Course description

Compilers Design

CS 545

Kingdom of Saudi Arabia
Ministry of Higher Education
Princess Nora Bint Abdul Rahman University

National Organization of Evaluation and Accreditation

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### Course description / Compiler Design

**Educational institution:** Princess Nora Bint Abdul Rahman University

**Faculty:** Computer Sciences and Information **Department:** Computer Science

#### A) Course specifications and general information

1. **Course name and Number:** Compilers Design – CS 545

2. **Number of credits:** 3 (contact hours: lecture - 3)

3. **The program or programs in which the course is offered:** The Bachelor of Computer Sciences and Information in computer science.

4. **Name of faculty member responsible for the course:** One of the staff members of appropriate specialization to be assigned in time.

5. **Level or year in which the course is offered:** Level 9

6. **pre-requisite course(s) (if any):** Programming languages concepts - CS 444

7. **Requirements associated with this course (if any):** None.

8. **Course teaching place if not in main campus:** None.
B) Objectives

1- Brief description of basic learning outcomes:
In this module students will develop a deeper understanding of Compilers technology. Students will learn the most important techniques for the representation and generation of Languages. Those techniques will be then applied to the construction of a compiler for a programming language. In particular, during this module the student will learn how to build the different parts of a Compiler: Lexical Analyzer, Parser, Code Generation and Optimization.

2 - Briefly describe any current plans being implemented to develop and improve the course (eg: the increasing use of materials and references that rely on information technology or the Internet, and changes in course content based on the results of new research in the field):
- Taking into account the following learning entities (e-Learning via networking, e-Learning software, collaborative learning, learning via problem-solving and decision-making, investigative learning, constructive learning).
- Periodic reviewing the course by the plans and schedules Commission in the department.
- Update course's content regularly on the basis of recent developments in the field.
- Keep pace with the rapid development in the field through the use of modern technologies.
- Update learning resources for the course on a regular basis.
- Comparison of course vocabulary with what is being presented in other local, regional and global departments.
- Access to relevant Web sites.
C) Course Description

1- Topics to be discussed:
Studying the structure of compilers. Topics include: lexical analysis; syntax analysis including LL, SLR, LALR and LR parsers; type checking; run-time environments; intermediate code generation; and compiler-construction tools.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of weeks</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to the course content, text book(s), reference(s) and course plan.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Overview: Introduction to the Notion of Compiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammars and Lexical Analyzers Syntax</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Top-Down Parsing: Left Recursion and Left Factoring, First Sets, Follow Sets, Recursive Descent Parsing, LL(1) Table-Driven Parsing</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Bottom-Up Parsing: SLR, LAR and LR Parser</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Parser Generator: Lex and Yacc (or Jlex and Cup)</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Semantic Processing: Syntax-Directed Translation, Intermediate Representations, Design of Predictive Compilers</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Error Detection and Recovery</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Intermediate Code Generation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Code Optimization</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

2 - Course components (total contact hours per semester):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Private lessons</th>
<th>Practical / Field / cooperative training or privilege for students in health specialties</th>
<th>others</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
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#### 3 - Additional private study / expected learning hours by students in a week (expected to be an average for the semester not a specific requirement in each week):
4 credit hours (selected readings on topics from books and specialized scientific periodicals).

#### 4 - Development of learning outcomes in the fields or areas of learning
For each learning field shown below indicate:
- A brief summary of the knowledge or skills for which course is designed in order to develop them.
- Description of the learning strategies to be used to develop that knowledge or skills.
- Methods of student assessment used in the course to evaluate learning outcomes.

### A – Knowledge

#### 1 - Description of the knowledge to be acquired:
Students who successfully complete this course will be able to:
- Have a deeper understanding of Compilers technology.
- Demonstrate the most important techniques for the representation and generation of Languages.
- Demonstrate how to build the different parts of a Compiler: Lexical Analyzer, Parser, Code Generation and Optimization.

#### 2 - Strategies for Education (teaching) to be used to develop that knowledge:
Interactive lecture, discussion and dialogue, collaborative learning, e-learning, guided discovery, brainstorming, problem solving, research / projects.

#### 3 - Methods of assessment of gained knowledge:
- Written tests (objective and essay).
- Classroom assignments and homework.
- Theoretical Research or an article.
- Mini-projects and presentations.
- Participation in seminars.
B - Cognitive skills

1 - Cognitive skills to be developed:
Skill originality, fluency skill, flexibility skill, illustration skill, description skill, sentencing skill, conclusion skill, comparison skill, problem-solving skill, generalization skill.

2 - Learning strategies used in the development of cognitive skills:
Lectures, discussion, brainstorming, problem solving, decision making, research and projects, survey and simulation.

3- Methods of assessment of acquired cognitive skills:
- Written tests (objective and essay).
- Research.
- Mini-projects and presentations.
- Participation in seminars.

C - Inter-relations skills (personal) and responsibility

1 - Description of the interpersonal skills with others, and the capacity to carry responsibility to be developed:
- Skill of collaborative work in an environment of collective action.
- Collective decision-making skills.
- Skill of negotiation.
- Skill of effective communication.
- Skill to accept criticism from others.
- Skill to lead a group.
- Each individual carry the responsibility in implementing the tasks assigned to her and leading to work success.

