ATTACHMENT 2 (e)

Course Specifications

Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Course Specification

Problem Solving Skills
14021601-3

Course Specification

Institution **Umm Al Qura University**	Date of Report: **07-1437 / 04-2016**
College/Department **College of Computers and Information Systems** **Information Systems Department**	

A. Course Identification and General Information

1. Course title and code:
Problem Solving Skills
14021601-3

2. Credit hours
3 credits

3. Program(s) in which the course is offered.
Information Systems, Bachelor of Science

4. Name of faculty member responsible for the course
dr. Skander Turki

5. Level/year at which this course is offered
1st year (after preparatory)/ level 3

6. Pre-requisites for this course (if any)
None

7. Co-requisites for this course (if any)

8. Location if not on main campus:
Delivered in the four locations where the Information Systems BSc is given:
- Al Abidiyya main campus boys section,
- Al Zahir main campus girls section,
- Al Qunfuda Boys section,
- Al Qunfuda Girls section.

9. Mode of Instruction (mark all that apply)

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

Comments:

B Objectives

1. What is the main purpose for this course? a- Apply problem solving strategies b- Develop intuition-driven strategies selection c- Understand and apply problem generalization and problem abstraction d- Apply simple mathematics to solve real world problems/puzzles e- Improve computational thinking
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) Develop a lab manual for a series of sessions on a robots block-programming simulator such as Scratch, Robot Emile, or a Logo Turtle- like graphical tool. Use as textbook: **Puzzle-based Learning: Introduction to critical thinking, mathematics, and problem solving. Matthew Michalewicz** But also make use of online puzzles websites, robots programming simulators and visual block-programming tools.

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

1 Topics to be Covered		
List of Topics	No of Weeks	Contact hours per week
Introduction to number theory	3	2
Understanding the problem: Through puzzles, we illustrate how problem misunderstanding leads to wrong answers: The student learns that spending sufficient time understanding the problem makes the difference.	1	2
Intuition: Through simple puzzles, we illustrate how intuition can be biased. The student learns that relying too much on intuition without analyzing the problem is dangerous. Solid calculations are much more reliable.	1	2
Modeling the problem: Through puzzles, we illustrate the importance of building a simple model of the problem yet keeping significant details. The student learns how to abstract a problem statement and define appropriate models of his problem clearly stating its variables, constraints and objectives. We also show how a bad model may be counterproductive.	2	2
Basic mathematical principles: We illustrate basic mathematical principles and how they can solve apparently complex puzzles. Invariance principle, Extremal principle, problem decomposition and devide & conquer.	2	2
Solving simple constraint satisfaction problems through puzzles.	1	2
Solving simple optimization problems through puzzles: Translate the objective to an evaluation function then search for the best feasible solution.	1	2
Solving simple probability problems.	1	2
Solving simple statistics problems. Show the importance of the sampling process.	1	2

Pattern recognition: Pattern identification in sequences, numbers, actions or events in order to discover future ones: Generalization of the solution. Misleading patterns are illustrated.	2	2
Illustrate different strategies for problem solving. Discovering winning strategy. Difficulty of strategy generalization.	1	2
Labs Description		
Simple Algorithm Design : Computational Thinking through the use of "Turtle" to draw geometrical figures by sequencing instructions executed by a drawing turtle.	7	14
Other simple robotics simulation environments are used to introduce in an attractive way basic computational thinking concepts to the student: -Instruction sequences. -Variables and assignment. -Problem decomposition.	9	18

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	32		32			64
Credit	80%		20%			3 credits

3. Additional private study/learning hours expected for students per week.	4

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	Understand problem solving strategies	Lab work, use of robotics simulators such as Turtle, Scratch, etc. Problem sets, Puzzles.	LAB EXAMS with personal presentation and explanation of student's solutions to the lab instructor EXAMS
1.2	Understand problem generalization and problem abstraction		
1.3	Understand simple mathematics and its applications to solve real world problems/puzzles		
1.4	Understand basics of computational thinking		
2.0	**Cognitive Skills**		
2.1	Apply problem solving strategies	Exercises, lab problem	Quizzes and/or Online Quizzes, Midterm, Final Exam
2.2	Develop intuition-driven strategies selection	Exercises, lab problem	
2.3	Apply problem generalization and problem abstraction	Exercises, lab problem	
2.4	Apply simple mathematics to solve real world problems/puzzles	Exercises, lab problem	
2.5	Improve computational thinking	Exercises, lab problem	
3.0	**Interpersonal Skills & Responsibility**		
3.1	N/A		
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of simple educational robotics simulations environments	Lab work, use of robotics simulators such as Turtle, Scratch, etc.	Lab Exams
5.0	**Psychomotor**		
5.1	N/A		

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
	estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop,

Cognitive Skills	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	Assessment task (eg. essay, test, group project, examination etc.)	Duration in weeks	Proportion of Final Assessment
1	Problem sets	Bi-monthly	10%
2	Online Quizzes	Every 3 weeks	10%
3	Midterm Exam	Eight week	20%
4	2 Lab Exams	Eight and fifteenth week	30%
5	Final exam	Exams week	30%

D. Student Support

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

Office hours

E Learning Resources

1. Required Text(s) : a- Algorithmic Problem Solving, R. Blackhouse, John Wiley & Sons, 2011, ISBN-13: 978-0470684535 b- Puzzle-based Learning: Introduction to critical thinking, mathematics, and problem solving. Matthew Michalewicz, http://www.amazon.com/Puzzle-based-Learning-Introduction-critical-mathematics/dp/1876462639/ref=sr_1_1?ie=UTF8&s=books&qid=1212262753&sr=1-1
2. Essential References a- Adventures in Group Theory: Rubik's Cube, Merlin's Machine, and Other Mathematical Toys: http://mike.verdone.ca/media/rubiks.pdf
3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)
4-.Electronic Materials, Web Sites etc
5- Other learning material such as computer-based programs/CD, professional standards/regulations

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) - Data Show - Computer Lab
2. Computing resources - Computer PCs with the following software installed 1. Scratch (MIT free software) : *http://scratch.mit.edu/* 2. Tutle Academy online site: http://www.brainpop.com/games/turtleacademy/
3. Other resources (specify --eg. 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 End-of-term course/teacher evaluation for is to be completed by students at the end of the semester, evaluating the content of the course, its teaching, the learning, assessment methods.. The monitoring of these students feedback will allows the course quality improvement

2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Peer Evaluation Procedure • Instructor self-evaluation
3. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) • Upon student request, his/her work might be remarked by another faculty member within the department.
4 Processes for Improvement of Teaching • (Self , Peer) Review, Identify, Analyse, and Revise
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. - Review and update course content - Update course references - Use students feedback

Faculty or Teaching Staff: _____

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

Received by: _____ **Dean/Department Head: Dr. Skander Turki**

Signature: _____ **Date: 07-1437 / 04-2016**