جامعة أم القرى

كلية الحاسب الآلي ونظم المعلومات

الماجستير في علوم الحاسب الآلي

(الذكاء الاصطناعي برسالة)

4. Learning and Teaching

4/1 Learning Outcomes and Graduate Specifications

4/1/1 Main tracks or specializations covered by the program:

(a)

(b)

(c)

4/1/2 Curriculum Study Plan Table (Courses & Thesis)

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	14016162-3	Fundamentals of Artificial Intelligence	Required	---	3
	14016163-3	Machine Learning	Required	---	3
	14016165-3	Data Mining	Required		3
	14016166-3	Optimization Methods	Required	---	3
Level 2	14016262-3	Neural Network	Required	---	3
	14016263-3	Natural Language Processing	Required	---	3
	14016264-3	MS Group Project	Required	---	1
	14016xxx-3	Elective 1	Elective	See elective list	3
	14016xxx-3	Elective 2	Elective	See elective list	3
Level 3	14016461-2	Independent Studies I	Required	---	**2**
	14016464-9	Thesis	Required	Completion of Level 1 & 2 courses	To be continue next level
Level 4	14016462-2	Independent Studies II	Required	---	2
	14016464-9	Thesis	Required	Completion of Level 1 & 2 courses	9
		TOTAL			**38**

- ***List of elective courses is given separately***

Include additional levels or courses if needed

Elective Courses

Serial Number	Course ID	Course Name	Pre-Requisite
1	14016473-3	Research Methodology in CS	---
2	14016474-3	Reinforcement Learning	---
3	14016475-3	Data Visualization	---
4	14016476-3	Pattern Recognition	---
5	14016477-3	Social Media Analytics	---
6	14016478-3	Introduction to Robotics	---
7	14016481-3	Distributed Systems	---
8	14016482-3	Advances Topics in Artificial Intelligence	---
9	14016483-3	Automatic Speech Recognition	---
10	14016484-3	Deep Learning	---
11	14016485-3	Evolutionary Computation	---
12	14016486-3	IoT Systems	---
13	14016487-3	Computer Vision	---
14	14016488-3	Advanced Topics in Information Security	---
15	14016489-3	Advances Topics in Cloud Computing	---

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Fundamentals of Artificial Intelligence

Course Code: 14016162-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Fundamentals of Artificial Intelligence 14016162-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 1
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This is course introduces students the field of Artificial Intelligence and review basic mathematical concepts needed for solving AI related problems.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course serves as a broad introduction to the field of Artificial Intelligence. First the course reviews the mathematical concepts and methods needed to solve the problems of AI such as of linear algebra, calculus, and complex analysis. After covering basic mathematical concepts, the course introduces basic principles of AI such as: programming tools of AI, problem representation and search techniques, constraint Satisfaction, classical planning uncertain knowledge and reasoning, decision making

	1. Topics to be Covered		
	List of Topics	**No. of Weeks**	**Contact hours**
Introduction to artificial intelligence		1	3
Basic Math for AI	Linear Algebra	1	3
	Vector Calculus and analytic geometry	1	3
	Ordinary differential equations	1	3
	Complex Analysis	1	3
	Basics of information theory	1	3
Programming tools for AI		1	3
Problem representation and search techniques		1	3
Constraint Satisfaction		1	3
Classical Planning and Acting in the Real World		2	6
Uncertain knowledge and reasoning		2	6
Decision making		1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	A comprehensive introduction to AI and its programming tools	Lecture, Group discussion	Exams, Homework, Quizzes
1.2	Recognizing different search and optimization techniques with their applications	Group discussion, research activities,	Exam, Homework, Quizzes
1.3	Recognizing different real-world applications of AI including planning, reasoning and decision making	Lecture, Group discussion, research activities	Exam, Homework, Quizzes
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate an AI based system, process, component, or program to meet desired needs.	Lecture, Case studies, research activities	Exams, Reports
2.2	Investigate real-world problems in the context of AI and design innovative solutions	Lecture, Case studies, research activities,	Exams, Reports
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation

3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism software, Report, Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Group presentation
4.2	Use of latest information technologies	Lectures, Project	Project Report, Home works, Group presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for an intelligent system	Research activities, Projects	Reports, Research paper, Group presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Quiz 3	7	3.3%
6	Midterm Exam	9	20%
7	Homework 3	10	3.3%
8	Project Report	12	15%
9	Project Presentations	13	5%
10	Final Exam	15	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. S. Russell and P. Norvig. Artificial Intelligence: A Modern Approach. Prentice Hall, Third Edition (2009). ii. Poole, David L., and Alan K. Mackworth. Artificial Intelligence: foundations of computational agents. Cambridge University Press, 2010.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in AI related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python, WEKA or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Mohsin Bilal

Signature: *Mohsin Bilal* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Machine Learning

Course Code: 14016163-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Machine Learning 14016163-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 1
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course serves as an introductory class into the field of Machine Learning.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course introduces the students to the field of Machine Learning (ML). ML is concerned with building systems and developing algorithms able to learn from past experiences to gain some insights of the future experiences. This course will overview some of the important concepts and techniques related to ML from both theoretical and practical perspectives.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Learning Theory	2	6
Convergence, Bias/Variance tradeoff, VC theory, Large Margins	2	6
Supervised Learning (SVM, Naive Bayes, etc.)	2	6
Unsupervised Learning	1	3
Decision Trees and Random Forests	2	6
Genetic Algrithms	2	6
Kernel Methods	1	3
Deep Learning	1	3
Reinforcement Learning	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3

	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamental concepts of machine learning and learning theory	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	Recognize a variety of techniques to model supervised learning via regression and classification	Lecture, Group discussion	Exam, HWs, Quizzes
1.3	Recognize a variety of techniques to model unsupervised learning	Lecture, Group discussion	Exam, HWs, Quizzes
1.4	Recognize the fundamental concepts and techniques of reinforcement and deep learning	Lecture, Group discussion	Exams, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Design and implement a machine learning based system, process, component or program to meet desired needs.	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Group presentation

4.2	Use of latest information technologies	Lectures, Project	Project Report, Home works, presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required related to the subject	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Quiz 1	2	2.5%
2	Homework 1	3	2.5%
3	Quiz 2	4	2.5%
4	Homework 2	5	2.5%
5	Quiz 3	6	2.5%
6	Homework 3	7	2.5%
7	Midterm Exam	9	20%
8	Quiz 4	11	2.5%
9	Homework 4	12	2.5%
10	Project Report	13	15%
11	Project Presentations	14	5%
12	Final Exam	15	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. S. Russell and P. Norvig. Artificial Intelligence: A Modern Approach. Prentice Hall, Third Edition (2009). ii. Bishop, Christopher M. Pattern recognition and machine learning. springer, (2006). iii. M. Tim Jones. AI Application Programming, (2005).
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Machine Learning related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python, WEKA or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

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2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Mohsin Bilal

Signature: *Mohsin Bilal* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Data Mining

Course Code: 14016165-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Data Mining 14016165-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Muhammad Arif
5. Level/year at which this course is offered: 2 or 3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of data mining to analyze large datasets.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. It is currently regarded as the key element of a more general process called Knowledge Discovery that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to data mining	1	3
Data Warehouse	2	6
Data preprocessing	1	3
Data mining knowledge representation	1	3
Attribute-oriented analysis	1	3
Data mining algorithms: Association rules	2	6
Data mining algorithms: Classification	2	6
Data mining algorithms: Prediction	1	3
Evaluation measures	1	3
Clustering	1	3
Advanced techniques, Data Mining software and applications	1	3

2. Course components (total contact and credit hours per semester):

	Lecture	Tutorial	Laboratory/	Practical	Other	Total

				Studio			
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand basics of data mining	Lectures	Exam, Quizzes
1.2	Understand data preprocessing and knowledge representation	Lectures	Exams, Homework, Quizzes
1.3	Understand different data mining and clustering algorithms in real world applications	Lectures	Exam, Homework, Quizzes
1.4	Identify current tools for data mining applications	Lectures, Project	Exam, Homework, Project report
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate data mining algorithms	Lecture, Case studies	Exams, Quizzes, Homework
2.2	Evaluate data mining algorithms using evaluation measures	Lecture, Case studies,	Exams, Quizzes, Homework
2.3	Design, implement and evaluate real world data mining application	Group discussion, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		

