Course Specifications

Course Title:	**Decision Making Under Uncertainty**
Course Code:	AI 414
Program:	**Information and Computer Science**
Department:	**Computer Science and Information**
College:	College of Science AL Zulfi
Institution:	Al Majmaah University

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☐ Others ☐ **b.** Required ☐ Elective ■	
3. Level/year at which this course is offered:	
4. Pre-requisites for this course (if any)**:** **ICS 211- MATH 220**	
5. Co-requisites for this course (if any)**:**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom		80 %
2	Blended		10 %
3	E-learning		10 %
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	20
3	Tutorial	10
4	Others (specify)	
	Total	60
Other Learning Hours*		
1	Study	30
2	Assignments	30
3	Library	20
4	Projects/Research Essays/Theses	
5	Others (specify)	20
	Total	100

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides an introduction of provides an introduction to the challenges of decision making under uncertainty from a computational perspective. It presents both the theory behind decision making models and algorithms and a collection of example applications that range from speech recognition to aircraft collision avoidance.

Focusing on two methods for designing decision agents, planning and reinforcement learning, the course covers probabilistic models, introducing Bayesian networks as a graphical model that captures probabilistic relationships between variables; utility theory as a framework for understanding optimal decision making under uncertainty; Markov decision processes as a method for modeling sequential problems; model uncertainty; state uncertainty; and cooperative decision making involving multiple interacting agents. A series of applications shows how the theoretical concepts can be applied to systems for attribute-based person search, speech applications, collision avoidance, and unmanned aircraft persistent surveillance.

2. Course Main Objective

- Learn to make rational decisions based on a probabilistic model and utility function.
- Understand to construct these models and how to use them to make inferences.
- Evaluate and analyze of sequential decision problems in stochastic environments.
- Analyze sequential decision problems with state uncertainty and methods for computing optimal and approximately optimal solutions.
- Develop the ability to discuss AI techniques models in which agents may have uncertainty about both the state of the environment and the choices of the other agents.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Understand of how to make rational decisions based on a probabilistic model and utility function.	K3-AI
2	**Skills :**	
2.1	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	S3-AI
2.2		
3	Competence:	
3.1	Develop the ability to discuss AI techniques models in which agents may have uncertainty about both the state of the environment and the choices of the other agents.	C3-AI
3.2		
3.3		
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction	4
2	Decision Making Under Uncertainty	8
3	Probabilistic Models	4
4	Decision Problems	4

5	Model Uncertainty	4
6	State Uncertainty	8
7	Cooperative Decision Making	4
8	Dynamic Models for Speech Applications	4
9	Optimized Airborne Collision Avoidance	8
10	Multiagent Planning for Persistent Surveillance	8
11	Integrating Automation with Humans	4
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Understand of how to make rational decisions based on a probabilistic model and utility function	Lectures, Lab demonstrations Case studies Individual presentations	Written Exam Homework assignments Class & lab Activities Quizzes
1.2			
…			
2.0	**Skills**		
2.1	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	Group discussions, Lab demonstrations, Brainstorming Presentations	Home works and assignments
2.2			
…			
3.0	**Competence**		
3.1	Develop the ability to discuss AI techniques models in which agents may have uncertainty about both the state of the environment and the choices of the other agents.	Group discussions, Case Studies, Brainstorming Presentations	Written Exam Homework assignments Class & lab Activities Quizzes
3.2			
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First written mid-term exam	6	10%
2	Second written mid-term exam	12	10%
3	Presentation, class activities, and group discussion	Every week	10%
4	Homework assignments	After Every chapter	10%
5	Practical exam	15	20%
6	Final exam	16	40%
7	Total		100%
8			

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Decision Making Under Uncertainty: Theory and Application Mykel J. Kochenderfer et al, The MIT Press, 2015
Essential References Materials	Advances in Decision Making Under Risk and Uncertainty, Mohammed Abdellaoui, John D. Hey (eds.), Springer, Year: 2008
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms and Laboratories are available at the college of science at Al-Zulfi.
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart Boards, software, data shows and AV technological resources are available.
Other Resources	

Item	Resources
(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student-faculty management meetings.	Program Leaders	Direct
Discussion within the staff members teaching the course	Peer Reviewer	Direct
Departmental internal review of the course.	Peer Reviewer	Direct
Reviewing the final exam questions and a sample of the answers of the students by others.	Peer Reviewer	Direct
Visiting the other institutions that introduce the same course one time per semester.	Faculty	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	