Course Name: Intelligent and Quantum Computers
Course Code: IT445

I. Basic Course Information

Major or minor element of program: Major
Department offering the course: Information Technology Department

Academic level: 400 Level
Semester in which course is offered: First (Fall) Semester
Course pre-requisite(s): Mathematics - 3 [MA 214]

Credit Hours: 3
Contact Hours Through:

Lecture	Tutorial*	Practical*	Total
2.5	0.0	1.5	4.0

* 1.5 hours for **either** Tutorial or Practical

Approval date of course specification: September 2014

II. Overall Aims of Course

Introducing concepts, models, algorithms, and tools for development of intelligent systems, introduce foundation of quantum and describe simple algorithms based on quantum mechanical systems.

III. Program ILOs covered by course

Program Intended Learning Outcomes (By Code)			
Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
K1,K13,K17	I2,I11,I14	P14,P15,P18	G1,G2,G5

IV. Intended Learning Outcomes of Course (ILOs)

a. Knowledge and Understanding

On completing the course, students should be able to:

K.1 Explainfundamentals of computational intelligence models.
K.2 Recognize principles of quantum superposition and quantum measurement.
K.3 Manipulate tensor-product states, use and explain the concepts of entanglement.

b. Intellectual/Cognitive Skills

On completing the course, students should be able to:

I.1 Implement neural networks, genetic algorithms, fuzzy neural networks, and ant colony optimization algorithms.
I.2 Apply computational intelligence techniques to classification, pattern recognition, prediction, rule extraction, and optimization problems.
I.3 Develop user modelling.
I.4 Use the basic linear algebra tools of quantum information theory.

c. Practical/Professional Skills

On completing the course, students should be able to:

P.1 Apply different computational intelligence techniques to classification.
P.2 Modify applications for entanglement such as quantum teleportation and quantum secret key.
P.3 Solve range of simple problems involving one or two quantum bits.

d. General and Transferable Skills

On completing the course, students should be able to:

G.1 Improve management skills.
G.2 Improve team work skills.
G.3 Develop better work ethics through valuing individual efforts and strictly prohibiting plagiarism.
G.4 Learn to follow design requirements through requiring precise understanding of written questions.

V. Course MatrixContents

	Main Topics / Chapters	Duration (Weeks)	Course ILOs Covered by Topic (By ILO Code)			
			K & U	I.S.	P.S.	G.S.
1-	Computational intelligence	2	K1	I1	P1	
2-	Data transformation	2	K1		P1,P2	G1
3-	Classical computation	1	K1,K2			G2
4-	Connect type activities	1		I2	P2	
5-	Introduction to quantum machine	2		I2	P3	
6-	Quantum computation	1			P2	G3
7-	Quantum communication	1	K3	I3,I4		G3
8-	Physical realizations	3			P3	G4
	Net Teaching Weeks	**13**				

VI. Course Weekly Detailed Topics / hours / ILOs

Week No.	Sub-Topics	Total Hours	Contact Hours	
			Theoretical Hours	Practical Hours*
1	Computational intelligence	2.5	2.5	
2	Computational intelligence cont'd	4	2.5	1.5
3	Data transformation	4	2.5	1.5
4	Data transformation cont'd	4	2.5	1.5
5	Classical computation	4	2.5	1.5
6	Connect type activities	4	2.5	1.5
7	**Midterm Exam**			
8	Introduction to quantum machine	4	2.5	1.5
9	Introduction to quantum machine cont'd	4	2.5	1.5
10	Quantum computation	4	2.5	1.5
11	Quantum communication	4	2.5	1.5
12	Physical realizations	4	2.5	1.5
13	Physical realizations cont'd	4	2.5	1.5
14	Physical realizations cont'd	4	2.5	1.5
15	**Final Exam**			
Total Teaching Hours		**51**	**33**	**18**

* **No Practical/Tutorial during the first week of the semester**

VII. Teaching and Learning Methods

Teaching/Learning Method	Selected Method	Course ILOs Covered by Method (By ILO Code)			
		K & U	Intellectual Skills	Professional Skills	General Skills
Lectures & Seminars	X	All	All		
Tutorials					
Computer lab Sessions					
Practical lab Work	X			All	
Reading Materials	X	All	All		
Web-site Searches	X	All	All		
Research & Reporting					
Problem Solving / Problem-based Learning					
Projects					
Independent Work					
Group Work	X	All			All
Case Studies					
Presentations					
Simulation Analysis					
Others (Specify):					

VIII. Assessment Methods, Schedule and Grade Distribution

Assessment Method	Selected Method	Course ILOs Covered by Method (By ILO Code)				Assessment Weight / Percentage	Week No.
		K & U	I.S.	P.S.	G.S.		
Midterm Exam	X	All	All			15%	7
Final Exam	X	All	All			60%	15
Quizzes	X	All	All			10%	5,9
Course Work							
Report Writing							
Case Study Analysis							
Oral Presentations							
Practical	X			All		10%	10
Group Project	X	All	All	All	All	5%	12
Individual Project							
Others (Specify):							

IX. List of References

Essential Text Books	• Russel C.E., Yuhui S. Computational Intelligence Concepts to Implementations, Elsevier, 2007. • Principle of quantum computation and information Volume I: basic concepts. By Giuliano Benenti and Giulio Casati, 2004
Course notes	• The slides for lectures
Recommended books	• None
Periodicals, Web sites, etc …	• Various

X. Facilities required for teaching and learning

- Any Development System platform

Course coordinator: Prof. Hoda Mohamed Onsi

Head of Department: Prof. Reda Abd el-Wahab

Date: September 2014