3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Demonstrate the ability to apply recent tools in Data mining application	Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of data mining algorithms	Lecture, Case studies	Exams, homework
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required related to the subject	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 2011. ii. Witten, Ian H., Eibe Frank, Mark A. Hall, and Christopher J. Pal. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann, 2016.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Data Mining related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

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3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Muhammad Arif

Signature: *Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Optimization Methods

Course Code: 14016166-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Optimization Methods 14016166-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Muhammad Arif
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course covers the main concepts of optimization

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Several problems in many areas such as machine learning, computer vision, data analysis, scheduling, etc. require optimization. This course will teach students computational methods for linear, nonlinear, network, and integer optimization.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to the need of optimization in AI	1	3
Unconstrained optimization methods – Gradient methods	1	3
Unconstrained optimization methods – Newton-like methods	1	3
Unconstrained optimization methods – Conjugate direction methods	1	3
Unconstrained optimization methods – Restricted step methods	1	3
Sum of squares and Nonlinear equations	1	3
Constrained optimization – Linear programming	1	3
Constrained optimization – Quadratic programming	1	3
Constrained optimization – Nonlinear programming	2	6
Optimization using meta-heuristics methods, e.g., Particle Swarm Optimization (PSO)	2	6
Discrete optimization	2	6

2. Course components (total contact and credit hours per semester):

	Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total

Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand basics of mathematics and statistics required for optimization	Lectures	Exam, Quizzes
1.2	Understand unconstrained and constrained optimization algorithms	Lectures	Exams, Homework, Quizzes
1.3	Understand different meta-heuristic optimization methods	Lectures	Exam, Homework, Quizzes
1.4	Understand discrete optimization methods	Lectures	Exam, Homework, Quizzes
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate constrained and unconstrained optimization methods	Lecture, Case studies	Exams, Quizzes, Homework, Reports,
2.2	Design, implement and evaluate heuristic methods-based optimization	Lecture, Case studies,	Exams, Reports
2.3	Design, implement and evaluate discrete optimization methods	Group discussion, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work in a group to accomplish an application of optimization methods	Group discussion, Project	Project Report, Project presentation

4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of optimization methods	Lecture, Case studies	Exams
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Rardin, Optimization in Operations Research, 2nd Edition, Pearson 2017. ii. Fletcher, Roger. Practical methods of optimization. John Wiley & Sons, 2013. iii. Chong, Edwin KP, and Stanislaw H. Zak. An introduction to optimization. Vol. 76. John Wiley & Sons, 2013.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Optimization related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Muhammad Arif

Signature: *Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Neural Network

Course Code: 14016262-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Neural Network 14016262-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 2
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of neural networks and their application in real world applications.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

In this course the students will be introduced to various neural network models and algorithms, adaptive behavior, associative learning, competitive dynamics and biological mechanisms. Several applications of artificial neural networks will be studied including computer vision, cognitive information processing, control, and signal analysis.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Model Building through Regression	1	3
The Least-Mean-Square Algorithm	1	3
Multilayer Perceptrons	1	3
Kernel Methods and Radial-Basis Function Networks	1	3
Support Vector Machines	1	3
Regularization Theory	1	3
Principal-Components Analysis (PCA)	1	3
Self-Organizing Maps (SOM)	1	3
Information-Theoretic Learning Models	1	3
Stochastic Methods	1	3
Dynamic Programming	1	3
Neurodynamics	1	3
Bayesian Filtering for State Estimation of Dynamic Systems	1	3
Dynamically Driven Recurrent Networks	1	3

2. Course components (total contact and credit hours per semester):							
		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the basics of neural network design, algorithms, and supervised model building though regression and MLP	Lecture, Group discussion	Exams, Homework, Quizzes
1.2	Understand different types of neural network including RFB, SVM and regularization theory	Lecture, Group discussion	Exam, Homework, Quizzes
1.3	Understand PCA and SOM and different learning models	Lecture, Group discussion	Exam, Homework, Quizzes
1.4	Understand Neurodynamics and Dynamically Driven Recurrent Networks	Lecture, Group discussion	Exams, Homework, Quizzes
2.0	**Cognitive Skills**		
2.1	Design and implement an ANN based system, process, component or program to meet desired needs.	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
2.2	Investigate real world problems in the context of Neural Network and design innovative solutions	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project

3.0	**Interpersonal Skills & Responsibility**		
3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project research activities, Project	Project Report, Group presentation
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	2.5%
2	Homework 1	3	2.5%
3	Quiz 2	4	2.5%
4	Homework 2	5	2.5%
5	Midterm Exam	7	20%
6	Quiz 3	8	2.5%
7	Homework 3	9	2.5%
8	Quiz 4	11	2.5%
9	Homework 4	12	2.5%
10	Project Report	13	15%
11	Project Presentations	14	5%
12	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Haykin, Simon S. Neural networks and learning machines. Vol. 3. Upper Saddle River, NJ, USA: Pearson, 2009
ii. Demuth, Howard B., Mark H. Beale, Orlando De Jess, and Martin T. Hagan. Neural network design. Martin Hagan, 2014.
iii. Rojas, Raúl. Neural networks: a systematic introduction. Springer Science & Business Media, 2013.
iv. Samarasinghe, Sandhya. Neural networks for applied sciences and engineering: from fundamentals to complex pattern recognition. CRC Press, 2016.

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

i. Recent Papers in Neural Networks related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i.

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

i. MATLAB, Python, or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Mohsin Bilal

Signature: *Mohsin Bilal* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Natural Language Processing

Course Code: 14016263-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Natural Language Processing 14016263-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Muhammad Arif
5. Level/year at which this course is offered: 2
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of natural language processing (NLP).

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course introduces computational linguistics, from morphology (word formation) and syntax (sentence structure) to semantics (meaning), and natural language processing applications such as parsing, machine translation, generation and dialog systems.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Basic Text Processing	1	3
Finite-state methods for morphology	1	3
N-gram Language Models	1	3
Word Classes and Part-of-Speech Tagging	1	3
Hidden Markov Model and Maximum Entropy Models	1	3
Grammar Formalisms and Treebanks	1	3
Parsing with Context Free Grammars	1	3
Statistical Parsing and Probabilistic Context Free Grammars	2	6
Lexical Semantics and Word Sense Disambiguation	1	3
Semantic Role Labeling and Semantic Parsing	1	3
Information Extraction	1	3
Question Answering and Summarization	1	3
Sentiment Analysis	1	3

2. Course components (total contact and credit hours per semester):

	Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total

Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand approaches to syntax and semantics in NLP.	Lectures	Exam, Quizzes
1.2	Understand approaches to discourse, generation, dialogue and summarization within NLP	Lectures	Exams, Homework, Quizzes
1.3	Understand current methods for statistical approaches to machine translation	Lectures	Exam, Homework, Quizzes
1.4	Recognize the application of NLP in real world applications	Lectures, Case studies, Project	Exam, Project Report
1.5	Identify current tools for NLP	Lectures, Project	Project report
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate methods for NLP	Lecture, Case studies	Exams, Quizzes, Homework
2.2	Design, implement and evaluate relevant machine learning techniques for NLP	Lecture, Case studies,	Exams, Reports
2.3	Develop an NLP system for a real-world problem	Group discussion, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work in a group to accomplish an application of NLP	Group discussion, Project	Project Report, Project presentation

3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Demonstrate the ability to apply recent tools in NLP	Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of NLP systems	Lectures, Project	Exam, Project Report, Project presentation
5.0	**Psychomotor (if any)**		

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. D.Jurafsky, J.H.Martin, Speech and Language Processing2nd Edition, Pearson-Prentice Hall, 2009.
ii. Kumar, Ela. Natural language processing. IK International Pvt Ltd, 2011.
iii. Lehnert, Wendy G. Strategies for natural language processing. Psychology Press, 2014.
iv. Clark, Alexander, Chris Fox, and Shalom Lappin, eds. The handbook of computational linguistics and natural language processing. John Wiley & Sons, 2013.

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

i. Recent Papers in NLP related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i.

