| *Courses Committee* | *Programming & Algorithms, Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401213-3 Logic Analysis & Design (3 credits)
## Coordinator: Muhammad Rashid

Catalog Description

| |
|---|
| Computer arithmetic (how data is manipulated by a computer), digital logic and how it relates to boolean algebra, designing of combinational and sequential circuits |

Prerequisites

| |
|---|
| 4800151-2 – Computing Skills 2 |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Data representation in computer systems (signed and unsigned arithmetic) | 1 |
| Addition, subtraction, multiplication and division | 2 |
| Floating-point arithmetic | 3 |
| Fundamentals of Boolean algebra and logic gates | 6-10 |
| Basic concepts of combinational circuits (adders, subtractors, multiplexors, decoders, encoders, magnitude comparator) | 11-13 |
| Basic concepts of sequential circuits (flip flops, counters) | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Morris Mano, DIGITAL DESIGN, 4th Edition, Prentice Hall, 2007 |

Assessment Methods

| |
|---|
| Quizzes       **15 %** |
| Written assignments to be completed outside class   **10 %** |
| Midterm     **25 %** |
| Final Exam  **50 %** |

Course Learning Outcomes (CLOs)

| |
|---|
| 1.  Understanding of basic computer arithmetic (how computer manipulates data)<br>2.  Understanding of digital logic at the gate and switch level<br>3.  Understanding of  combinational and sequential circuits (designing of simple circuits) |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | ✓ | | | | | |
| CLO 2 | ✓ | ✓ | | | | ✓ | | | | ✓ | |
| CLO 3 | ✓ | | ✓ | | | ✓ | | | | ✓ | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
*Students apply knowledge of digital logic to develop circuits. Students apply knowledge of computing to practical computing problems.*

**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*Students analyze the Boolean functions and simplify it.*

**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs**
*Students are required to design simple digital circuits (combinational as well as sequential)*

**d. an ability to function effectively on teams to accomplish a common goal**
*---*

**e. an understanding of professional, ethical, legal and social issues and responsibilities**
*---*

**f. an ability to communicate effectively**
*The written assignments and class presentation enable students to communicate effectively*

**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
*---*

**h. a recognition of the need for, and an ability to engage continuing professional development**
*---*

**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
*---*

**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
*In this course students understand the trade-offs between timing and cost when minimizing digital circuits (using Karnaugh maps and Quine–McCluskey techniques).*

**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
*---*

Approvals

| Course Coordinator | Muhammad Rashid | 10 Sep 2011 |
|---|---|---|
| Courses Committee | Systems, Committee Leader: Mohammad Ansari | 10 Sep 2011 |
| Program Committee | Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari | DATE |

# 1401104-3 - Structured Programming (3 credits)
## Coordinator: Mohamed Darieby

Catalog Description

| |
|---|
| Builds on 1401102-3 introducing abstract data types, recursion, use of predefined collection classes, exceptions. Also explores larger design concepts such as encapsulation, inheritance, and classes, while exposing issues related to documentation and testing. |

Prerequisites

| |
|---|
| 1401102-3 – Computer Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Implementing linked structures (linked lists, binary trees) | 1-2 |
| Abstract data types: stacks, queues, lists, maps, sets | 3-6 |
| Recursion and recursive backtracking | 7 |
| Using off-the-shelf components (e.g., Java Collections Framework) | 8 |
| Use of inheritance for additive change and factoring out common code | 9-10 |
| Exceptions and exception handling | 11 |
| Class design: encapsulation, documentation, appropriate choice of fields | 12 |
| Thorough testing and debugging | 13-14 |
| Virtual machines and intermediate languages | 15 |

Weekly Hours

| |
|---|
| 2 x 50 mins lectures, 2 x 50 mins labs |

Textbook/References

| |
|---|
| Head First Java, 2nd Edition by Kathy Sierra and Bert Bates |

Assessment Methods

| |
|---|
| Medium-size projects every 2 weeks to be completed outside class<br>Midterm<br>Final exam |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will be able to apply standard data abstractions (lists, maps, sets, stacks, queues) and recursion to solve straightforward programming problems<br>2. Students will appreciate some of the advantages of, and be able to apply, object oriented design (encapsulation, interfaces, inheritance)<br>3. Students will appreciate the benefits of code reuse by learning how to make use of off-the-shelf components from libraries such as the Java Collections Framework. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |
| CLO 2 | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |

| CLO 3 | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to a project*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *---*
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d. an ability to function effectively on teams to accomplish a common goal**
> *Projects are implemented in teams.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> *---*
> **f. an ability to communicate effectively**
> *The projects require communications, specifications, progress reports, and final report.*
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> *---*
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> *The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> *The students are required to use standard design and development principles on a significant software project*

Approvals

| Course Coordinator | Mohamed Darieby | 11 Nov 2011 |
|---|---|---|
| Courses Committee | Programming & Algorithms, Committee Leader: Mohamed Darieby | 29 Nov 2011 |
| Program Committee | Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari | DATE |

# 1401214-3 - Computer Organization and Assembly Programming (3 credits)

## Coordinator: Muhammad Rashid

Catalog Description

| |
|---|
| Instruction set architecture and MIPS assembly language, processor computation (data path and control), processor communication (cache and I/O modules) |

Prerequisites

| |
|---|
| 1401213-3 – Logic Analysis & Design |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Review of  pre-requisites and introduction to computer organization | 1 |
| Instruction set architecture and MIPS assembly language | 5-7 |
| Processor data path and control | 8-9 |
| Exception and protection mechanisms | 10-11 |
| Memory hierarchies and cache | 12-13 |
| An overview of I/O modules and devices | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Computer Organization & Design: The Hardware/Software Interface, D. Patterson and J. Hennessy (3$^{rd}$ edition or newer) |

Assessment Methods

| |
|---|
| Quizzes        **15 %**<br>Written assignments to be completed outside class   **10 %**<br>Midterm      **25 %**<br>Final Exam  **50 %** |

Course Learning Outcomes (CLOs)

| |
|---|
| 1.  Understanding of instruction set architecture (ISA) and basic assembly language programming skills (MIPS ISA)<br>2.  Understanding of  processor computation by building processor data path and control<br>3.  Understanding of  processor communication by cache memory and I/O modules |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | ✓ | ✓ | | ✓ | | | | | |
| CLO 2 | ✓ | | ✓ | ✓ | | ✓ | | | | | |
| CLO 3 | ✓ | | ✓ | ✓ | | ✓ | | | | | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**

*Students apply knowledge of computer organization and assembly language to a project*

**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**

---

**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs**

*Students are required design and implement a software project to meet a specification.*

**d. an ability to function effectively on teams to accomplish a common goal**

*Projects are implemented in teams.*

**e. an understanding of professional, ethical, legal and social issues and responsibilities**

---

**f. an ability to communicate effectively**

*The written assignments and class presentation enable students to communicate effectively*

**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**

---

**h. a recognition of the need for, and an ability to engage continuing professional development**

---

**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**

---

**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**

---

**k. an ability to apply design and development principles in the construction of software systems of varying complexity**

---

Approvals

| *Course Coordinator* | *Muhammad Rashid* | *28 Jul 2011* |
|---|---|---|
| *Courses Committee* | *Systems,* <br> *Committee Leader: Mohammad Ansari* | *10 Sep 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401210-3 - Discrete Structures (3 credits)
## Coordinator: Imdadullah Khan

Catalog Description

| |
|---|
| This course covers the mathematical foundations of computer science and engineering. It provides an introduction to elementary concepts in mathematics such as definitions, logic, proofs, functions, relations and counting principles. The course also introduces students to elementary discrete structures such as sets, partial orders, graphs and trees. |

Prerequisites

| |
|---|
| 404151-4 – Introduction to Set Theory |

Major Topics Covered in the Course (14 week semester)

| Topic | Reading | Week |
|---|---|---|
| Logic, Truth Table, Propositional equivalences | [KR] 1.1, 1.2 | 1,2 |
| Predicates and Quantifiers | [KR] 1.3 | 3 |
| Sets and Functions | [KR] 1.4 – 1.6 [JMJN] 1.2,1.4 | 4 |
| Relations, Equivalences and Partial Orders | [KR] Chapter 6 [JMJN] 1.5, 1.6, 2.1 | 5,6 |
| Proofs: Induction, Contradiction, Contrapositives | [KR] 3.1, 3.2 [JMJN] 1.3 | 7,8,9 |
| Counting Principles: Cardinality, factorials, permutations, Binomial coefficients, Inclusion-Exclusion, Pigeon-Hole Principle, sums and asymptotics | [KR] 4.1 – 4.3, 5.5,5.6 [JMJN] 3.1 – 3.3, 3.7 [KR] 1.7, 1.8 | 10,11,12 |
| Graphs and Trees:  Representation, degree sequences and hand shaking lemma, Euler tours, Planar graphs, Euler Formula. Properties of Tree, Spanning Trees | [KR] 7.1 – 7.3, 7.5, 7.6, 8.1, 8.2, 8.5, 8.6 [JMJN] 4.1 – 4.3, 4.4, 5.1, 5.3. 5.4 | 13,14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| [KR] Discrete Mathematics and Its Applications, 4th Edition, By Kenneth Rosen [JMJN] Invitation to Discrete Mathematics, 2nd Edition, By Jiri Matousek and Jaroslav Nesetril |

