ATTACHMENT 2 (e)

Course Specifications

Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Course Specifications
(CS)

Course Specifications

Institution Najran University	Date of Report 18-05-2014
College/Department : Computer Science, College of Science and Arts, Sharorah	

A. Course Identification and General Information

1. Course title and code:
   Title: Design and Analysis of Algorithms Code 507CS-3 (٥٠٧عال-٣)
2. Credit hours : 3
3. Program(s) in which the course is offered.
(If general elective available in many programs indicate this rather than list programs)
   Computer Science Program
4. Name of faculty member responsible for the course
   Dr. Ahmed Abdu Alattab
5. Level/year at which this course is offered:
   Fifth Level/ 3rd Year
6. Pre-requisites for this course (if any)
   404CS-3 (Data Structures)
7. Co-requisites for this course (if any)
8. Location if not on main campus
9. Mode of Instruction (mark all that apply)

a. Traditional classroom	*	What percentage?	100%
b. Blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. Correspondence		What percentage?	
f. Other		What percentage?	

Comments:

We still teach this course using traditional methods but there is a plan to transform all course into electronic format using E-learning

B Objectives

1. What is the main purpose for this course? **After the completion of teaching this course the student should be able to:** - Remind principles, concepts and knowledge necessary in the field of algorithms - Retrieve the theoretical background of adequate knowledge of algorithms - Use the logical and independent creator thinking in the field of algorithms - Apply and interprets the experiments and analyze the results and places the appropriate solutions in the field of algorithms - Use the fundamentals of mathematical and statistical methods in the field of algorithms.
2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)

In this course introduction to algorithm will be introduced: Algorithms descriptions, Algorithms & Flowcharts, Algorithms and Pseudocode. Algorithms analysis: Worst, Best and average case analysis. Recurrences and asymptotic. Algorithm design techniques : Divide-and-conquer and Brute-force algorithms. Efficient algorithms for sorting and searching, : Merge sorting ,Quick sorting, Insertion sorting ,Selection sorting ,Shell sorting ,Sequential search and Binary Search. Graph algorithms; and shortest paths: Depth first search algorithms and Breadth first search algorithms. Complex problem algorithms: Greedy Algorithms Dynamic programming, Dijkstra's algorithm, knapsack problem, Hanoy Tower problem and the traveling-salesman problem.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Introduction to Algorithms What Is An Algorithm? Algorithms Descriptions Algorithms & Flowcharts Examples	1	2
Algorithms and PseudoCode with Examples	1	2
Control Structures Decision Structures Examples	1	2

Algorithm Analysis Algorithm specification Time versus space Complexity of Algorithms Time complexity Space complexity	1	2
Asymptotic Notations and Basic Efficiency Classification Order notation Omega notation Theta notation Order of growth classifications Worst, Average, and Best Cases Examples : Sequencing algorithms Repetition in algorithms Conditions in algorithms Recursive in algorithms Fibonacci numbers and arithmetic sequences/ progression algorithms Comparison of algorithms without hardware consideration	2	4
Algorithm Design Techniques /strategies Divide-and-conquer: Brute-force algorithms	1	2
Sorting algorithms Types of sorting algorithms Internal sorting and external sorting Merge sorting Quick sorting Insertion sorting Selection sorting Shell sorting An Empirical Comparison of Sorting Algorithms	3	6
Searching algorithms Concept of searching Sequential search Binary Search	2	4
Graphics Algorithms Depth first search algorithms Breadth first search algorithms	1.5	3
Complex problem algorithms Greedy Algorithms Dynamic programming Dijkstra's algorithm knapsack problem Hanoy Tower problem The traveling-salesman problem	1.5	3

1. Topics to be Covered in the Lab		
List of Topics	**No. of Weeks**	**Contact Hours**
Implementation of Algorithms Examples of: **Algorithms & Flowcharts**	1	2
Implementation of Algorithms Examples of: **Algorithms and PseudoCode**	1	2
Implementation of Algorithms Examples of: Control Structures Decision Structures	1	2
Algorithms Analysis Implementation of Algorithms Examples of : Sequencing algorithms Repetition in algorithms Conditions in algorithms Recursive in algorithms Fibonacci numbers and arithmetic sequences/ progression algorithms Comparison of algorithms without hardware consideration	3	6
Implementation of Algorithms Examples of : Merge sorting Quick sorting Insertion sorting Selection sorting Shell sorting An Empirical Comparison of Sorting Algorithms	3	6
Implementation of Algorithms Examples of : Sequential search Binary Search	1.5	3
Implementation of Algorithms Examples of: Depth first search algorithms Breadth first search algorithms	1.5	3
Complex problem algorithms Implementation (as far as possible) of Algorithms Examples of: Greedy Algorithms Dynamic programming Dijkstra's algorithm knapsack problem Hanoy Tower problem The traveling-salesman problem	2	4

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	30	0	30	0	0	60
Credit	30		15			45

3. Additional private study/learning hours expected for students per week.	3

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

Course Learning Outcomes, Assessment Methods, and Teaching Strategy work together and are aligned. They are joined together as one, coherent, unity that collectively articulate a consistent agreement between student learning, assessment, and teaching.