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

i. MATLAB, Python or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Muhammad Arif

Signature: *Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: MS Group Project

Course Code: 14016264-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: MS Group Project 14016264-3
2. Credit hours: 1
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2
6. Pre-requisites for this course (if any):
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		percentage?	
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	100

Comments:

B Objectives

1. The main objective of this course

The main objective of MS Group Projects to provide students an opportunity to investigate a real-life problem, related to their field of study, and find its solution that demonstrate the skills they learnt during the master program. The project requires students to work collaboratively on an area of interest with the support of an advisor.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

A committee will be formed to evaluate the proposals of projects. To improve the quality of research, the committee may ask to enhance to scope of a group project. Students will be encouraging to choose group project from the latest trends in the field of Artificial Intelligence.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

For group project, a group of students must choose a topic related to Artificial Intelligence, which they would like to do a scientific group project. The main parts of a group project are: doing actual research, implementation (e.g., programming), writing about the results, and presenting the results. The assessment must be conducted thoroughly to ensure all group members contribute to the project outcome.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)		

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	As needed					As needed
	Actual	As needed					As needed
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Artificial Intelligence in solving real life problems	Discussion with advisor	Seminar Presentation
1.2	An ability to identify current techniques, skills, and tools necessary for the development of computer-based systems	Discussion with advisor	Seminar Presentation
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate Artificial Intelligence related system, process, component, or program to meet desired needs.	Discussion with advisor	Seminar Presentation
2.2	Investigate real world problems in the context of Artificial Intelligence and design innovative solutions	Discussion with advisor	Seminar Presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Discussion with advisor	Seminar Presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Discussion with advisor	Seminar Presentation
3.3	Act ethically and responsibly with high moral standards	Discussion with advisor	Seminar Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Discussion with advisor	Seminar Presentation
4.2	Use of latest information technologies	Discussion with advisor	Seminar Presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of intelligent systems	Discussion with advisor	Seminar Presentation

5.0	Psychomotor (if any)		
5.1	Ability to operate and construct necessary tools required for computing system	Discussion with advisor	Seminar Presentation

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Presentation of Group project	1-14	100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks
2. List Essential References Materials (Journals, Reports, etc.) i. To be decided based on the topic of project
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. The IEEE Computer Society https://www.computer.org/ ii. Association for Computing Machinery https://www.acm.org/
4. 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.) i. Graduate student lab with PCs ii. Seminar room
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Independent Studies I

Course Code: 14016461-2

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Independent Studies I 14016461-2
2. Credit hours: 2
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 3
6. Pre-requisites for this course (if any):
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		percentage?	
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	100

Comments:

B Objectives

1. The main objective of this course

Independent study enables a student to pursue for course credit a research or other academic topic of interest under the supervision of a faculty member. The specific content of an offering of the course should focus on a specific area of Artificial Intelligence.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content because of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. The student and the course supervisor discuss and propose goals and topics. Students are expected to provide a progress report to their supervisor. At the end of the course, a seminar day will be announced in which students shall present their work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Independent Study course is not a regularl schedule course, but is arranged, planned and managed by a supervising faculty member in line with the goals that are proposed by the student, and then approved by the supervisor. The course involves more student self-discipline and a greater sense of direction than ordinary courses. The he student is expected to plan and execute his/her activities with much less monitoring. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)	1-14	42

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	As needed					As needed
	Actual	As needed					As needed
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Artificial Intelligence in solving real life problems	Discussion with advisor	Seminar Presentation
1.2	An ability to identify current techniques, skills, and tools necessary for the development of computer-based systems	Discussion with advisor	Seminar Presentation
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate Artificial Intelligence related system, process, component, or program to meet desired needs.	Discussion with advisor	Seminar Presentation
2.2	Investigate real world problems in the context of Artificial Intelligence and design innovative solutions	Discussion with advisor	Seminar Presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Discussion with advisor	Seminar Presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Discussion with advisor	Seminar Presentation
3.3	Act ethically and responsibly with high moral standards	Discussion with advisor	Seminar Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Discussion with advisor	Seminar Presentation
4.2	Use of latest information technologies	Discussion with advisor	Seminar Presentation

4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of intelligent systems	Discussion with advisor	Seminar Presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for computing system	Discussion with advisor	Seminar Presentation

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Presentation of Independent Studies	14	100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Decided by advisor
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Artificial Intelligence research
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. iii. The IEEE Computer Society https://www.computer.org/ iv. Association for Computing Machinery https://www.acm.org/
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. Decided by advisor

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.) i. Seminar room ii. lab (if needed)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Independent Studies II

Course Code: 14016462-2

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Independent Studies II 14016462-2

2. Credit hours: 2

3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

(If general elective available in many programs indicate this rather than list programs)

4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan

5. Level/year at which this course is offered: 4

6. Pre-requisites for this course (if any):

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		percentage?	
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	100

Comments:

B Objectives

1. The main objective of this course

Independent study enables a student to pursue for course credit a research or other academic topic of interest under the supervision of a faculty member. The specific content of an offering of the course should focus on a specific area of Artificial Intelligence.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. The student and the course supervisor discuss and propose goals and topics. Students are expected to provide a progress report to their supervisor. At the end of the course, a seminar day will be announced in which students shall present their work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Independent Study course is not a regular schedule course, but is arranged, planned and managed by a supervising faculty member in line with the goals that are proposed by the student, and then approved by the supervisor. The course involves more student self-discipline and a greater sense of direction than ordinary courses. The he student is expected to plan and execute his/her activities with much less monitoring. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)	1-14	42

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	As needed					As needed
	Actual	As needed					As needed
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Artificial Intelligence in solving real life problems	Discussion with advisor	Seminar Presentation
1.2	An ability to identify current techniques, skills, and tools necessary for the development of computer-based systems	Discussion with advisor	Seminar Presentation
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate Artificial Intelligence related system, process, component, or program to meet desired needs.	Discussion with advisor	Seminar Presentation
2.2	Investigate real world problems in the context of Artificial Intelligence and design innovative solutions	Discussion with advisor	Seminar Presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Discussion with advisor	Seminar Presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Discussion with advisor	Seminar Presentation
3.3	Act ethically and responsibly with high moral standards	Discussion with advisor	Seminar Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Discussion with advisor	Seminar Presentation
4.2	Use of latest information technologies	Discussion with advisor	Seminar Presentation

4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of intelligent systems	Discussion with advisor	Seminar Presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for computing system	Discussion with advisor	Seminar Presentation

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Presentation of Independent Studies	14	100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. To be decided by advisor
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Artificial Intelligence Research
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. The IEEE Computer Society https://www.computer.org/ i. Association for Computing Machinery https://www.acm.org/
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. To be decided by the advisor

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.) i. Seminar room ii. lab (if needed)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Thesis

Course Code: 14016464-9

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Thesis 14016464-9
2. Credit hours: 9
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 3 and 4
6. Pre-requisites for this course (if any): Completion of Level 1 & 2 courses
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		percentage?	
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	100

Comments:

B Objectives

1. The main objective of this course

The main objective of Thesis is to provide students an opportunity to investigate a research problem, related to their field of study, and find its innovative solution that demonstrate the skills they learnt during the master program. The Thesis requires students to work independently on an area of interest with the support of an advisor.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

A committee will be formed to evaluate the proposal of Thesis. To improve the quality of research, the committee may ask to enhance to scope of Thesis. Students will be encouraging to choose Thesis topic from the latest trends in the field of computer science.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

For Thesis, each student must choose a research topic related to Artificial Intelligence technique, which he/she would like to investigate. A student can select his/her one's own topic or guided by a faculty member to choose a research topic for Thesis. The student must take initiative in finding advisor who will guide him/her during are research. The main parts of a research are: doing actual research, implementation (e.g., programming), writing about the results, and presenting the results.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)		

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	As needed					As needed
	Actual	As needed					As needed
Credit	Planned	9					9
	Actual	9					9