Assessment Methods

| |
|---|
| Homework: 20% Quizzes: 10% Midterm: 30% Final: 40% |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Be able to analyze complexity of algorithms 2. Be able to apply number theory to practical problems 3. Be able to synthesize elementary proofs 4. Be able to apply concepts of graph theory and trees to solve real world problems |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | | | ✓ | |
| CLO 2 | ✓ | | | | | | | | | ✓ | |
| CLO 3 | ✓ | | | | | | | | | ✓ | |
| CLO 4 | ✓ | | | | | | | | | ✓ | |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students will be able to analyze computational processes*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> ---
> **d. an ability to function effectively on teams to accomplish a common goal**
> ---
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f. an ability to communicate effectively**
> ---
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> ---
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *This course provides the foundation for algorithms and theory of computing. Hence the students will be able to apply methods learned in this course to analyze and reason mathematically about the tradeoffs involved in design choices. Furthermore this course will enable students to model many systems using discrete structures.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Imdadullah Khan* | *11 Dec 2011* |
|---|---|---|
| *Courses Committee* | *Theoretical Computing, Committee Leader: Khaled Sayed* | *11 Dec 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401211-3 - Web Programming (3 credits)
## Coordinator: Abdelmajid Khelil

Catalog Description

| |
|---|
| This course provides an introduction to network/Internet programming. It covers the major concepts for programming distributed applications, in particular, asynchronous and synchronous inter-process communication, process synchronization and remote procedure call (RPC). |

Prerequisites

| |
|---|
| 1401102-3 – Computer Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Admin + Introduction | 1 |
| Brief Introduction to Java | 2-6 |
| Threads/Synchronization | 7-8 |
| Basic Network Concepts | 9 |
| Remote Invocation Method (RMI) | 10-11 |
| Socket Programming | 12-14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Primary Book: Java Network Programming, Elliotte Rusty Harold, O'Reilly, 3rd edition, 2005, ISBN: 978-0-596-00721-8<br>Secondary Book: Jan Graba, An Introduction to Network Programming with Java, 2nd edition, 2007, ISBN-13: 978-1-84628-380-2 |

Assessment Methods

| |
|---|
| Bi-weekly assignments to be completed outside class (40%), Midterm (30%), Final Exam (30%) |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. The student will have a working knowledge of Internet Programming theory and practice.<br>2. The student will design and experiment with various Internet Programming concepts and components via projects, to increase overall understanding of modern Internet Programming.<br>3. The student will be able to write and debug small distributed Java programs. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | | | ✓ | |
| CLO 2 | ✓ | | | ✓ | | | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to a project*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *---*
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *---*
> **d. an ability to function effectively on teams to accomplish a common goal**
> *Projects are implemented in teams.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> *---*
> **f. an ability to communicate effectively**
> *---*
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> *---*
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> *---*
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> *---*

Approvals

| *Course Coordinator* | *Abdelmajid Khelil* | *23 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Programming & Algorithms, Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401105-3 - Advanced Programming (3 credits)
## Coordinator: Mohamed Darieby

Catalog Description

| |
|---|
| Students will experience programming-in-the-large issues such as version control, team development, formal testing, and compiling for different target machines. Students will also advance their programming skills by exploring good design principles (e.g., patterns), understanding bad design methods (e.g., anti-patterns), and gain early experience in software engineering issues such as design, specification, and implementation |

Prerequisites

| |
|---|
| 1401104-3 - Structured Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Linux OS, and manipulating files and strings through the command line <br>     Utilities (e.g., find, awk, sed, grep), Shell scripts | 1-3 |
| Advanced programming concepts <br>     Emphasis on pointers and memory management, garbage collection <br>     Design patterns and anti-patterns | 4-7 |
| Software development tools <br>     Build tools, debuggers, version control systems, profilers | 8-9 |
| Basic software engineering concepts <br>     Specifications, interfaces, and testing. Multi-person programming | 10-12 |
| Introduction to secure and defensive programming <br>     Re-emphasize information hiding, interfaces <br>     Array bounds checking, buffer overflow attacks, cast checking | 13-14 |

Weekly Hours

| |
|---|
| 2 x 50 mins lectures, 2 x 50 mins labs |

Textbook/References

| |
|---|
| 1. Design Patterns: Elements of Reusable Object-Oriented Software <br>    Gamma et al., Addison Wesley, 1994, ISBN 0201633612 <br> 2. Code Complete: A Practical Handbook of Software Construction <br>    McConnell, Microsoft Press, 2004, ISBN 0735619670 |

Assessment Methods

| |
|---|
| Some medium-size projects <br> One larger team project <br> Final exam |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will know about the issues related to large-scale software development <br> 2. Students will become better developers through knowledge of design patterns and anti-patterns <br> 3. Students will gain early experience in software engineering issues such as design, specification and implementation |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | | ✓ | | | | | ✓ | | |
| CLO 2 | ✓ | | ✓ | | | | | | ✓ | | |
| CLO 3 | | | ✓ | | | | | | | | ✓ |

Relationship of Course to ABET Student Outcomes

| |
|---|
| **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**<br>*Students apply knowledge of computing and design to a project*<br>**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**<br>*---*<br>**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**<br>*Students are required design and implement a software project to meet a specification.*<br>**d. an ability to function effectively on teams to accomplish a common goal**<br>*Projects are implemented in teams.*<br>**e. an understanding of professional, ethical, legal and social issues and responsibilities**<br>*---*<br>**f. an ability to communicate effectively**<br>*---*<br>**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**<br>*---*<br>**h. a recognition of the need for, and an ability to engage continuing professional development**<br>*---*<br>**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**<br>*Projects use current computing and modeling/design tools.*<br>**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**<br>*---*<br>**k. an ability to apply design and development principles in the construction of software systems of varying complexity**<br>*The students are required to use standard design and development principles on a significant software project* |

Approvals

| *Course Coordinator* | *Mohamed Darieby* | *15 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Programming & Algorithms,*<br>*Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401217-3 - Logic Programming (3 credits)
## Coordinator: Khaled Sayed

Catalog Description

| |
|---|
| The aim of this course is to present the key concepts behind logic programming: logic as a declarative (context-free) language, how to write programs with logic, and how to make efficient implementations. In particular, we will cover: recursive structures, syntax and semantics of propositional logic, 1st order and higher-order logics, inferences rules, unification and resolution, SLD-resolution, negation as failure, and implementation issues. |

Prerequisites

| |
|---|
| 1401210-3 – Discrete Structures |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introducing the concepts of Logic, Mathematical Logic, and   Logic programming. | |
| Distinguishing between declarative, object-oriented, and logic programming methodologies. | |
| Directionless of logic programming. | |
| Mathematical Logic (First order logic) issues (Rules of mathematical representation, Representing facts and rules) | |
| Mathematical Logic (First order logic) issues (Deduction, Computation function and predicate, Unification, Resolution, and Clause Form) | |
| Introduction to Logic Programming and Prolog Syntax. | |
| Starting Prolog with Prolog terms and Prolog programs. | |
| Clauses, Predicates, Variables. | |
| Common Variables and Satisfying and evaluating goals. | |
| Unification and backtracking. | |
| Operations and Arithmetic. Input and Output. | |
| Loops, Preventing Backtracking. | |
| Lists and String in Prolog. | |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Programming in Prolog: Using the ISO Standard<br>Clocksin and Mellish, Springer, 2003, ISBN 3540006788 |

Assessment Methods

| |
|---|
| Programming exercises<br>MidTerm Exam<br>Project<br>Final exam |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will appreciate the declarative programming model, and be able to identify when it would be useful in problem solving. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | | | | | | | | | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
---
**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
---
**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
---
**d. an ability to function effectively on teams to accomplish a common goal**
---
**e. an understanding of professional, ethical, legal and social issues and responsibilities**
---
**f. an ability to communicate effectively**
---
**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
---
**h. a recognition of the need for, and an ability to engage continuing professional development**
---
**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
---
**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
---
**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
---

Approvals

| *Course Coordinator* | *Khaled Sayed* | *12 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Artificial Intelligence,*<br>*Committee Leader: Muhammad Arif* | *12 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401215-3 - Computer Architecture (3 credits)
## Coordinator: Muhammad Rashid

Catalog Description

| |
|---|
| This course extends 1401214-3 (computer organization) by covering advanced processor features that are standard in modern processors, and exploring the design and trade-offs of memory hierarchies, including implications for parallel processor architectures. |

Prerequisites

| |
|---|
| 1401214-3 – Computer Organization and Assembly Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Review of pre-requisites and introduction to computer architecture | 1 |
| Evaluation of computer performance | 3-5 |
| Enhancing computer performance with pipelining (data path and control) | 6-7 |
| Data Hazards, forwarding, stalls, branch hazards, exceptions | 8-9 |
| Exploitation of memory hierarchy (Cache and virtual memory) | 10-11 |
| Fundamentals of multiprocessing (shared memory, clusters and message passing) | 12 |
| Hardware multithreading, SISD, MIMD, SIMD, SPMD and vector processing | 13 |
| Fundamentals of instruction level parallelism | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Computer Organization & Design: The Hardware/Software Interface, D. Patterson and J. Hennessy (3$^{rd}$ edition or newer) |