2 - Education strategies used to develop these skills and abilities:
- Assignments individually and collectively.
- Group discussion.

3 - Methods of assessment of students’ interpersonal skills and ability to take responsibility:
- Evaluation of individual works periodically.
- Personal interviews.
- Organized observation.
- Colleagues’ evaluation.
D - Communication skills, information technology, mathematical (numerical) skills:

1 - Description of numerical skills and communication skills to be developed:
- The ability to use computers and operating systems.
- The ability to use modern technologies in communication and linking and networking.
- The use of information technologies to access, preserve, and process information.

2 - Education strategies used to develop these skills:
- Participation in conducting lectures.
- Practical training.
- Giving theoretical assignments.

3 - Methods of assessment of students’ communication skills, information technology, mathematical (numerical) skills:
- Research and reports.
- Presentations.
- Design lessons using information technology.
- Assignments Assessment.

E) Motor skills (if required)

1 - Description of the psychomotor skills to be developed in this area:
- Skill to operate and use computers and modern technology.
- The ability to choose the appropriate tools and use them in a correct way.

2 - Learning strategies used in the development of motor skills:
- Applications, training and guided discovery.
- Simulation and modeling.
- Research projects.
- Collaborative teaching.
- Presentations.
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3 - Methods of assessment of students’ psychomotor skills:
- Method of modeling.
- Practical classroom applications.
- Performance assessment card.
- Observation.

4 - Schedule of Assessment Tasks according to which the students are evaluated during the Semester

<table>
<thead>
<tr>
<th>index</th>
<th>The nature of the evaluation function (e.g.: article, quiz, group project, etc.)</th>
<th>Due week</th>
<th>Assessment weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First exam</td>
<td>Week 7</td>
<td>15%</td>
</tr>
<tr>
<td>2</td>
<td>Second exam</td>
<td>Week 12</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>Theoretical assignments</td>
<td>Weeks 5 &amp; 10</td>
<td>5%</td>
</tr>
<tr>
<td>4</td>
<td>Final exam(Theory)</td>
<td>After Week 15</td>
<td>60%</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

D) Support provided to students

Procedures or arrangements implemented to ensure the presence of faculty members to provide advice and guidance to the student when needed (specify the amount of time - office hours per week):
- Direct supervision by faculty member during practical training.
- Determination of the number of Office hours to which the faculty member is committed, and assure to be announced to the students.
- Web site with communication facilities.
- Academic advising to help students in resolving any academic and study problems related to the course.

E) Learning resources

1 – the principal book(s) requested:

2- Basic references.

3 - Books and references recommended (scientific journals, reports, etc.) (List is attached):

4 - Electronic Materials and Web sites, etc.:
   None.

5 - Other learning materials such as programs that run on computer, or professional standards or regulations:
   None.

F) Required Facilities:
Determine the requirements of the course including the size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories and the availability of computers, etc.).

1 - Educational facilities (lecture rooms, laboratories, etc.):
   - Classrooms for lectures which are featured to traditional education, e-learning, and equipped with a computer, display device, data show screen, ordinary blackboard, smart board, integrated sound system, proper lighting system, and proper conditioning system.

2 - Computers:
   - A computer for faculty member in the classroom.

3 - Other resources (specify):
   None
### G) Assessment of the course and improvements:

#### 1 - Strategies to get the student’s results and the education effectiveness:
- Analysis of students’ results.
- Observation during work.
- Students’ evaluations.
- Colleagues’ evaluations.
- Teacher’s achievements portfolio.
- Evaluation questionnaire filled by the students.
- Interview a sample of students enrolled in the course to take their opinions.

#### 2 - other strategies used to evaluate the learning process, either by Professor or by section:
- Self-assessment.
- External evaluation.
- Periodic review of course (the Commission of study plans).

#### 3 - Operations to improve education:
- Taking into account the recommendations yielded from the internal review of the course.
- Guidelines about course teaching provided by the by study plans commission.
- Department Guidelines about faculty member performance on the basis of direct observation.
- Training and development.
- Workshops to improve the educational process.

#### 4 - Verification of the levels of students’ achievements (for example: check exam correction or grades by independent faculty member for a sample work of female students, course lecturer periodically exchange correcting a sample of assignments or tests with another faculty member teaching the same course in other educational institution)
- Use of external correctors from departments outside the university.
- Collective and collaborative correction made by academic staff members in the department.
- Review of a sample of papers that have been corrected by a special committee.
5 - Describe the arrangements and plans for periodic review of the effectiveness of the course and planning for improvement:
- Comparison of the course to its counterparts offered in similar departments.
- Periodic revision of course description by faculty member.
- Periodic revision of course description by the study plans and schedules Commission.
- Update learning resources related to the course to ensure that the course is kept up with developments in the field.
- Make use of statistical results of course evaluation made by students to improve and develop the course.
- Giving the opportunity for students to express their opinions about what is taught and receive suggestions and study their effectiveness.