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of computer science in solving real life problems	Discussion with advisor	Seminar Presentation
1.2	An ability to identify current techniques, skills, and tools necessary for the development of computer-based systems	Discussion with advisor	Seminar Presentation
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate computer science related system, process, component, or program to meet desired needs.	Discussion with advisor	Seminar Presentation
2.2	Investigate real world problems in the context of computer science and design innovative solutions	Discussion with advisor	Seminar Presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Discussion with advisor	Seminar Presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Discussion with advisor	Seminar Presentation
3.3	Act ethically and responsibly with high moral standards	Discussion with advisor	Seminar Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Discussion with advisor	Seminar Presentation
4.2	Use of latest information technologies	Discussion with advisor	Seminar Presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of intelligent systems	Discussion with advisor	Seminar Presentation

5.0	Psychomotor (if any)		
5.1	Ability to operate and construct necessary tools required for computing system	Discussion with advisor	Seminar Presentation

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Presentation of Research Project	1-14	100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) iii. Office Hours for student counseling and support – Three hours/week iv. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Decided by advisor
2. List Essential References Materials (Journals, Reports, etc.) ii. Recent Papers in Computer Science Research
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. v. The IEEE Computer Society https://www.computer.org/ vi. Association for Computing Machinery https://www.acm.org/
4. 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.) iii. Seminar room
2. Technology resources (AV, data show, Smart Board, software, etc.) iii. Whiteboard iv. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching ii. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

iii. Course file of the course will be maintained and evaluated by some senior faculty member. iv. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development ii. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) iii. A random sample from the marked papers may be evaluated by an independent senior faculty member. iv. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. iii. Department has curriculum committee that periodically review courses. iv. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Research Methodology in CS

Course Code: 14016473-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Research Methodology in CS 14016473-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 1
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides a graduate-level study of research methodologies in computer science particularly artificial intelligence.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The course will teach state of the art theoretical and practical knowledge of research methodologies used in computer science particularly in artificial intelligence. Students will be assigned assignments and project to implement the research methods techniques to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

In this course, we will study research methodologies used in computer science, particularly in artificial intelligence (AI). The course introduces students to contemporary perspectives in CS/AI research and focuses on developing a range of skills involved in formulating a research proposal; including framing research questions, reviewing the literature and choosing appropriate methodologies for different types of study. The course will cover topics such as experiment design, simulations, statistics, analysis of data, etc. Students will learn various aspects of reading, writing, evaluating papers, and presenting research. There will be assignments during the semester allowing the students to practice different research skills and methodologies covered in the lectures. There will be a semester-long project in which students select, design, and execute research project and present the result at the end of the semester.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Data collection techniques (survey, experiment, questionnaire, etc.)	1	3
Framing research questions and choosing appropriate methodologies	1	3
Experiment design		
Simulation and statistical analysis of data	2	6
Graphs and visualization of data	2	6
Ethics of research	2	6
Accessing research material	1	3
Review literature	1	3
Writing research papers	2	6
Peer review	1	3
Presenting research work	1	3

2. Course components (total contact and credit hours per semester):							
		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamental of Research Methods	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	Ability to apply knowledge of Research Methods in publications, review and presentation	Lecture, Group discussion	Exam, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Apply conceptual understanding of Research Methods	Lecture, Project	Exam, HWs
2.3	Ability to understand publication process used in academic community	Lecture, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation

3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of computing tools used in research	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in research methods	Lecture, Case studies, Project	Exams, Project Report, Project presentation
5.0	**Psychomotor (if any)**		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	HW 1	2	5%
2	HW 2	3	5%
3	HW 3	5	5%
4	HW 4	6	5%
5	Midterm Exam	8	20%
6	Writing Research Paper	10	40%
7	Presentation	15	20%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. John W. Creswell and J. David Creswell. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. SAGE Publications, latest edition. ii. Nigel G. Fielding (Editor), Raymond M. Lee (Editor), Grant Blank (Editor). The SAGE Handbook of Online Research Methods. SAGE Publications, latest edition.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent research papers in related to Research Methods
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. Access to research databases, e.g., IEEE, ACM, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. Decided by the course instructor

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.) i. One classroom (25 seats)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching iii. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member.

ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development ii. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Reinforcement Learning

Course Code: 14016474-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Reinforcement Learning 14016474-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 2
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides knowledge of Reinforcement Learnings and their application in real world applications.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course covers a range of adaptive learning systems, reinforcement learning and unsupervised methods, particularly as used in RL systems. By the end of the module the student should have a grasp of modern learning techniques and the issues involved in dealing with real-world data. The main techniques covered in the course are basic reinforcement learning, dynamic programming, Monte Carlo methods, Q-learning, function approximation, unsupervised and constructive methods, radial basis and other local functions, classifier systems as compared to RL systems.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Reinforcement learning framework	1	3
Bandit problems and action selection	1	3
Dynamic programming methods	1	3
Monte-Carlo methods	2	6
Temporal difference methods	1	3
Q-learning and eligibility traces	1	3
Environment modeling	2	6
Actor-critic applications	1	3
Planning in the RL context	1	3
Constructive methods - nets that grow	2	6
Evaluating performance of algorithms	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand reinforcement learning framework	Lectures	Exam, Quizzes
1.2	Understand basic and advanced reinforcement learning techniques	Lectures	Exams, Homework, Quizzes
1.3	Understand self-growing net algorithms	Lectures	Exam, Homework, Quizzes
1.4	Identify current tools for reinforcement learning in real world applications	Lectures, Project	Exam, Homework, Project report
2.0	**Cognitive Skills**		
2.1	Ability to evaluate how effective a particular RL algorithm is	Lecture, Case studies	Exams, Quizzes, Homework
2.2	Describe multiple criteria for analyzing RL algorithms and evaluate algorithms on these metrics	Lecture, Case studies,	Exams, Quizzes, Homework
	Evaluate a real-world problem to be formulated as RL problem	Group discussion, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		

3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project research activities, Project	Project Report, Group presentation
4.2	Demonstrate the ability to apply recent tools in RL application	Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of RL algorithms	Lecture, Case studies	Exams, homework
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) iii. Office Hours for student counseling and support – Three hours/week iv. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks iii. Csaba Szepesvari and Ronald Brachman, Algorithms for Reinforcement Learning, Morgan and Claypool Publishers, 2010. iv. M.Wiering and M.V.Otterlo, Reinforcement Learning: State-of-the-art, Volume 12, Springer Science & Business Media 2012.
2. List Essential References Materials (Journals, Reports, etc.) iii. Recent Papers in Reinforcement Learnings related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. ii.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. ii. MATLAB, Python, or similar 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.) ii. One classroom (25 seats) iii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) iii. Whiteboard iv. Internet connection v. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

iv. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department iii. Course file of the course will be maintained and evaluated by some senior faculty member. iv. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development iii. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) iii. A random sample from the marked papers may be evaluated by an independent senior faculty member. iv. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. iii. Department has curriculum committee that periodically review courses. iv. Faculty council review offer program as per need.

Name of Course Instructor: Dr Muhammad Arif

Signature: *Dr Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Data Visualization

Course Code: 14016475-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Data Visualization 14016475-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2 or 3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course is intended to cover main concepts related to data visualization.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The course will teach state of the art theoretical and practical knowledge in the field of data visualization. Students will be assigned assignments and project to implement the visualization techniques to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Data visualization is an integral part of Artificial intelligence. It fulfills the growing need for researchers, analysts, designers, usability experts, and other data professionals to represent the data in an attractive graphical way. This course covers the underlying theory and practical concepts in creating visual representations of large amounts of data. It covers the core topics in data visualization such as data representation, visualization toolkits, scientific visualization, information visualization, flow visualization, and volume rendering techniques.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to Data visualization	1	3
Computer Graphics and Visualization	2	6
Discrete Data Representation	2	6
Visualization Applications	1	3
Visualization Pipeline	2	6
Fundamental Techniques for Scalar and vector Visualization	2	6
Tensor Visualization Techniques	2	6
Image and Volume visualization	2	6

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42

Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamental mathematical and statistical principles of data visualization	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	Ability to apply knowledge of computing to write data visualization code	Lecture, Group discussion	Exam, HWs, Quizzes
1.3	An ability to recognize the use of visualization modeling methods to model real life data	Lecture, Group discussion	Exam, HWs, Quizzes
1.4	Develop ability to identify current techniques, skill, and tools necessary for the development of visualization systems.	Lecture, Group discussion	Exams, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Apply conceptual understanding of data visualization principles and theories	Lecture, Project	Exam, HWs
2.2	Implement and evaluate data visualization process, component, or program	Lecture, Case studies,	Exams, Reports
2.3	Investigate the real-world problems in the context of data visualization and design innovative solutions	Lecture, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation

3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest data visualization tools	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of visualization systems.	Lecture, Case studies, Project	Exams, Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for a visualization system	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	HW 1	2	5%
2	Quiz 1	3	5%
3	HW 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Telea, Alexandru C. Data visualization: principles and practice. CRC Press, latest edition.
ii. Yuk, Mico, and Stephanie Diamond. Data visualization for dummies. John Wiley & Sons, latest edition.