Assessment Methods

| | | | |
|---|---|---|---|
| Quizzes | **15 %,** | Written assignments to be completed outside class | **10 %** |
| Midterm | **25 %,** | Final Exam | **50 %** |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Understanding of computer performance evaluation<br>2. Understanding of pipelined CPU and cache hierarchy<br>3. Understand fundamental concepts in multiprocessing |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | ✓ | | | ✓ | |
| CLO 2 | ✓ | | | | | | ✓ | | | ✓ | |
| CLO 3 | ✓ | | | | | | ✓ | ✓ | | ✓ | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**

*Students apply knowledge of computing and mathematics to assess and compare different architectures and organization designs*

**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**

*---*

**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**

*---*

**d. an ability to function effectively on teams to accomplish a common goal**

*---*

**e. an understanding of professional, ethical, legal and social issues and responsibilities**

*---*

**f. an ability to communicate effectively**

*---*

**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**

*The course provides students of assessing different engineering solutions in terms of architecture speed (MIPS), cost and their trade off.*

**h. a recognition of the need for, and an ability to engage continuing professional development**

*The final paper aims at recognizing the need to read about new architectures and organizations in a field that advances at a high pace.*

**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**

*---*

**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**

*Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*

**k. an ability to apply design and development principles in the construction of software systems of varying complexity**

*---*

Approvals

| *Course Coordinator* | *Muhammad Rashid* | *28 Jul 2011* |
|---|---|---|
| *Courses Committee* | *Systems,* <br> *Committee Leader: Mohammad Ansari* | *10 Sep 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401218-4 - Data Structures & Algorithms (4 credits)
## Coordinator: Amine Marref

Catalog Description

| |
|---|
| The objective of this course is to provide the fundamentals of data structures and algorithm design needed in the remainder of the curriculum, introduce algorithm analysis, and develop students' problem solving and computer programming skills. Emphasis on linked lists, stacks, queues, trees, priority queues, heaps and graphs, and abstract data types. Also includes object oriented concepts. |

Prerequisites

| |
|---|
| 1401105-3 - Advanced Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Basics of algorithm analysis | 3-4 |
| Linear Data Structures | 5 |
| Sorting | 6-7 |
| Search Trees | 8-9 |
| Hash Tables | 10-11 |
| Priority Queues | 12 |
| Graphs | 13-15 |

Weekly Hours

| |
|---|
| 2 x 50 mins lectures, 2 x 50 mins labs |

Textbook/References

| |
|---|
| Data Structures and Algorithms in Java, 4th edition, by M.T. Goodrich and R. Tamassia. John Wiley and Sons, Inc., ISBN: 0-471-73884-0 |

Assessment Methods

| |
|---|
| The students are expected to complete programming assignments, and pass written examinations on class material. The mark division is 50% for final exam, 25% for midterm exam, and 25% for practical work and quizzes. |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. The students will be able to describe, construct, and use various implementations for fundamental data abstractions such as lists, stacks, queues, trees, and graphs<br>2. The students will be able to design and implement efficient algorithms for manipulating data structures<br>3. The students will be able to compare the efficiency of various data structures and algorithms and to choose the most appropriate ones for a given application |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | ✓ | | | | | | ✓ | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO 2 | ✓ | ✓ | | | | | | | | ✓ | |
| CLO 3 | ✓ | ✓ | ✓ | | | | | | | ✓ | |

Relationship of Course to ABET Student Outcomes

> **a.  an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students appreciate the use of mathematical proofs to reason about and compare the asymptotic complexity of various algorithms through the use of Big-Oh and other notations. They will also develop an understanding of how to represent different algorithm resource requirements as mathematical functions on the size of the input (logarithmic, linear, etc.)*
>
> **b.  an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *Students can analyze the time and space requirements of a particular problem by performing asymptotic analysis.*
>
> **c.  an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are asked to modify algorithms to produce different outputs or combine algorithms and data structures to offer new solutions e.g. search trees + in-order traversal for sorting.*
>
> **d.  an ability to function effectively on teams to accomplish a common goal**
> ---
>
> **e.  an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
>
> **f.  an ability to communicate effectively**
> ---
>
> **g.  an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
>
> **h.  a recognition of the need for, and an ability to engage continuing professional development**
> ---
>
> **i.  an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *The students learn how to use the most up-to-date libraries in the course-selected programming language to implement different data structures e.g. maps in Java.*
>
> **j.  an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are able to compare various algorithms e.g. which of the sorting algorithms is best for which kind of input, which is best in parallel systems, which is best when memory is limited, which is best when implemented as part of a dependable system, etc.*
>
> **k.  an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Amine Marref* | *20 Jul 2011* |
|---|---|---|
| *Courses Committee* | *Programming & Algorithms, Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401231-4 - Programming Language Design (3 credits)
## Coordinator: Khaled Sayed

Catalog Description

| |
|---|
| An introduction to programming language, Specification and analysis, Additional topics include control structures, data types and structures, runtime, Environments, binding strategies, compilers, and interpreters. |

Prerequisites

| |
|---|
| 1401105-3 - Advanced Programming<br>1401217-3 - Logic Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Preliminaries | 1-2 |
| Evolution of the Major Programming Languages | 3-5 |
| Describing Syntax and Semantics | 6 |
| Names, Variables, Bindings and Type Checking. | 7-8 |
| Scope and lifetime. | 9-10 |
| Referencing Environments  Named Constants | 11 |
| Primitive Data Types, Character String Types | 12 |
| User-Defined Ordinal Types | 13 |
| Array Types and  Associative Arrays | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Sebesta R.W., Concepts of Programming Languages, 9th Edition,  Addison-Wesley, 2010 |

Assessment Methods

| |
|---|
| Home works  **5 %**<br>Quiz        **5%**<br>Midterm      **25 %**<br>Research in Assigned Programming Language   **15 %**<br>Final Exam  **50 %** |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Apply concepts from prerequisite courses, especially formal languages and architecture courses, in the context of evaluating the features of programming languages.<br>2. Explain and evaluate design and implementation features of programming languages.<br>3. Apply conceptual knowledge of the syntax of languages, as well as the design of language data structures and control statements, to the efficient implementation of a working language. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs |
|---|

| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CLO 1 | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | |
| CLO 2 | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | |
| CLO 3 | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | |

Relationship of Course to ABET Student Outcomes

**a.  an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
---
**b.  an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*Students could determine the language that is suitable language for programming each problem.*
**c.  an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs**
---
**d.  an ability to function effectively on teams to accomplish a common goal**
*Students works in team to accomplish a research on certain language. .*
**e.  an understanding of professional, ethical, legal and social issues and responsibilities**
---
**f.  an ability to communicate effectively**
*The assigned research on a language and presentation at the end of course  enable students to communicate effectively.*
**g.  an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
---
**h.  a recognition of the need for, and an ability to engage continuing professional development**
*Students learn how to differentiate between programming languages domains is useful in continuation of professional development.*
**i.  an ability to use the current techniques, skills, and tools necessary for computing practice.**
*Students get knowledge about different language as tools and technologies to be used in developing applications.*
**j.  an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
---
**k.  an ability to apply design and development principles in the construction of software systems of varying complexity**
---

Approvals

| Course Coordinator | Khaled Sayed | 10 Oct 2011 |
|--------------------|--------------|-------------|
| Courses Committee | Theoretical Computing, Committee Leader: Khaled Sayed | 19 Oct 2011 |
| Program Committee | Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari | DATE |

# 1401222-3 - System Analysis & Design (3 credits)
## Coordinator: Mohammed Nour

Catalog Description

| |
|---|
| To introduce students to the relative complexity of information requirements, systems analysis and design within a business organization, and to introduce students to the concepts, formal techniques, tools and methods used in the analysis, design and implementation of information systems. The course approaches the development of information systems from a problem-solving perspective. This course builds upon concepts to which the student has been exposed to in previous classes. |

Prerequisites

| |
|---|
| 1402101-3 - Introduction to Information Systems |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction and Overview | 1 |
| Systems Analysis and the role of the analyst: <br><br> Software development process models overview such as waterfall, spiral, etc. and case studies on their usage.  Object-oriented development | 2 |
| The requirements engineering process: Facilitated workshops, Fact-finding interviewing, Other requirements elicitation techniques | 3,4 |
| Documenting requirements, analyzing requirements | 5 |
| Requirements Management, Validating requirements | 6 |
| Feasibility Analysis and System Proposal | 7 |
| Systems Design | 8 |
| Data Flow Diagrams | 9 |
| Process Modeling | 10 |
| Database Design | 11 |
| Output Design And Prototyping | 12 |
| Input Design And Prototyping | 13 |
| System Constructions and Implementation | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Systems Analysis and Design Methods, 6th Edition by Jeffery L. Whitten, Lonnie D. Bentley and Kevin C. Dittman, 2004, McGraw-Hill |

Assessment Methods

| |
|---|
| Project 60% <br> Exam 40% |

Course Learning Outcomes (CLOs)

