Detailed Course Description - Course Plan Development and Updating Procedures/ Computer Information Science Department	QF01/0408-3.0E

Faculty	**Faculty of Science and Information Technology**	**Department**	**Artificial Intelligence / Computer Science**
Course Number	**0142346**	**Course Title**	**Probability Theory in Artificial Intelligence**
Number of Credit Hours	**3**	**Pre-Requisite/Co-Requisite**	**Principles of AI**

Brief Course Description : The Probability Theory in Artificial Intelligence is the branch of mathematics that deals with modelling uncertainty. It is important because of its direct application in areas such as genetics, finance and Artificial Intelligence. It also forms the fundamental basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. This course introduces probability theory, random variables and Markov processes. Topics covered are: probability axioms, conditional probability; Bayes' theorem; discrete random variables, moments, bounding probabilities, probability generating functions, standard discrete distributions; continuous random variables, uniform, normal, Cauchy, exponential, gamma and chi-square distributions, transformations, the central limit theorem; definition and statistical inference, sample spaces, conditional probability and Bayes' rule, random variables, discrete and continuous probability distributions, expectation, estimation, and hypothesis testing.

	Course Goals and Learning Outcomes
Goal 1	**Presenting the concepts and Benefits of AI.**
Learning Outcomes	**1.1** Understanding the basic concepts and techniques of The Probability Theory. **1.2** Learning how to represent The Probability in both theory and practice with careful attention to underlying principles of probability and statistics .
Goal 2	**Describing concepts of state space search and its strategies.**
Learning Outcomes	**2.1** Learning the probability theory. **2.2** Learning the concepts of random variables and Markov processes. **2.3** Learning probability axioms, conditional probability; Bayes' theorem; discrete random variables **2.4** Learning the concepts of probability generating functions, standard discrete distributions. **2.5** Learning statistical inference, sample spaces, conditional probability and Bayes' rule, random variables, discrete.
Goal 3	**Describing the concepts of production systems.**
Learning Outcomes	**3.1** Understanding the concepts of production systems. **3.2** Learning the main components of production systems.
Goal 4	**Presenting basic concepts and roles of AI programming (PROLOG).**
Learning Outcomes	**4.1** Learning the concepts of PROLOQ language. **4.2** Learning the statements, rules and queries of Prolog language.

Goal 5	Describing Expert Systems and Machine learning.
Learning Outcomes	**5.1** Learning the concepts of expert systems and applications. **5.2** Learning the concepts of Knowledge Based Systems. **5.3** Learning the concepts of machine learning.
Textbook	Artificial Intelligence: Building Intelligent Systems. (1st edition) by P. Kulkarni and P. Joshi, PHI Learning Private Limited, 2015. ISBN: 978-81-203-5046-5
Supplementary References	**1.** Russell and Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, Inc., Prentice-Hall-Series, **2010**. **2.** Jeff Heaton, Artificial Intelligence for Humans, Volume.1, Fundamental Algorithms, Kindle Edition, 2013. **3.** Alan Mackworth and David Poole, Artificial Intelligence: Foundations of Computational Agents, Cambridge Canada Press, 2010. **4.** Robots Are People Too: How Siri, Google Car, and Artificial Intelligence Will Force Us to Change Our Laws by John F. Weaver. Praeger,Nov. 2013. ISBN: 1440829462, 9781440829468

Course Timeline				
Week	**Number of Hours**	**Course Topics**	**Pages (Textbook)**	**Notes**
01	**1** **1** **1**	1. **Introduction to** – probability axioms, – conditional probability; – Bayes' theorem; discrete random variables, – moments,	TXT: 1-7	
02	**1** **1**	**2. Problem solving** – Problem solving process – Formulating problems – Problem types and characteristics	TXT: 15-20	
02-03	**1** **1** **1**	**3. Problem solving** – bounding probabilities, – probability generating functions, – standard discrete distributions; – continuous random variables, discrete and continuous probability distributions, expectation, estimation, and hypothesis testing	TXT:39-47	
04-05	**1**	– uniform, normal, – Cauchy, exponential,	TXT- 56-65,	

	1 1	– gamma and chi-square distributions, – transformations, the central limit	69-83	
06	1 1 1	**Revision** **First exam 20%**		
07	1 1 1	**4. Intelligent agents** – theorem; – definition and statistical inference, – sample spaces, – conditional probability and Bayes' rule, – random variables,	TXT: 95-99	
08-10	1 1 1	**7. Knowledge and reasoning** – Knowledge representation – Knowledge-based agents – The Wumpus world – Logic – Prepositional logic – Predicate logic – Unification and lifting inference in FOL – Representing knowledge using rules – Prolog	TXT: 134-160, 477-483	
11-12	1 1 1	**8. Uncertain Knowledge and reasoning** – Uncertainty and methods – Probabilistic reasoning – Perception – Other techniques in Uncertainty and – reasoning process **Second Exam 20%**	TXT:170,171, 176, 182, 190-192	
13	1 1 1	**9. Planning** – Planning problem – Simple planning agent – Planning as a state space search	TXT: 199-202, 210-212	
14	1 1 1	**10. Learning** – What is machine learning – Learning paradigms	TXT: 233-238	
15	1 1 1	**11. Experts systems** – Architecture of experts systems – Existing experts systems – Rule based expert systems	TXT:267-270, 271, 276-277	
16	1 1 1	**Final Exam 50%**		

Theoretical Course Evaluation Methods and Weight	Participation = 10% First Exam 20% Second Exam 20% Final Exam 50%	**Practical (Clinical) Course Evaluation Methods**	Semester Students' Work = 50% (Reports, Research, Quizzes, Etc.) Final Exam = 50%

Approved by Head of Department		**Date of Approval**	

Extra information (to be updated every semester by corresponding faculty member)

Name of Teacher		Office Number	
Phone Number (Extension)		Email	_____@zuj.edu.jo
Office Hours			