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

ii. IEEE Transactions on Visualization and Computer Graphics (TVCG)
iii. Springer, Journal of Visualization
iv. Sage, Information Visualization journal

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i. https://twitter.com/, #datavisualization
ii. https://www.linkedin.com/company/data-visualization-blog

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

i. MATLAB, Tableau, SAS or other visualization 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Visualization software
ii. Whiteboard
iii. Internet connection

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Pattern Recognition

Course Code: 14016476-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Pattern Recognition 14016476-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Muhammad Arif
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of pattern recognition.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

By successful completion of the course, the students will have solid understanding of the principles of pattern recognition, main methods for model performance estimation, have a good grasp of different parametric and non-parametric methods for classification; clustering algorithms, have hands-on experience of using pattern recognition methods in computer vision and biomedical applications and graphical models.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Classifiers Based on Bayes Decision Theory	1	3
Linear Classifiers	1	3
Feature Selection	1	3
Feature Generation: Data Transformation and Dimensionality Reduction	1	3
Template Matching	1	3
Supervised Learning: The Epilogue	1	3
Clustering Algorithms I: Sequential Algorithms	1	3
Clustering Algorithms II: Hierarchical Algorithms	1	3
Clustering Algorithms III: Schemes Based on Function Optimization	1	3
Cluster Validity indices	1	3
Learning with tree (Decision tree, Boosting, Bagging, Random forest)	2	6
Graphical Models (Bayesian networks, Hidden markov model, Kalman filter	2	6

2. Course components (total contact and credit hours per semester):							
		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the mathematical and statistical foundation of pattern recognition	Lectures	Exam, Quizzes
1.2	Recognize the design and implementation of supervised and unsupervised Classifiers	Lectures	Exams, Homework, Quizzes
1.3	Understand the importance of feature generation and selection	Lectures	Exam, Homework, Quizzes
1.4	Recognize applications of pattern recognition in real world applications	Lectures, Case studies, Project	Exam, Homework, Project Report
2.0	**Cognitive Skills**		
2.1	Analyze and design methods for automatic training of classifiers	Lecture, Case studies	Exams, Quizzes, Homework, Reports,
2.2	Design, implement and evaluate supervised and unsupervised classifiers	Lecture, Case studies,	Exams, Reports

2.3	Develop a pattern recognition system for a real world problem	Group discussion, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest information technologies	Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis classifiers	Lecture, Case studies, Project	Exams, Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Sergios Theodoridis and Konstantinos Koutroumbas Pattern Recognition, Academic Press; 4th edition, 2008.
ii. Fukunaga, Keinosuke. Introduction to statistical pattern recognition. Academic press, 2013.
iii. Devroye, Luc, László Györfi, and Gábor Lugosi. A probabilistic theory of pattern recognition. Vol. 31. Springer Science & Business Media, 2013.
iv. Watanabe, Satosi, ed. Methodologies of pattern recognition. Academic Press, 2014.

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

i. Recent Papers in Pattern Recognition related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

ii.

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

i. MATLAB, Python or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr Muhammad Arif

Signature: *Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Social Media Analytics

Course Code: 14016477-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Social Media Analytics 14016477-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Science in Computer Science

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of social media data analysis.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The course will teach state of the art theoretical and practical knowledge in the field of social media analytics. Students will be required to use APIs of social media Websites such as Twitter, Facebook, Instagram to implement the assignment/project. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course covers concepts and techniques for retrieving, exploring, visualizing, and analyzing social network and social media data, website usage, and clickstream data. Students learn to use key metrics to assess goals and return on investment, perform social network analysis to identify important social actors, subgroups, and network properties in social media.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Text Analytics on Social media	2	6
Network Analysis methods	2	6
Actions Analytics on social platform	2	6
Social Media Apps Analytics	1	3
Social Media Hyperlinks Analytics	2	6
Social Media Location Analytics	2	6
Social Media Search Engine Analytics	1	3
Aligning Social Media Analytics with Business Goals	2	6

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamental mathematical and computing principles of social media analytics	Lecture, Group discussion	Exams, Homework, Quizzes
1.2	Ability to apply knowledge of computing to write social media analytics code	Lecture, Group discussion	Exam, Homework, Quizzes
1.3	An ability to extract desired knowledge (e.g., business forecast) from social media networks such as Facebook and Twitter	Lecture, Group discussion	Exam, Homework, Quizzes
2.0	**Cognitive Skills**		
2.1	Apply conceptual understanding of social media analytics principles and theories	Lecture, Project	Exam, Homework
2.2	Implement and evaluate social media analytics process, component, or program	Lecture, Case studies,	Exams, Reports
2.3	Investigate the real-world problems in the context of social media analytics and design innovative solutions	Lecture, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		

4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest social media analytics tools	Lecture, Project	Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for social media analytics	Research activities, Projects	Project, Homework, presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Homework 1	2	5%
2	Quiz 1	3	5%
3	Homework 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Khan, Gohar F. Seven Layers of Social Media Analytics: Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engines, and Location Data. CreateSpace Independent Publishing Platform, latest edition.
ii. Tushar Sharma, Dipanjan Sarkar, Raghav Bali, Learning Social Media Analytics with R, Packt Publishing, latest edition.
iii. Russell, Matthew A. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More. " O'Reilly Media, Inc.", latest edition.

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

i. Recent Papers in Social Media Analytics related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i. Facebook, Twitter to extract data and apply social media analytics.

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

i. Twitter, Facebook APIs to be use in conjunctions of social media analytics tools

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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Social media visualization software
ii. Whiteboard
iii. Internet connection

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Introduction to Robotics

Course Code: 14016478-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Introduction to Robotics 14016478-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Khaled Termisi
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of Robotics.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course is an introduction to several core areas in robotics: kinematics, dynamics and control; motion planning; state estimation, localization and mapping; vision for robotics. Lectures on these topics will be complemented by a large practical that exercises knowledge of a cross section of these techniques in the construction of an integrated robot in the lab, motivated by a task such as robot navigation.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to Robotics	1	3
Kinematics - forward and inverse	2	6
Dynamics	1	3
Control	1	3
Sensing - proprioception, etc.	2	6
Motion planning - basics and sampling-based methods	2	6
Motion planning - planning under uncertainty, etc.	2	6
State estimation, localization and mapping	1	3
Implementing SLAM; Multi-modal sensor fusion	1	3
Machine vision	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42

Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the essential of design and implementation of robotics systems.	Lecture, Small group discussion, research activities.	Exams, Homework, Quizzes, Reports, presentations
1.2	An ability to recognize the use of robotics in solving real life problems.	Lecture, Small group discussion, research activities	Exams, Quizzes, Reports, Research paper, presentations
2.0	**Cognitive Skills**		
2.1	Apply conceptual understanding of concepts, principles and theories related to robotics	Lecture, Homework, research activities	Exams, Homework, Quizzes
2.2	Design, implement and evaluate an robotics based system, process, component, or program to meet desired needs.	Lecture, Homework, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
2.3	Investigate real world problems in the context of robotics and design innovative solutions	Lecture, Homework, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of latest information technologies	Project	Project Report, Project presentation

5.0	Psychomotor (if any)		
5.1			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	3	5%
2	Homework 1	2	5%
3	Quiz 2	7	5%
4	Homework 2	6	5%
5	Midterm Exam	8	20%
6	Quiz 3	11	5%
7	Homework 3	10	5%
9	Project	13	20%
10	Final Exam	15	30%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Niku, Saeed B. "Introduction to Robotics: Analysis, Control, Applications, Hoboke" (2010). ii. Fukuda, Toshio, ed. Soft Computing for Intelligent Robotic Systems. Vol. 21. Physica, 2013.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Robotics related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python or similar software ii. Robotic toolkit to build simple robots