1. Know the notion of a system and the phases, activities and deliverables in system analysis
2. Know the basic techniques of systems analysis, design and implementation
3. Understand and synthesize the different models used to describe a system, the competencies needed by systems analysts in order to carry out their tasks and responsibilities successfully, and fact finding and analysis techniques used in system analysis
4. Be able to perform system analysis, and work successfully with team members

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | | | | ✓ |
| CLO 2 | | ✓ | | | | | | | | | ✓ |
| CLO 3 | | | | | | | | ✓ | | | ✓ |
| CLO 4 | | | | ✓ | | ✓ | | | | | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
*Students apply knowledge of computing and design to a project*
**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*Students apply systems analysis to gather system requirements*
**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
*---*
**d. an ability to function effectively on teams to accomplish a common goal**
*Projects are implemented in teams.*
**e. an understanding of professional, ethical, legal and social issues and responsibilities**
*---*
**f. an ability to communicate effectively**
*The projects require communications, specifications, progress reports, and final report.*
**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
*---*
**h. a recognition of the need for, and an ability to engage continuing professional development**
*The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*
**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
*Projects use current computing and modeling/design tools.*
**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
*Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
*The students are required to use standard design and development principles on a significant software project*

Approvals

| Course Coordinator | Mohammed Nour | 20 Oct 2011 |
|---|---|---|
| Courses Committee | Design & Databases, Committee Leader: Mohammed Nour | 20 Oct 2011 |
| Program Committee | Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari | DATE |

# 1401233-3 – Internet Application Development (3 credits)
## Coordinator: Mohammed Nour

Catalog Description

| |
|---|
| This is a practical course that will enable students to develop skills in website development and administration, exploring backend/server technologies such as (PHP/ASP and XML, JavaScript, CSS and web framework). The course will focus on building dynamic websites and issues relating to user input validation, authorization, roles management, database connectivity and session and state management |

Prerequisites

| |
|---|
| 1401105-3 – Advanced Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction and revision for XHTML forms | 1 |
| Cascading Style Sheets (CSS) and themes | 2 |
| JavaScript and Document Object Model (DOM) | 3,4 |
| Web servers management and Administration | 5 |
| Web Forms and server side scripting | 6 |
| Web Development Frameworks | 7,8 |
| User input Validation | 9 |
| Database Connectivity | 10 |
| XML and AJAX | 11 |
| Session and state management | 12 |
| Authentication and Authorization | 13 |
| Web 2.0 Applications and open source applications | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 1 x 50 mins labs |

Textbook/References

| |
|---|
| 1. Robert Sebesta, Programming the World Wide Web, 2011, ISBN-10: 0132130815 |
| 2. Stepp,Miller,Kirst. Web Programming Step by Step.( 1st Edition, 2009) Companion Website: http://www.webstepbook.com/ |
| 3. http://www.w3schools.com/html/default.asp |

Assessment Methods

| |
|---|
| Assignments  30%, project 30%, exam 40% |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will be able to construct websites that receive and perform complex processing of user input on the server side. |
| 2. Students will be appreciate the different methods of storage available for data required and served by web applications. |
| 3. Students will be able to create websites with interactivity without page reloading |
| 4. Students will be able to configure a modern web server for deploying large web sites. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | | ✓ | | ✓ | | | ✓ | | |
| CLO 2 | | | ✓ | | | | | | | | |
| CLO 3 | | | | | | | | | ✓ | | |
| CLO 4 | | | | | | | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> ---
> **b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d.   an ability to function effectively on teams to accomplish a common goal**
> *Projects are implemented in teams.*
> **e.   an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f.   an ability to communicate effectively**
> *The project requires a written final report.*
> **g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h.   a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> ---
> **k.   an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Mohammed Nour* | *20 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Design & Databases,* <br> *Committee Leader: Mohammed Nour* | *20 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401227-3 – File Processing & Organization (3 credits)
## Coordinator: Amine Marref

Catalog Description

| |
|---|
| Design and analysis of efficient computer algorithms. Algorithm design techniques, including divide-and-conquer, depth-first search, and greedy approaches. Worst-case and average-case analysis. Models of computation. NP-complete problems. |

Prerequisites

| |
|---|
| 1401218-4 - Algorithms and Data Structures |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Advanced Search-Tree Structures (Red-Black Trees, B- Trees, Tries, Splay Trees). | 2-4 |
| Advanced Heap Structures (Fibonacci Heaps). | 5-6 |
| Graphs and Graph Algorithms (Graph Representations, Depth-First Search, Breadth-First Search, Minimum Spanning Trees, Shortest Paths, Maximum Flow, Matching). | 7-10 |
| Geometric Algorithms (Intersection of Line Segments, Convex Hull). | 11-12 |
| Advanced Design and Analysis Techniques (Greedy Algorithms, Dynamic Programming) | 13-15 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Introduction to Algorithms by T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, Second Edition, MIT Press, 2001. ISBN 0-262-03293-7 |

Assessment Methods

| |
|---|
| The students are expected to complete theoretical assignments, and pass written examinations on class material. The mark division is 50% for final exam, 25% for midterm exam, and 25% for homework and quizzes. |

Course Learning Outcomes (CLOs)

1. The students will be able to describe, construct, and use various implementations for advanced data abstractions such as more specialized search trees and heaps.
2. The students will be able to design and implement advanced algorithms and analyze them.
3. The students will develop an understanding of various algorithm-design paradigms e.g. divide-and-conquer, greedy, etc.

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | ✓ | | | | | | | | |
| CLO 2 | ✓ | ✓ | | | | | | | | ✓ | |

| CLO 3 | ✓ | ✓ | ✓ | | | | | | | ✓ | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
*Students will develop an understanding of how to represent different algorithm resource requirements as mathematical functions on the size of the input (logarithmic, linear, etc.)*

**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*Students can analyze the time and space requirements of a particular problem by performing asymptotic analysis.*

**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired specification**
*Students are asked to modify algorithms to produce different outputs or combine algorithms and data structures to offer new solutions.*

**d. an ability to function effectively on teams to accomplish a common goal**
*---*

**e. an understanding of professional, ethical, legal and social issues and responsibilities**
*---*

**f. an ability to communicate effectively**
*---*

**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
*---*

**h. a recognition of the need for, and an ability to engage continuing professional development**
*---*

**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
*---*

**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
*Students are able to compare various algorithms for specific problems and the optimal choice of data structures.*

**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
*---*

Approvals

| *Course Coordinator* | *Amine Marref* | *20 Jul 2011* |
|---|---|---|
| *Courses Committee* | *Programming & Algorithms, Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401310-3 – Compiler Construction (3 credits)
**Coordinator: Khaled Sayed**

Catalog Description

| |
|---|
| Compiler construction: lexical analysis, including regular languages and finite-state acceptors; syntactic analysis, including parsing techniques and grammars; code generation and optimization. |

Prerequisites

| |
|---|
| 1401231-3 Programming Language Design |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction to compilers structure & goals | 1 |
| Arithmetic expression processing using a stack | 2 |
| Simple compiler structure | 3 |
| Grammar, parse tree, and ambiguous grammar | 4 |
| Translation schemes | 5 |
| Context-free grammar & parsing | 6 |
| Introduction to left recursion and right recursion | 7 |
| Lexical analyzer (language, errors, pattern specifications) | 8 |
| Operations on languages and regular expressions | 9 |
| Finite automata | 10-11 |
| Parsers and errors and sentential error | 12 |
| Left recursion and left factoring | 13 |
| FIRST, FOLLOW, and transition diagrams | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Compilers: Principles, Techniques, and Tools ,A. V. Aho, R. Sethi, J. D. Ullman; (c) 2010; |

Assessment Methods

| |
|---|
| Home works  **10 %**<br>Quiz      **5%**<br>Midterm    **20 %**<br>Project   **15 %**<br>Final Exam  **50 %** |

Course Learning Outcomes (CLOs)

| |
|---|
| 1.  Understanding of the organization of a compiler<br>2.  Understanding of the concepts of scanning, parsing, and translation<br>3.  Understanding of Compiler writing tools. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |

| | | | ✓ | ✓ | | | | | ✓ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO 1 | | | ✓ | ✓ | | | | | ✓ | | |
| CLO 2 | | | ✓ | ✓ | | | | | ✓ | | |
| CLO 3 | | | ✓ | ✓ | | ✓ | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> ---
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required to implement a simple compiler to translate infix code representation to postfix representation.*
> **d. an ability to function effectively on teams to accomplish a common goal**
> *The assigned project and assignments and presentation at the end of course enable students to communicate effectively.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f. an ability to communicate effectively**
> *The projects require communications, specifications, progress reports, and final report.*
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> *The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> ---
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| | | |
|---|---|---|
| **Course Coordinator** | **Khaled Sayed** | **8 Oct 2011** |
| **Courses Committee** | **Theoretical Computing, Committee Leader: Khaled Sayed** | **19 Oct 2011** |
| **Program Committee** | **Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari** | **DATE** |

# 1401312-3 - Fundamentals of Database Systems (3 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| |
|---|
| Fundamentals of database design and data indexing techniques. Data models. Data base design theory. Query languages, their implementation and optimization. Database transaction processing. |