The ***National Qualification Framework*** provides five learning domains. Course learning outcomes are required. Normally a course has should not exceed eight learning outcomes which align with one or more of the five learning domains. Some courses have one or more program learning outcomes integrated into the course learning outcomes to demonstrate program learning outcome alignment. The program learning outcome matrix map identifies which program learning outcomes are incorporated into specific courses.

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. **Fourth**, if any program learning outcomes are included in the course learning outcomes, place the @ symbol next to it.

Every course is not required to include learning outcomes from each domain.

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize how to create and design solutions with different strategies	- **Lecture** - Discussion - Brain Storming	- Achievement Exam
1.2	Describes the student how to use many of the algorithms in solving realistic problems	- **Lecture** - Discussion - Problem Solving - Brain Storming	- Achievement Exam
2.0	**Cognitive Skills**		
2.1	Recognizes how to find design solutions to various strategies.	- **Lecture** - Discussion - Problem Solving - Brain Storming	- Achievement Exam - Projects
2.2	The student detects/ recognizes use many of the algorithms in solving realistic problems.	- **Lecture** - Discussion - Self learning - Brain Storming - Problem Solving	- Problem Solving - Projects
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work effectively in the working groups	- Cooperation Education	- Projects
3.2	Communicate positively with other students	• Lecture • Discussion	- - Projects
4.0	**Communication, Information Technology, Numerical**		
4.1	Uses Modern technology in presentation and report writing	• Discussion • Lecture • Self learning • Problem solving • Cooperation education	• Projects
4.2	Uses modern technology to connect with others and fruitful cooperation with them in a sustainable manner	• Discussion • Lecture • Self learning • Problem solving • Cooperation education	• Projects
5.0	**Psychomotor**		

Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching

NQF Learning Domains	Suggested Verbs
Knowledge	list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write
Cognitive Skills	estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise
Interpersonal Skills & Responsibility	demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write
Communication, Information Technology, Numerical	demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize
Psychomotor	demonstrate, show, illustrate, perform, dramatize, employ, manipulate, operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct

Suggested ***verbs not to use*** when writing measurable and assessable learning outcomes are as follows:

Consider	Maximize	Continue	Review	Ensure	Enlarge	Understand
Maintain	Reflect	Examine	Strengthen	Explore	Encourage	Deepen

Some of these verbs can be used if tied to specific actions or quantification.

Suggested assessment methods and teaching strategies are:

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture, debate, small group work, whole group and small group discussion, research activities, lab demonstrations, projects, debates, role playing, case studies, guest speakers, memorization, humor, individual presentation, brainstorming, and a wide variety of hands-on student learning activities.

5. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Mid-term exam	8	15
2	Quizzes	During the semester	10
3	Mid-Tem Lab Assignments	10	10
	Assignments	During the semester	5
4	Final Lab Assignment	15	10
5	Final Exam	At the end of semester	40
6	Attendance	During the semester	10

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

E. Learning Resources

1. List Required Textbooks

Algorithms (4th Edition) by Robert Sedgewick, Kevin Wayne ,2013
Levitin, Anany. Introduction to the design & analysis of algorithms, 3rd ed. Pearson Addison-Wesley, 2012.

2. List Essential References Materials (Journals, Reports, etc.)

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

- Steven S. Skiena The Algorithm Design Manual Second Edition, Springer-Verlag London Limited 2008, ISBN: 978-84800-069-8 e-ISBN: 978-1-84800-070-4
- Michael Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley, 2002

Introduction to Algorithms, McGraw Hill, New York, Thomas H, Charles E. 2001

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)

- http://www.algorist.com/
- http://www.cs.uiuc.edu/~jeffe/teaching/algorithms/
- https://www.coursera.org/course/algo

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) - **Lecture Room with 30 chairs, data show , lecturer desktop, and good lighting.**

2. Computing resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching: ✓ Distribution of a questionnaire for students to know how to achieve the goals in the theoretical and practical side.
2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor: ✓ Discussions with colleagues who specialize in teaching methods and means of learning. ✓ Self-evaluation of the performance of the teacher. ✓ Discussions with other colleagues who taught this course.
3 Processes for Improvement of Teaching ✓ Diagnose weaknesses and turn them into strengths. ✓ Discussions about the decision and methods of teaching ✓ Study the needs of the labor market of college graduates
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

Faculty or Teaching Staff: __Dr. Ahmed Abdu Alattab

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Signature: _____ **Date Report Completed: _____**

Received by: _____ **Dean/Department Head**

Signature: _____ **Date: _____**