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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. iii. Department has curriculum committee that periodically review courses. iv. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Khaled Termisi

Signature: *Khaled Termisi* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Distributed Systems

Course Code: 14016481-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Distributed Systems 14016481-3

2. Credit hours: 3

3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

(If general elective available in many programs indicate this rather than list programs)

4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan

5. Level/year at which this course is offered: 2/3

6. Pre-requisites for this course (if any):

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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides a graduate-level introduction to parallel and distributed systems. Both shared-memory parallel computers and distributed-memory clusters will be studied.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The course will teach state of the art theoretical and practical knowledge in the field of parallel and distributed systems. Students will be assigned assignments and project to implement the distributed computing techniques to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

We will cover fundamental and current research topics in the design, implementation, and evaluation of parallel and distributed systems. Our focus will be on the systems software and distributed programming systems, but some hardware issues will also be covered. Topics will include parallel algorithms, parallelization strategies, virtual machines, and operating system support. Aspects of the practice and research issues in distributed will be covered.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to parallel and distributed systems	1	3
Hardware architectures (multiprocessors, clusters, etc.)	2	6
Concurrency and synchronization	2	6
Data and work partitioning	2	6
Granularity	1	3
Load balancing	2	6
P-Threads, Locks and semaphores	2	6
MPI, MapReduce and Hadoop	2	6

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42

Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamental of distributed systems	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	Ability to apply knowledge of distributed computing to write distributed systems code	Lecture, Group discussion	Exam, HWs, Quizzes
1.3	An ability to recognize the use of distributed computing modeling methods to model real life data	Lecture, Group discussion	Exam, HWs, Quizzes
1.4	Develop ability to identify current techniques, skill, and tools necessary for the development of distributed computing solutions	Lecture, Group discussion	Exams, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Apply conceptual understanding of distributed systems principles and theories	Lecture, Project	Exam, HWs
2.2	Implement and evaluate distributed systems process, component, or program	Lecture, Case studies,	Exams, Reports
2.3	Investigate the real-world problems in the context of distributed systems and design innovative solutions	Lecture, Project	Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation

3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest high-performance computing tools	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of distributed computing systems.	Lecture, Case studies, Project	Exams, Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for a distributed computing system	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	HW 1	2	5%
2	Quiz 1	3	5%
3	HW 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Ajay D. Kshemkalyani. Distributed Computing: Principles, Algorithms, and Systems. Cambridge University Press, latest edition.
ii. Nicola Santoro. Design and Analysis of Distributed Algorithms. Wiley-Interscience, latest edition.

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

i. Recent research papers in Distributed Systems journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i. https://twitter.com/, #hpc
ii. https://www.chpc.ac.za/

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

i. Unix/Linux
ii. MATLAB, MPI, distributed computing 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Visualization software
ii. Whiteboard
iii. Internet connection

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Advanced Topics in Artificial Intelligence

Course Code: 14016482-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Advances Topics in Artificial Intelligence 14016482-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

Advanced topics selected from current literature that deals with theoretical foundations and advances in Artificial Intelligence. The specific content of an offering of the course should focus on a specific area of Artificial Intelligence.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course will teach state of the art theoretical and practical knowledge in the field of Artificial Intelligence. Students will be assigned assignments and project to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)	1-14	42

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Artificial Intelligence in solving real life problems (e.g., face recognition, disease detection, robotics)	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	An ability to identify current techniques, skills, and tools necessary for the development of intelligent systems	Lecture, Group discussion	Exam, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate system, process, component, or program of an intelligent system (e.g., intelligent image recognition)	Lecture, Project	Exam, HWs
2.2	Investigate real world problems in the context of Artificial Intelligence and design innovative solutions	Lecture, Case studies,	Exams, Reports
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest development tools to build AI based systems	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of algorithms.	Lecture, Case studies, Project	Exams, Project Report, Project presentation

5.0	Psychomotor (if any)		
5.1	Ability to operate and construct necessary tools required for computing system	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	HW 1	2	5%
2	Quiz 1	3	5%
3	HW 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Decided by the teacher
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Artificial Intelligence Research
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. IEEE Transactions on Emerging Topics in Computational Intelligence https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7433297 ii. AI journals by Springer publishers https://www.springer.com/computer/ai?SGWID=0-147-12-114571-0
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python, or some other related 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. iii. Department has curriculum committee that periodically review courses. iv. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Automatic Speech Recognition

Course Code: 14016483-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Automatic Speech Recognition 14016483-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides knowledge of speech recognitions and their application in real world applications.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. To provide practical knowledge, programming package or tool will be introduced to the students. Practical home works related to application of automatic speech recognition will be designed.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course covers the theory and practice of automatic speech recognition (ASR), with a focus on the statistical approaches that comprise the state of the art. The course introduces the overall framework for speech recognition, including speech signal analysis, acoustic modeling using hidden Markov models, language modeling and recognition search. Advanced topics covered will include speaker adaptation, robust speech recognition and speaker identification. The practical side of the course will involve the development of a speech recognition system.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Signal analysis for ASR	2	6
Statistical pattern recognition (Bayes decision theory, Learning algorithms, Evaluation methods, Gaussian mixture model, and EM algorithm)	2	6
Hidden Markov Models (HMM)	1	3
Context-dependent models	2	6
Discriminative training	2	6
Language models for LVCSR (large vocabulary continuous speech recognition)	1	3
Robust ASR (Robust features Noise reduction, Microphone arrays)	1	3
Adaptation (Noise adaptation, Speaker adaptation/normalization, Language model adaptation)	1	3
Speaker recognition	2	6

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the statistical framework used for automatic speech recognition.	Lectures	Exam, Quizzes
1.2	Understand the concepts of statistical pattern recognition	Lectures	Exams, Homework, Quizzes
1.3	Understand the language models for speech recognition in real world applications	Lectures	Exam, Homework, Quizzes
1.4	Identify current tools for automatic speech recognition	Lectures, Project	Exam, Homework, Project report
2.0	**Cognitive Skills**		
2.1	Analyze and design methods for automatic speech recognition	Lecture, Case studies	Exams, Quizzes, Homework, Reports,
2.2	Design, implement and evaluate statistical pattern recognition methods in the context of automatic speech processing	Lecture, Case studies,	Exams, Reports
2.3	Develop a speaker recognition system for a real world problem	Group discussion, Project	Project Report, Project presentation

2.4	Ability to apply adaptation in the speech processing systems	Lecture, Project	Exams, Project Report, Project presentation
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Act ethically and responsibly with high moral standards	Research activities, Project	Anti-plagiarism Presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Demonstrate the ability to apply recent tools in automatic speech recognition applications	Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of automatic speech recognition systems	Lectures, Project	Exam, Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	7	20%
6	Quiz 3	8	3.3%
7	Homework 3	9	3.3%
8	Project Report	11	15%
9	Project Presentations	12	5%
10	Final Exam	14	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Rabiner, Lawrence R., and Biing-Hwang Juang. "Fundamentals of speech recognition." (1993). ii. Jurafsky, Dan. Speech & language processing. Pearson Education India, 2000.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Speech Recognitions related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python, or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development ii. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr Muhammad Arif

Signature: *Dr Muhammad Arif* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Deep Learning

Course Code: 14016484-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Deep Learning 14016484-3

2. Credit hours: 3

3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

(If general elective available in many programs indicate this rather than list programs)

4. Name of faculty member responsible for the course Dr. Mohsin Bilal

5. Level/year at which this course is offered:2/3

6. Pre-requisites for this course (if any):

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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course provides theoretical and practical knowledge of deep learning.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. A range of topics will be covered from basic neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning, and applications to problem domains like speech recognition and computer vision.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Fundamentals of deep learning	2	6
Deep feedforward neural networks	2	6
Regularization of deep learning	2	6
Convolutional networks	2	6
Sequence modeling (recurrent and recursive networks)	2	6
Probabilistic models for deep learning	2	6
Deep reinforcement Learning	2	6