Prerequisites

| |
|---|
| 1401222-3 - Systems Analysis and Design |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Relational algebra: relations, tuples, attributes, schemas, relational operators and expressions. | 1 |
| Functional Dependencies: keys, closures, Armstrong's axioms, canonical cover. | 2 |
| Normalization: anomalies, lossless decomposition, dependency preservation, BCNF, 3NF. | 3,4,5 |
| SQL queries: types, 3 valued logic, nulls, select, ordering, joins, set operators, aggregate functions, grouping, sub-queries. | 6,7 |
| SQL data manipulation: insertion, deletion, and update. | 8,9 |
| SQL data definition: schema definition, default, primary key, unique, not null, check, assertions, foreign keys, referential integrity, views. | 10 |
| Transactions: failures, atomicity, consistency, isolation, durability. | 11 |
| Entity Relationship Modeling: Entities, relationships, attributes, ER diagrams, relationships, participation, fan and chasm traps, roles, weak entities, mapping to relation schemas, is-a relationships and hierarchies. | 12,13 |
| Database Indexing | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Fundamentals of Database Systems, 5th ed., by Elmasri and Navathe, Pearson International Edition, 2007. |

Assessment Methods

| |
|---|
| The student is expected to complete theoretical homework and programming assignments, pass written examinations, and successfully complete a project.. |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. The student will understand various different types of data modeling techniques and the supporting theoretical foundation. <br> 2. The student will understand how to use different types of query languages. <br> 3. The student will understand a variety of techniques for designing database schemas, associated index structures, and design and implementation of a database system. <br> 4. The student will understand the notions of concurrency control, recovery, and security. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | | | | ✓ |
| CLO 2 | | | | | | | | | ✓ | | |
| CLO 3 | | | ✓ | | | | | | | | ✓ |
| CLO 4 | ✓ | | | ✓ | | ✓ | | | | | ✓ |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
*Students apply knowledge of computing and design to a project*
**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*---*
**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
*Students are required design and implement a software project to meet a specification.*
**d. an ability to function effectively on teams to accomplish a common goal**
*Projects are implemented in teams.*
**e. an understanding of professional, ethical, legal and social issues and responsibilities**
*---*
**f. an ability to communicate effectively**
*The projects require communications, specifications, progress reports, and final report.*
**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
*---*
**h. a recognition of the need for, and an ability to engage continuing professional development**
*The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*
**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
*Projects use current computing and modeling/design tools.*
**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
*Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
*---*

Approvals

| *Course Coordinator* | *Mohammed Abdurrahman* | *15 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Design & Databases,*<br>*Committee Leader: Mohammed Nour* | *19 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401311-3 - Operating Systems (3 credits)
## Coordinator: Abdelmajid Khelil

Catalog Description

| |
|---|
| This course provides an introduction to operating system design and implementation. It covers the major components of most operating systems, in particular process management, memory management (segmentation, paging, swapping), file systems, and OS protection and security. |

Prerequisites

| |
|---|
| 1401215-3 - Computer Architecture |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction to Operating Systems | 1-2 |
| Process and thread management | 3-8 |
| Memory management | 9-11 |
| File system | 12-13 |
| I/O system | 14 |
| Protection & Security | 15 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Operating Systems Concepts, seventh edition, Silberchatz, Galvin, and Gagne, John Wiley & Sons Inc., ISBN 0-471-69466-5 |

Assessment Methods

| |
|---|
| Theoretical homework (20%), programming assignments (20%), and written exams (60%) |

Course Learning Outcomes (CLOs)

| |
|---|
| a. Understand the main principles and techniques used to implement processes and threads, inter-process communication, process synchronization, and algorithms for process scheduling |
| b. Understand virtual memory abstractions in operating systems. |
| c. Have an understanding of disk organization and file system structure. |
| d. Understand device and I/O management functions in operating systems as part of a uniform device abstraction. |
| e. Evaluate security risks in operating systems and understand the role operating systems can and should play in establishing security. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | ✓ | | | | | ✓ | ✓ | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLO 2 | ✓ | | | ✓ | | | | | ✓ | ✓ | |
| CLO 3 | ✓ | | | ✓ | | | | | ✓ | ✓ | |
| CLO 4 | ✓ | | | ✓ | | | | | ✓ | ✓ | |
| CLO 5 | ✓ | | | ✓ | | | | | ✓ | ✓ | |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to programming assignments*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> ---
> **d. an ability to function effectively on teams to accomplish a common goal**
> *Programming assignments are implemented in teams.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f. an ability to communicate effectively**
> ---
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Students leverage the capabilities of a modern OS to solve real problems.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Abdelmajid Khelil* | *17 Aug 2011* |
|---|---|---|
| *Courses Committee* | *Systems,* <br> *Committee Leader: Mohammad Ansari* | *10 Sep 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401313-3 - Software Engineering (3 credits)
## Coordinator: Basem Kazemi

Catalog Description

| |
|---|
| Software engineering concepts including the software life cycle and other software-development process models. Specification techniques, design methodologies, performance analysis, and verification techniques. Team-oriented software design and development, and project management techniques. Introduction to design and debugging tools of a modern programming language. Homework and laboratory projects that emphasize design and the use/features of a modern programming language in software development |

Prerequisites

| |
|---|
| 1401222-3 – System Analysis & Design |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction to software engineering and its impact on software development | 1 |
| Critical software engineering principles such as modularity, abstraction, software evolution, etc | 2,3 |
| Software development process models such as waterfall, spiral, etc. and case studies on their usage. Object-oriented development models | 4,5,6 |
| Traditional and object-oriented software design concepts and techniques | 6,7 |
| Software verification via testing, analysis, and debugging | 8,9 |
| Software engineering tools and environments. Practice in using tools for software design, and testing | 10,11,12 |
| Basic management concepts including an introduction to team aspects of solving software design problems | 13,14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Software Engineering – Principle and Practice Hans Van Vliet, 3rd, 2010, 978-0-470-03146 |

Assessment Methods

| |
|---|
| The student is expected to complete theoretical homework and programming tasks, to pass written examinations, and to successfully complete a significant project |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. The student will have a working knowledge of established software engineering issues and practice and their relationship to emerging methodologies, paradigms, techniques, tools, and languages.<br>2. The student will be able to analyze, design and implement a modern application from an architectural perspective, which includes a decomposition into components of software, hardware, and their interdependencies.<br>3. The student will be able to design and prototype software from written specifications and/or supplied application libraries. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | ✓ | | | |
| CLO 2 | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| CLO 3 | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ |

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to a project*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *---*
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d. an ability to function effectively on teams to accomplish a common goal**
> *Projects are implemented in teams.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> *---*
> **f. an ability to communicate effectively**
> *The projects require communications, specifications, progress reports, and final report.*
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> *---*
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> *The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> *The students are required to use standard design and development principles on a significant software project*

Approvals

| *Course Coordinator* | *Basem Kazemi* | *17 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Design & Databases,* <br> *Committee Leader: Mohammed Nour* | *19 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401330-3 - Computer Graphics (3 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| |
|---|
| The course offers an introduction to computer graphics hardware, algorithms, and software. Topics include overview of graphics hardware, 2D and 3D object representation, geometric transformations, 2D viewing, 3D viewing, illumination models, color modes, and color applications. |

Prerequisites

| |
|---|
| 1401105-3 – Advanced Programming |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Computer graphics hardware | |
| 2D objects drawing | |
| Line drawing algorithms | |
| Geometric transformations in 2D & 3D | |
| Animation | |
| 3D objects drawing | |
| Lighting | |
| Color models and applications | |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 2 x 50 min labs |

Textbook/References

| |
|---|
| Computer Graphics with OpenGL, 3rd edition, Hearn & Baker, Prentice Hall, 2004, ISBN: 978-0130153906.<br>OpenGL Programming Guide: The Official Guide to Learning OpenGL, Versions 3.0 and 3.1, 7th edition, Dave Shreiner & The Khronos OpenGL ARB Working Group, Addison-Wesley, 2009, ISBN: 978-0321552624. |

Assessment Methods

| |
|---|
| 1. Bi-weekly Individual programming assignments<br>2. Bi-weekly assignment<br>3. Mid-term and final exam<br>4. Group final project |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Understand the foundation of the implementation of computer graphics modelling and rendering systems<br>2. Understand the mathematical background of computer graphics<br>3. Understand the handling of colors |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs |
|---|

| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CLO 1 | ✓ | | ✓ | | | | | | ✓ | | |
| CLO 2 | ✓ | | | | | | | | | ✓ | |
| CLO 3 | ✓ | | ✓ | | | | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to a project*
> **b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *---*
> **c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d.   an ability to function effectively on teams to accomplish a common goal**
> *---*
> **e.   an understanding of professional, ethical, legal and social issues and responsibilities**
> *---*
> **f.   an ability to communicate effectively**
> *---*
> **g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> *---*
> **h.   a recognition of the need for, and an ability to engage continuing professional development**
> *---*
> **i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and  to document the solution including the tradeoffs involved in their design choices.*
> **k.   an ability to apply design and development principles in the construction of software systems of varying complexity**
> *---*