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3

	Actual	3					3

3. Individual study/learning hours expected for students per week.	9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the fundamentals and regularization of deep neural networks	Lecture, Group discussion	Exams, Homework, Quizzes
1.2	Understand the convolutional and deep recurrent neural networks	Lecture, Group discussion	Exam, Homework, Quizzes
1.3	Understand the deep probabilistic models and reinforcement learning	Lecture, Group discussion	Exam, Homework, Quizzes
2.0	**Cognitive Skills**		
2.1	Design and implement a deep learning-based system, process, component or program to meet desired needs.	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
2.2	Investigate real world problems in the context of Deep Learning and design innovative solutions	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.3	Act ethically and responsibly with high moral standards	Small group discussion, research activities, Projects	Anti-plagiarism software's, Project

			Report, Group presentations
4.0	Communication, Information Technology, Numerical		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project research activities, Project	Project Report, Group presentation
4.2	Use of latest information technologies	Lectures, research activities, Project	Project Report, Group presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for an intelligent system	Research activities, Projects	Reports, Research paper, Group presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	8	20%
6	Quiz 3	10	3.3%
7	Homework 3	11	3.3%
8	Project Report	13	15%
9	Project Presentations	14	5%
10	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning (adaptive computation and machine learning series)." Adaptive Computation and Machine Learning series (2016).
ii. Buduma, Nikhil, and Nicholas Locascio. Fundamentals of Deep Learning: Designing Next-generation Machine Intelligence Algorithms. " O'Reilly Media, Inc.", 2017.
iii. Josh Patterson and Gibson, Adam. "Deep learning: a practitioner's approach. O'Reilly Media; 1 edition, 2017.

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

i. Recent Papers in Deep Learning and AI related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i.

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

i. MATLAB, Python, or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Mohsin Bilal

Signature: *Mohsin Bilal* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Evolutionary Computation

Course Code: 14016485-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Evolutionary Computation 14016485-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Mohsin Bilal
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

This course introduces evolutionary techniques to the students.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

Evolutionary Computation can be considered as a sub-field of Artificial Intelligence. Evolutionary algorithms use Nature as a metaphor and are inspired in the principles of natural selection and genetics. These algorithms have been applied successfully for solving difficult problems across a broad spectrum of fields, including engineering, economics and finance, architecture, design, automatic programming, art generation, and many others. In this course, you will learn the basic working principles of these algorithms.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
What is Evolutionary Computation? Historical perspective. Major classes of Evolutionary Algorithms. Local vs global search methods.	1	3
Simple genetic algorithms. Major methods for selection, recombination, mutation, and replacement. Representations and design of operators.	2	6
Evolution strategies. The 1/5 rule. Self-adaptation of mutation step sizes.	1	3
Representations. Design of operators. Using problem specific information.	1	3
Genetic programming.	2	6
Interactive Evolutionary Computation.	1	3
Constraint handling. Finding multiple optima. Multi-objective optimization.	2	6
Basic GA theory. Limitations of simple EAs. Problem difficulty and the NFL theorem.	1	3

Goldberg's decomposition for competent GAs.	1	3
Parameter setting in EAs. Performance assessment.	1	3
Basic ideas of Model-based EAs.	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize Evolutionary Computations (EC), simple Genetic Algorithms (SGA) and Evolutionary Strategies (ES)	Lecture, Group discussion	Exams, Homework, Quizzes
1.2	Recognize Representations, Operators, Genetic Programming (GP) and Interactive EC	Lecture, Group discussion	Exam, Homework, Quizzes
1.3	Understand constraint handling, single/multi-objective optimization	Lecture, Group discussion	Exam, Homework, Quizzes
1.4	Conceptual understanding of GA theories, issues and assessments	Lecture, Group discussion	Exam, Homework, Quizzes
2.0	**Cognitive Skills**		

2.1	Design and implement an evolutionary algorithm-based system, process, component or program to meet desired needs.	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
2.2	Investigate real world problems in the context of Evolutionary Computation and design innovative solutions	Lecture, Case studies, research activities, Group discussion	Exams, Reports, Project
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Small group discussion, research activities, Projects	Project Report, Group presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Small group discussion, research activities, Projects	Project Report, Group presentation
3.3	Act ethically and responsibly with high moral standards	Small group discussion, research activities, Projects	Anti-plagiarism software's, Project Report, Group presentations
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project research activities, Project	Project Report, Group presentation
5.0	**Psychomotor (if any)**		
5.1			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	2	3.3%
2	Homework 1	3	3.3%
3	Quiz 2	4	3.3%
4	Homework 2	5	3.3%
5	Midterm Exam	8	20%
6	Quiz 3	10	3.3%
7	Homework 3	11	3.3%
8	Project Report	13	15%
9	Project Presentations	14	5%
10	Final Exam	15	40%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. A.E. Eiben, J.E. Smith, Introduction to Evolutionary Computing (Natural Computing Series) Springer; 2nd ed. 2015.
ii. Kenneth A. De Jong, Evolutionary Computation: A Unified Approach, MIT Press, 2016.
iii. Riccardo Poli, William B. Langdon, Nicholas Freitag McPhee, A Field Guide to Genetic Programming, Lulu Enterprises, 2008.

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

i. Recent Papers in Evolutionary Computation related journals

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

ii.

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

i. MATLAB, Python, or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Mohsin Bilal

Signature: *Mohsin Bilal* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: IoT Systems

Course Code: 14016486-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: IoT Systems 14016486-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Khaled Termisi
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

The course Principles and Design of the 'Internet of Things Systems' (IoT) is concerned with the emerging discipline of digitizing the physical world with wireless sensors, analyzing the sensor data to provide actionable information, and influencing the physical world via actuators, with an optional human in the loop.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course aims to deliver a sound understanding of the design and analysis of Internet of Things through lectures and practice. The lectures provide the foundational knowledge in sensors and actuators, fusion of data from multiple sensors, sensor data calibration and topics in sensor data analytics: pre-processing and extraction of features in time-series sensor data, and classification methods. The students conduct a major piece of coursework working in pairs to develop an IoT application using the Orient speck platform. Students will experience all the stages in the design and implementation of a complex system, from its specification to the demonstration of a working prototype. They will be exposed to aspects of embedded systems programming, networking algorithms, wireless protocols, user interface design, and system integration and testing.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to IoT (Sensing, Actuation, Basics of Networking)	1	3
Basics of Networking, Communication Protocols and Sensor Networks	1	3
Interoperability in IoT (Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino)	2	6
Introduction to Raspberry	1	3
Implementation of IoT with Raspberry Pi	2	6
SDN for IoT	1	3
Cloud Computing	1	3

Fog Computing	1	3
Smart Cities and Smart Homes	1	3
Connected Vehicles	1	3
Smart grid	1	3
Industrial IoT	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the essential of design and implementation of IoT systems.	Lecture, discussion, research activities.	Exams, Homework, Quizzes, Reports, presentations
1.2	An ability to recognize the use of IoT in solving real life problems.	Lecture, discussion, research activities	Exams, Quizzes, Reports, Research paper, presentations
2.0	**Cognitive Skills**		

2.1	Apply conceptual understanding of concepts, principles and theories related to IoT systems.	Lecture, Homework, discussion, research activities	Exams, Homework, Quizzes
2.2	Design, implement and evaluate an IoT based system, process, component, or program to meet desired needs.	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
2.3	Investigate real world problems in the context of IoT systems and design innovative solutions	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of latest information technologies related to IoT systems.	Lectures, research activities, case studies, Projects, Seminars	Exams, Homework, Quizzes
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for an IoT systems	Research activities, Projects	Reports, Research paper, Group presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	3	5%
2	Homework 1	2	5%
3	Quiz 2	7	5%
4	Homework 2	6	5%
5	Midterm Exam	8	20%
6	Quiz 3	11	5%
7	Homework 3	10	5%
9	Project	13	20%
10	Final Exam	15	30%

D. Student Academic Counseling and Support

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

i. Office Hours for student counseling and support – Three hours/week
ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

i. Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling Technologies, Platforms, and Use Cases. CRC Press, 2017.
ii. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. VPT, 2014.
iii. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

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

i. Recent Papers in IoT related journal

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

i.