Approvals

| | | |
|---|---|---|
| *Course Coordinator* | *Mohammed Abdurrahman* | *31 Oct 2011* |
| *Courses Committee* | *Programming & Algorithms, Committee Leader: Mohamed Darieby* | *29 Nov 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401333-3 - Human Computer Interaction (3 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| |
|---|
| Students will gain an understanding of user interface design, and alternatives to traditional "keyboard and mouse" computing, including virtual reality, and ubiquitous computing. Students will become familiar with sensory and cognitive systems and be able to apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to computer operation. Students will appreciate the importance of a design and evaluation methodology that begins with and maintains a focus on the user, the social implications of technology and ethical responsibilities in the design of technological systems. |

Prerequisites

| |
|---|
| 1401330-3 – Computer Graphics |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Background--the development, context, and scope of HCI | 1 |
| User-Centered Design, Understanding and Observing Users | 2 |
| Use Case Scenarios, Personas, and User Modeling | 3 |
| User Experience, Usability Requirements, and Low-Fidelity Prototyping | 4 |
| Usability Testing, Interaction Design and Analytical Evaluation | 5 |
| Models and Theories: GOMS, MHP, Fitts' Law | 6,7 |
| Accessibility and Risks: Error Classification, Automation, Designing for Error | 8 |
| Graphics and Sound: GUIs, speech and non-speech audio | 9,10 |
| Multimodal Interfaces and Ubiquitous Computing | 11 |
| Gestural Interaction and Tangible User Interfaces | 12 |
| Affective and Social Computing | 13 |
| Augmented Reality and Computer Supported Cooperative Work | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Designing the User Interface: Strategies for Effective Human-Computer Interaction,5/E, Shneiderman et al., ISBN: 0321537351, Pearson, 2009 |

Assessment Methods

| |
|---|
| Homework, project, and exams. |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Students will know key concepts in designing usable products<br>2. Students will be able to evaluate the usability of a given computer-based solution |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs |
|---|

| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CLO 1 | | | ✓ | | | | | | | | |
| CLO 2 | | | ✓ | | | | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> ---
> **b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d.   an ability to function effectively on teams to accomplish a common goal**
> ---
> **e.   an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f.   an ability to communicate effectively**
> ---
> **g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h.   a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Projects use current computing and modeling/design tools.*
> **j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> ---
> **k.   an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Mohammed Abdurrahman* | *1 Nov 2011* |
|----------------------|------------------------|--------------|
| *Courses Committee* | *N/A,*<br>*Committee Leader: N/A* | *N/A* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401335-3 - Advanced Database Systems (3 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| The enhanced entity-relationship (EER) model. Relational database design by ER- and EER-to-relational mapping. Concepts for object databases. Object database standards, languages, and design. Object-relational databases. XML databases. Database transaction and query processing. Distributed databases. Database security. Database tuning and recovery. |
|---|

Prerequisites

| 1401312-3 - Fundamentals of Database Systems |
|---|

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Advanced relational algebra and SQL: Set vs. bag semantics, NULL values, Distinct operator, Semi join, left join, right join, SQL constraints and triggers, Data mining and OLAP operators: Group By, Roll Up, Cube, Pivot | 1 |
| The Enhanced Entity-Relationship (EER) model and EER to relational mapping | 2 |
| Object and Object-Relational Databases: Concepts, Models, Languages and Standards | 3 |
| XML for semi-structured data: XML language and its tree representation, XML schema language, XPath/XQuery languages, Translation of an XML schema into a relational schema | 4 |
| Database File Indexing Techniques, B-Trees, and B+-Trees | 5 |
| Query Processing and Query Optimization Techniques | 6,7 |
| Database Tuning and Physical Design Issues | 8,9 |
| Advanced Database Transaction Processing | 10 |
| Database Recovery Protocols | 11 |
| Distributed Databases (DDB): Horizontal/vertical fragmentation, Basic distributed query processing, Semi-join query processing | 12,13 |
| Database Security | 14 |

Weekly Hours

| 3 x 50 mins lectures, 0 lab hours |
|---|

Textbook/References

| Database Systems: Models, Languages, Design And Application Programming, 6th Edition, Pearson International Edition, ISBN: 0132144980, 2011. |
|---|

Assessment Methods

| The student is expected to complete theoretical homework, pass written examinations, and successfully complete a project. |
|---|

Course Learning Outcomes (CLOs)

1. The students will understand different terms of advanced data modeling e.g. object, object-relational, and XML and the supporting theoretical foundation.
2. The students will learn techniques of advanced schema mapping i.e. from enhanced entity relation to relational, object to relational, object-relational to relational, and xml to relational.

| 3. The students will understand advanced database topics such as indexing, query processing, local and distributed transaction processing, and security. |
| --- |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | | | | | | | | | ✓ | ✓ |
| CLO 2 | | | | | | | | | ✓ | | |
| CLO 3 | | | ✓ | ✓ | | | | ✓ | | | ✓ |

Relationship of Course to ABET Student Outcomes

| |
| --- |
| **a.  an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline** <br> *Students apply knowledge of computing and design to a project* <br> **b.  an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution** <br> *---* <br> **c.  an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired** <br> *Students are required to apply indexing and tuning to a database project.* <br> **d.  an ability to function effectively on teams to accomplish a common goal** <br> *Some course work will be done as team projects.* <br> **e.  an understanding of professional, ethical, legal and social issues and responsibilities** <br> *---* <br> **f.  an ability to communicate effectively** <br> *---* <br> **g.  an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues** <br> *---* <br> **h.  a recognition of the need for, and an ability to engage continuing professional development** <br> *The students often must utilize database vendors blogs and open source sites to learn and apply the new technologies that they have chosen in support of their projects.* <br> **i.  an ability to use the current techniques, skills, and tools necessary for computing practice.** <br> *Projects use current computing and modeling/design tools.* <br> **j.  an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.** <br> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.* <br> **k.  an ability to apply design and development principles in the construction of software systems of varying complexity** <br> *The students are required to use standard design and development principles on a significant database project* |

Approvals

| *Course Coordinator* | *Mohammed Abdurrahman* | *20 Jul 2011* |
| --- | --- | --- |
| *Courses Committee* | *Design & Databases,* <br> *Committee Leader: Mohammed Nour* | *19 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401332-3 - Introduction to Artificial Intelligence (3 credits)
## Coordinator: Muhammad Arif

Catalog Description

| This course introduces basics of Artificial Intelligence, concept of Intelligent agents and various types of agents. It includes various search techniques, Propositional logic and First order logic. It further introduces the concept of knowledge engineering and inference systems. |
|---|

Prerequisites

| 1401310-3 – Compiler Construction |
|---|

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction to AI | |
| History of AI | |
| AI Domains | |
| AI Applications | |
| Intelligent Agents and Environment | |
| Structure of Different type of Agents | |
| Problem Solving through search | |
|     (i) Un-informed search (BFS, DFS, Depth First, Depth limited and iterative deepening search) | |
|     (ii) Informed Search (Greedy best first search, A* search, Heuristics) | |
|     (iii) Local Search Algorithms (Hill Climbing, Simulated Annealing) | |
| Adversarial Search (Minimax Algorithm, Alpha Beta Pruning, Chance Minimax) | |
| Logical Agents (knowledge based agents, propositional logic, First Order Logic, Knowledge | |
| Engineering in FOL | |
| Inference in FOL | |

Weekly Hours

| 3 x 50 mins lectures, 0 lab hours |
|---|

Textbook/References

| Artificial Intelligence: A Modern Approach 3rd Edition, Russell & Norvig, 2009, Prentice Hall, ISBN 0136042597 |
|---|

Assessment Methods

| Assignments, Quizzes, Discussion Group, Project, Midterm, Final Exam |
|---|

Course Learning Outcomes (CLOs)

| 1. Students will learn basics of AI, Intelligent Agents and their different types and applications.<br>2. They will learn in detail different search techniques including uninformed search, heuristic search, adversarial search that can be used in Game playing and other AI applications.<br>3. Students will learn logical agents, first order logic and first order inference system. |
|---|

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | ✓ | | | | | | | ✓ | |
| CLO 2 | | | ✓ | | | | | | | ✓ | |
| CLO 3 | | | ✓ | | | | | | | ✓ | |

Relationship of Course to ABET Student Outcomes

> **a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> ---
> **b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d.   an ability to function effectively on teams to accomplish a common goal**
> ---
> **e.   an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f.   an ability to communicate effectively**
> ---
> **g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h.   a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**
> ---
> **j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and  to document the solution including the tradeoffs involved in their design choices.*
> **k.   an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Muhammad Arif* | *12 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Artificial Intelligence, Committee Leader: Muhammad Arif* | *12 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401334-3 - Parallel & Distributed Computer Systems (3 credits)
## Coordinator: Mohammad Ansari

Catalog Description

| |
|---|
| Introduction to parallel computing using shared memory and distributed memory multi-core computers, including hands-on practice with such systems during programming homework assignments, and a team project. |

Prerequisites

| |
|---|
| 1401214-3 – Computer Organization and Assembly Programming<br>1401311-3 – Operating Systems |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Multi-core and its implications on software engineers | 1 |
| Parallel architectures | 2-3 |
| Source of loss in parallel performance | 4-6 |
| Accessing shared data safely | 7-9 |
| General parallel algorithmic models | 10 |
| Pthreads, OpenMP, and MPI | 11-14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Introduction to Parallel Programming, Peter Pacheco, 2011 |

Assessment Methods

| |
|---|
| A number of homework programming exercises (20%)<br>Two written exams (20% + 40%)<br>A team design and implementation project (20%) |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. Awareness of basic multiprocessor hardware taxonomy<br>2. A strong grasp of the basic software and hardware strategies for managing access to shared data (from locks, and barriers, to cache coherency)<br>3. An in-depth understanding of the major sources of performance loss in parallel programs, and some general solutions to reducing performance loss<br>4. Ability to use standard parallel programming APIs such as Pthreads, OpenMP, and MPI through practice on shared memory and distributed memory computers |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | ✓ | ✓ | | | | | | | | | |
| CLO 2 | ✓ | | ✓ | | | | | | | ✓ | ✓ |
| CLO 3 | ✓ | | ✓ | | | | | | | ✓ | ✓ |

| CLO 4 | ✓ | | | ✓ | | | | | ✓ | | |
|-------|---|---|---|---|---|---|---|---|---|---|---|

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students are required to have a good understanding and knowledge of principles of developing parallel programs to complete assessments*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *Students will learn about the trade-offs in different parallel architectures, and their implication on execution performance of software with different execution characteristics*
> **c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> *Students are required design and implement a software project to meet a specification.*
> **d. an ability to function effectively on teams to accomplish a common goal**
> *Projects are implemented in teams.*
> **e. an understanding of professional, ethical, legal and social issues and responsibilities**
> ---
> **f. an ability to communicate effectively**
> ---
> **g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> ---
> **h. a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Students will use current parallel programming tools and APIs in homework assignments and their project.*
> **j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> *Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*
> **k. an ability to apply design and development principles in the construction of software systems of varying complexity**
> *The students are required to use standard design and development principles on a parallel programming project*

Approvals

| Course Coordinator | Mohammad Ansari | 15 Jul 2011 |
|--------------------|-----------------|-------------|
| Courses Committee | Systems,<br>Committee Leader: Mohammad Ansari | 10 Sep 2011 |
| Program Committee | Head of Department: Ahmed Kattan<br>ABET Coordinator: Mohammad Ansari | DATE |

# 1401417-3 - Computer Network Systems (3 credits)
## Coordinator: Shaleeza Sohail

Catalog Description

| |
|---|
| The course covers principles of computer networking with the focus on the Internet. The structure, practices, protocols and components of computer networks involved in supporting the Internet, are studied in detail. Important concepts related to packet switching, layered architecture, TCP/IP protocol suite, window flow control, local area networks, Quality of Service and congestion control are covered in the course. |

Prerequisites

| |
|---|
| 1401311-3 – Operating Systems |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Introduction to Computer Networks, Internet Architecture, Circuit and Packet Switching, Access Systems | 1 - 2 |
| Application Layer Principles, HTTP, DNS, Peer to Peer Networks | 3 - 5 |
| Transport Layer Services, UDP, Reliable data delivery, TCP, Congestion Control | 6 - 8 |
| Network Layer Services, Virtual Circuits, IP, Addressing, Routing Protocols | 9 - 11 |
| Link Layer Services, Multiple Access Protocols, Link layer addressing, Ethernet, Switches | 12,13 |
| Introduction to Wireless and Mobile Networks, Wireless characteristics, CDMA, Cellular Networks, Mobility | 14 |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| Textbook: "Computer Networking: A Top-Down Approach", James Kurose and Keith Ross , 5th edition ISBN: 0136079679, Publisher: Addison-Wesley, 2009.<br>References: "Computer Networks", Andrew S. Tanenbaum, 5th Edition, Prentice Hall, 2011<br> "Data and Computer Communications", W. Stalling , 9th Edition, Prentice Hall, 2007 |

Assessment Methods

| |
|---|
| Final Exam 40%, Mid-Term Exam 15%, Project 15%, Quizzes 15%, Lab Work 15% |

Course Learning Outcomes (CLOs)

| |
|---|
| Students successfully completing this course will have:<br>1) Working knowledge of computer networks, Internet in particular. They will be able to describe the topics and solve related problems.<br>2) Skills to develop network applications based on client-server architecture.<br>3) Ability to apply mathematical knowledge for analysis of network protocols<br>4) Ability to identify, analyze and work out network engineering problems.<br>5) Ability to use new networking tools for engineering practices. |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs |
|---|

| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CLO 1 | ✓ | | | | | | | | | ✓ | |
| CLO 2 | ✓ | | ✓ | ✓ | | | | | | ✓ | ✓ |
| CLO 3 | ✓ | | | | | | | | | | |
| CLO 4 | ✓ | | | | | | | | | | |
| CLO 5 | ✓ | | | | | | | | ✓ | | |

Relationship of Course to ABET Student Outcomes

**a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
*Students are required to have a good understanding and knowledge of principles of networking to successfully pass all the evaluation components*

**b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
*---*

**c. an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
*Students are required to design and implement a network project to meet a specification.*

**d. an ability to function effectively on teams to accomplish a common goal**
*Projects are implemented in teams.*

**e. an understanding of professional, ethical, legal and social issues and responsibilities**
*---*

**f. an ability to communicate effectively**
*---*

**g. an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
*---*

**h. a recognition of the need for, and an ability to engage continuing professional development**
*---*

**i. an ability to use the current techniques, skills, and tools necessary for computing practice.**
*Students are required to use sophisticated network analyzer Wireshark in labs to visualize working of different protocols on different network layers*

**j. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
*Students are required to apply their knowledge of mathematics and computing to solve a number of networking problems. Moreover the design of the project requires computing and algorithmic skills.*

**k. an ability to apply design and development principles in the construction of software systems of varying complexity**
*Students are required to use software design principles on a significant network project*

Approvals

| **Course Coordinator** | **Shaleeza Sohail** | **18 Jul 2011** |
|------------------------|---------------------|-----------------|
| **Courses Committee** | **Systems,** <br> **Committee Leader: Mohammad Ansari** | **10 Sep 2011** |
| **Program Committee** | **Head of Department: Ahmed Kattan** <br> **ABET Coordinator: Mohammad Ansari** | **DATE** |

# 1401419-4 - Research Project (4 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| |
|---|
| This course is the first semester of the required major design experience. In a two semester-long project, student teams will propose, design, produce and evaluate a software and/or hardware system. The project will culminate in the delivery of a working system, a formal public presentation, and written documentation. Oral and written progress reports are required. |

Prerequisites

| |
|---|
| 1401311-3 – Operating Systems<br>1401335-3 – Advanced Database Systems |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| N/A | N/A |

Weekly Hours

| |
|---|
| 4 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| UQU Undergraduate Final Year Project Handbook. |

Assessment Methods

| |
|---|
| Weekly meetings, written report, and oral/poster presentation |

Course Learning Outcomes (CLOs)

| |
|---|
| 1. **Ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**.<br>2. **Ability to analyse a problem, and identify and define the computing requirements appropriate to its solution**.<br>3. **Ability to function effectively on teams to accomplish a common goal.**<br>4. **Ability to communicate effectively.**<br>5. **Recognition of the need for, and an ability to engage continuing professional development.**<br>6. **Ability to use the current techniques, skills, and tools necessary for computing practice.**<br>7. **Apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer based systems in a way that demonstrates comprehension of the trade-offs involved in design choices**<br>8. **Ability to apply design and development principles in the construction of software systems of varying complexity** |

Relationship of Course to ABET Student Outcomes

| |
|---|
| **a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**<br>       *Students apply knowledge of computing and design to a project*<br>**b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**<br>       *Students will develop project requirement specification* |

**c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**

        **---**

**d.   an ability to function effectively on teams to accomplish a common goal**

        *Projects are implemented in teams.*

**e.   an understanding of professional, ethical, legal and social issues and responsibilities**

        *---*

**f.   an ability to communicate effectively**

        *The projects require communications, specifications, progress reports, and final report.*

**g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**

        *---*

**h.   a recognition of the need for, and an ability to engage continuing professional development**

        *The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*

**i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**

        *Projects use current computing and modeling/design tools.*

**j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**

        *Students are required to apply their knowledge of computing to design a solution to a problem and  to document the solution including the tradeoffs involved in their design choices.*

**k.   an ability to apply design and development principles in the construction of software systems of varying complexity**

        *The students are required to use standard design and development principles on a significant software project*

Approvals

| *Course Coordinator* | *Mohamed Abdur Rahman* | *31 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Capstone,* <br> *Committee Leader: Mohamed Abdur Rahman* | *31 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan* <br> *ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401432-3 - Computer Security Systems(3 credits)
## Coordinator: Salah Aly

Catalog Description

This course is the first level of computer and network security. The course will cover various topics related to computer security, data privacy, network protection against various attacks. The course gives students enough knowledge and a reasonable background to understand network security, active and passive attacks, Internet privacy, secure communications. Students are expected to practice biweekly homeworks, develop critical thinking about computer and network security, and apply learned materials in different contexts of various attacks, wireless and Internet security.