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

i. MATLAB, Python or similar 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.)

i. One classroom (25 seats)
ii. One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

i. Whiteboard
ii. Internet connection
iii. Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Khaled Termisi

Signature: *Khaled Termisi* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Computer Vision

Course Code: 14016487-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Computer Vision 14016487-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Khaled Termisi
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

The course provides a theoretical and practical understanding of computer vision and video processing.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

In this course students will gain knowledge of theory and practice in Computer Vision, and by the end will have demonstrable ability to implement a working solution for real-world problems in image and video analysis. Students will get hands-on experience in deriving the mathematical underpinnings as well as the programmatic implementation of classical vision problems such as image classification, object detection and tracking, pose estimation, Structure-from-Motion, localization and mapping and more. Students will additionally learn how to train a deep neural network, write a GPU-optimized algorithm, evaluate their implementations on standard vision datasets, and compare their results to the state-of-the-art work of computer vision laboratories worldwide.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to Computer Vision	1	3
Optics, Light, Color, Human Vision, Cameras	1	3
2D low-level: Convolutions, Filters, Edges	1	3
2D mid-level: Interest points, Features, Descriptors	1	3
2D high-level: Shapes, Models, Matching	1	3
Stitching: Image Registration, Homography, Blending	2	6
Object detection: Introduction	1	3
Object detection: Eigenfaces, Viola-Jones, BoVW	1	3
Tracking: Mean-shift, Kalman Filters	1	3
Segmentation: Clustering, Region Growing, Superpixels, Graph methods, graph cuts, CRF/MRF	1	3
Multi-view 1: MVG intro, Epipolar Geometry, Disparity, MV camera calibration, Stereo, Structured Light	1	3

Multi-view 2: Structure-from-Motion, Visual odometry, SLAM 1, SLAM 2	1	3
GPU: Parallelizing vision tasks, Practicalities, CUDA, OpenCL	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the essential of design and implementation of Computer Vision based systems.	Lecture, Small group discussion, research activities.	Exams, Homework, Quizzes, Reports, presentations
1.2	An ability to recognize the use of Computer Vision in solving real life problems.	Lecture, Small group discussion, research activities	Exams, Quizzes, Reports, Research paper, presentations
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate an Computer Vision based system, process, component, or program to meet desired needs.	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, Group presentations

2.2	Investigate real world problems in the context of Computer Vision and design innovative solutions	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
2.3	Design, implement and evaluate an Computer Vision based system, process, component, or program to meet desired needs.	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of latest information technologies	Project	Project Report, Project presentation
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools of computer vision systems	Research activities, Projects	Reports, Research paper, Group presentations

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quiz 1	3	5%
2	Homework 1	2	5%
3	Quiz 2	7	5%
4	Homework 2	6	5%
5	Midterm Exam	8	20%
6	Quiz 3	11	5%
7	Homework 3	10	5%
9	Project	13	20%
10	Final Exam	15	30%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Prince, Simon JD. Computer vision: models, learning, and inference. Cambridge University Press, 2012. ii. Forsyth, David, and Jean Ponce. Computer vision: a modern approach. Upper Saddle River, NJ; London: Prentice Hall, 2011. iii. Szeliski, Richard. Computer vision: algorithms and applications. Springer Science & Business Media, 2010.
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Computer Vision related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. MATLAB, Python or similar 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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection iii. Anti-plagiarism software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Khaled Termisi

Signature: *Khaled Termisi* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Advanced Topics in Information Security

Course Code: 14016488-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Advanced Topics in Information Security 14016488-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

Advanced topics selected from current literature that deals with theoretical foundations and advances in Information Security. The specific content of an offering of the course should focus on a specific area of Information Security.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course will teach state of the art theoretical and practical knowledge in the field of Information Security. Students will be assigned assignments and project to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)	1-14	42

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Information Security in solving real life problems (e.g., financial, security systems)	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	An ability to identify current techniques, skills, and tools necessary for the development of secure computer-based systems	Lecture, Group discussion	Exam, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate system, process, component, or program using standards of Information Security methods.	Lecture, Project	Exam, HWs
2.2	Investigate real world problems in the context of Information Security and design innovative solutions	Lecture, Case studies,	Exams, Reports
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest tools related to Information Security	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques needed to solve Information Security problems.	Lecture, Case studies, Project	Exams, Project Report, Project presentation

5.0	Psychomotor (if any)		
5.1	Ability to operate and construct necessary tools required for Information/Computer Security	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	HW 1	2	5%
2	Quiz 1	3	5%
3	HW 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Decided by the teacher
2. List Essential References Materials (Journals, Reports, etc.) i. Recent Papers in Information Security related journals
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. IEEE Transactions on Information Forensics and Security https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10206 ii. Springer, International Journal of Information Security https://link.springer.com/journal/10207
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. Some software that implements cryptography standards such as AES, SHA, RSA, ECDSA, etc.

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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) i. Whiteboard ii. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
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i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Advances Topics in Cloud Computing

Course Code: 14016489-3

Date: 2018 –10 – 21.	**Institution**: Umm Al-Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: Advances Topics in Cloud Computing 14016489-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
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		percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

Advanced topics selected from current literature that deals with theoretical foundations and advances in Cloud Computing. The specific content of an offering of the course should focus on a specific area of Cloud Computing.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course will teach state of the art theoretical and practical knowledge in the field of Cloud Computing. Students will be assigned assignments and project to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
TBA (To Be Announced)	1-14	42

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	An ability to recognize the use of Cloud Computing in solving real life problems (e.g., cloud as service, cloud as storage)	Lecture, Group discussion	Exams, HWs, Quizzes
1.2	An ability to identify current techniques, skills, and tools necessary for the development of secure Cloud based systems	Lecture, Group discussion	Exam, HWs, Quizzes
2.0	**Cognitive Skills**		
2.1	Design, implement and evaluate system, process, component, or program on Cloud (e.g., Cloud data repository)	Lecture, Project	Exam, HWs
2.2	Investigate real world problems in the context of Cloud Computing and design innovative solutions	Lecture, Case studies,	Exams, Reports
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
3.2	Work effectively in groups to accomplish a common goal and show leadership qualities	Group discussion, Project	Project Report, Project presentation
3.3	Act ethically and responsibly with high moral standards	Lectures, discussion	Anti-plagiarism software, paper review, presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate clearly in oral and written form with range of audiences	Project	Project Report, Project presentation
4.2	Use of latest development tools related to Cloud Computing	Lecture, Project	Project Report, Project presentation
4.3	Demonstrate the ability to use mathematical and statistical techniques require to solve problems related to Cloud Computing	Lecture, Case studies, Project	Exams, Project Report, Project presentation

5.0	Psychomotor (if any)		
5.1	Ability to operate and construct necessary tools required for Cloud Computing	Research activities, Projects	Project, HWs, presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	HW 1	2	5%
2	Quiz 1	3	5%
3	HW 2	5	5%
4	Quiz 2	6	5%
5	Midterm Exam	8	20%
6	Project	10	20%
7	Final Exam	15	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) i. Office Hours for student counseling and support – Three hours/week ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks i. Decided by the teacher
2. List Essential References Materials (Journals, Reports, etc.) ii. Recent Papers in Cloud Computing Research
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. i. Springer Journal of Cloud Computing https://link.springer.com/journal/13677 ii. IEEE Transactions on Cloud Computing https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. i. Microsoft Azure Cloud Account ii. Amazon Web Services (AWS) Cloud Account

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.) i. One classroom (25 seats) ii. One lab (25 PCs)
2. Technology resources (AV, data show, Smart Board, software, etc.) iii. Whiteboard iv. Internet connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

i. Course file of the course will be maintained and evaluated by some senior faculty member. ii. Instructor evaluation is performed for every semester
3. Procedures for Teaching Development i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) i. A random sample from the marked papers may be evaluated by an independent senior faculty member. ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. i. Department has curriculum committee that periodically review courses. ii. Faculty council review offer program as per need.

Name of Course Instructor: Dr. Murtaza Ali Khan

Signature: *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____ **Date Received:** _____