Prerequisites

1401311-3 – Operating Systems

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Overview of computer security services | 1 |
| Passive and active attacks | 2 |
| Cryptographic public and symmetric keys: DES | 3-4 |
| Advanced Encryption Standard AES | 5 |
| Public key cryptography, and RSA algorithm | 6-7 |
| El-Gamal cryptosystem | 8 |
| Digital signatures and message authentication protocols | 9-10 |
| Transport layer security, SSL protocol, MAC scheme | 11-12 |
| Wireless security protocols, WPA, WEP | 13 |
| Viruses, and Internet attacks | 14 |

Weekly Hours

3 x 50 mins lectures, 0 lab hours

Textbook/References

Network Security Essentials, Fourth Edition, William Stallings, 2011
Additional materials will be distributed during the course.

Assessment Methods

Home works  **20 %**
Quiz       **20%**
Midterm     **20 %**
Final Exam  **40 %**

Course Learning Outcomes (CLOs)

1. Appreciate the need for computer security and computer protection, including the tradeoffs between different security and protection methods
2. Able to apply concepts of public keys, private keys, cryptosystem, authentication, digital signatures to secure simple systems.
3.  Implement some network security protocols such as SSL, MAC, and wireless security, WEP, WAP, and computer viruses, and Internet attacks, and utilize them in real applications to secure Internet traffic.

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | |
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO 1 | ✓ | | | | ✓ | | ✓ | | ✓ | | |
| CLO 2 | ✓ | | | | | | | | | | |
| CLO 3 | ✓ | | | | | | ✓ | | ✓ | | |

Relationship of Course to ABET Student Outcomes

> **a.  an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computer security, design to a project, and use this topic for other subjects. Students will realize the importance of security and protection for data and information.*
> **b.  an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> ---
> **c.  an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
> ---
> **d.  an ability to function effectively on teams to accomplish a common goal**
> ---
> **e.  an understanding of professional, ethical, legal and social issues and responsibilities**
> *Students will appreciate the implications of leaving systems insecure*
> **f.  an ability to communicate effectively**
> ---
> **g.  an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
> *Students will be able to analyze the impact of security on organizations and individuals*
> **h.  a recognition of the need for, and an ability to engage continuing professional development**
> ---
> **i.  an ability to use the current techniques, skills, and tools necessary for computing practice.**
> *Reports and projects use current computing and modeling/design tools.*
> **j.  an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
> ---
> **k.  an ability to apply design and development principles in the construction of software systems of varying complexity**
> ---

Approvals

| *Course Coordinator* | *Salah Aly* | *15 Oct 2011* |
|---|---|---|
| *Courses Committee* | *Theoretical Computing,*<br>*Committee Leader: Khaled Sayed* | *19 Oct 2011* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |

# 1401439-4 - Graduation Project (4 credits)
## Coordinator: Mohammed Abdurrahman

Catalog Description

| |
|---|
| This course is the second semester of the required major design experience. In a two semester-long project, student teams will propose, design, produce and evaluate a software and/or hardware system. The project will culminate in the delivery of a working system, a formal public presentation, and written documentation. Oral and written progress reports are required. |

Prerequisites

| |
|---|
| 1401419-3 – Research Project |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| N/A | N/A |

Weekly Hours

| |
|---|
| 4 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| UQU Undergraduate Final Year Project Handbook. |

Assessment Methods

| |
|---|
| Weekly meetings, written report, and oral/poster presentation |

Course Learning Outcomes (CLOs)

1. **Ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**.
2. **Ability to analyse a problem, and identify and define the computing requirements appropriate to its solution**.
3. **Ability to design, implement and evaluate a computer-based system, process, component or program to meet desired goal.**
4. **Ability to function effectively on teams to accomplish a common goal.**
5. **Ability to communicate effectively.**
6. **Recognition of the need for, and an ability to engage continuing professional development.**
7. **Ability to use the current techniques, skills, and tools necessary for computing practice.**
8. **Apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer based systems in a way that demonstrates comprehension of the trade-offs involved in design choices**
9. **Ability to apply design and development principles in the construction of software systems of varying complexity**

Relationship of Course to ABET Student Outcomes

> **a. an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
> *Students apply knowledge of computing and design to a project*
> **b. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
> *Students will develop project requirement specification*

**c.** **an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired goal**

*Students are required to design and implement a software project to meet a specification.*

**d.** **an ability to function effectively on teams to accomplish a common goal**

*Projects are implemented in teams.*

**e.** **an understanding of professional, ethical, legal and social issues and responsibilities**

*---*

**f.** **an ability to communicate effectively**

*The projects require communications, specifications, progress reports, and final report.*

**g.** **an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**

*---*

**h.** **a recognition of the need for, and an ability to engage continuing professional development**

*The students often must utilize the internet to learn and apply the new technologies that they have chosen in support of their projects.*

**i.** **an ability to use the current techniques, skills, and tools necessary for computing practice.**

*Projects use current computing and modeling/design tools.*

**j.** **an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**

*Students are required to apply their knowledge of computing to design a solution to a problem and to document the solution including the tradeoffs involved in their design choices.*

**k.** **an ability to apply design and development principles in the construction of software systems of varying complexity**

*The students are required to use standard design and development principles on a significant software project*

Approvals

| Course Coordinator | Mohammed Abdurrahman | 31 Oct 2011 |
|---|---|---|
| Courses Committee | Capstone, Committee Leader: Mohammed Abdurrahman | 31 Oct 2011 |
| Program Committee | Head of Department: Ahmed Kattan ABET Coordinator: Mohammad Ansari | DATE |

# 1401431-3 - Computers & Society (3 credits)
## Coordinator: Elham Hassanain

Catalog Description

| |
|---|
| This course explores basic cultural, social, legal, and ethical issues inherent in the discipline of computing. Students will investigate important non-technical aspects of their role as a computing expert such as personal responsibility in ensuring faulty products are not released to market. Finally, students will see the importance of remaining up to date in their specialties and in computing as a whole, not just for personal benefit, but for society, too. |

Prerequisites

| |
|---|
| |

Major Topics Covered in the Course (14 week semester)

| Topic | Week |
|---|---|
| Social (cultural, international, govt) implications of computing, and internet | |
| Identifying and evaluating ethical choices in software design | |
| Professionalism (care, attention, responsibility). Importance of keeping up to date. | |
| Codes of ethics, maintaining awareness of ethical consequences, ethical dissent | |
| Historical examples of software risks (such as the Therac-25 case) | |
| Computing in the workplace issues | |
| Implications of software complexity | |
| Risk assessment and risk management; risk removal, risk reduction and risk control | |
| Foundations of intellectual property (copyrights, patents) | |
| Software piracy | |
| Ethical and legal basis for privacy protection | |
| Privacy implications of database systems (e.g. data gathering, storage, and sharing) | |
| Technological strategies for privacy protection | |

Weekly Hours

| |
|---|
| 3 x 50 mins lectures, 0 lab hours |

Textbook/References

| |
|---|
| A Gift of Fire: Social, Legal, and Ethical Issues for Computers and the Internet (3rd Edition) by Sara Baase |

Assessment Methods

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|---|
| Essay assignments, presentation, project, midterm, final exam |

Course Learning Outcomes (CLOs)

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| 1. Students will be aware of, and be able to identify, the social, ethical, legal, professional, and privacy issues related to computing <br> 2. Students will be able to articulate varying perspectives regarding ethical, social, and professional issues in computer science and engineering <br> 3. Students will gain an appreciation for remaining up to date in their specialties |

Relationship between CLOs and Student Outcomes (list of POs on page 2). Entries in the table indicate which CLOs relate to which student outcomes.

| Student Outcomes – Mapped to CLOs | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLOs | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
| CLO 1 | | | | | ✓ | ✓ | | | | | |
| CLO 2 | | | | | | ✓ | ✓ | | | | |
| CLO 3 | | | | | | | | ✓ | | | |

Relationship of Course to ABET Student Outcomes

**a.   an ability to apply knowledge of mathematics, computing, science, and engineering appropriate to the discipline**
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**b.   an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution**
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**c.   an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired**
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**d.   an ability to function effectively on teams to accomplish a common goal**
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**e.   an understanding of professional, ethical, legal and social issues and responsibilities**
      *A significant portion of course will be spent on educating students about professional, ethical, legal and social issues and responsibilities of a computing professional*
**f.   an ability to communicate effectively**
      *The students will be required to write long reports and make presentations as part of the course.*
**g.   an ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues**
      *Students will work in teams and analyze the impact of a chosen computing technology on individuals, organizations, and society, including ethical, legal, security, and global policy issues.*
**h.   a recognition of the need for, and an ability to engage continuing professional development**
      *The students will utilize the internet to search for examples of ethical, legal, and social impact of computing, and build an awareness for the need to stay aware of such issues in the future.*
**i.   an ability to use the current techniques, skills, and tools necessary for computing practice.**
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**j.   an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.**
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**k.   an ability to apply design and development principles in the construction of software systems of varying complexity**
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Approvals

| *Course Coordinator* | *Elham Hassanain* | *18 Oct 2011* |
|---|---|---|
| *Courses Committee* | *N/A,*<br>*Committee Leader: N/A* | *N/A* |
| *Program Committee* | *Head of Department: Ahmed Kattan*<br>*ABET Coordinator: Mohammad Ansari* | *DATE* |