

## **COURSE DESCRIPTION FORM: AI-2002: Artificial Intelligence**

**INSTITUTION** FAST School of Computing, National University of Computer and Emerging Sciences, Peshawar Campus

**BS-CS: Spring-2023**

### **PROGRAM TO BE EVALUATED**

#### **Course Description**

<b>Course Code</b>	AI-2002	
<b>Course Title</b>	Artificial Intelligence	
<b>Credit Hours</b>	3+1	
<b>Course Instructors</b>	Hafeez ur Rehman Shahzeb Khan	
<b>Lab Instructor</b>	Hurmat Hidayat	
<b>Grading Policy</b>	Absolute grading	
<b>Policy about missed assessment items in the course</b>	Retake of missed assessment items (other than sessional/ final exam) will not be held. Student who misses an assessment item (other than sessional / final exam) is awarded zero marks in that assessment item i.e. late submission will not be accepted. For missed sessional/ final exam, exam retake/ pretake application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decides the exam retake/ pretake cases.	
<b>Course Plagiarism Policy</b>	Plagiarism in project or sessional/ final exam will result in F grade in the course. Plagiarism in an assignment will result in zero marks in the whole assignments category.	
<b>Prerequisites by Course(s) or Topics</b>		
<b>Assessment Instruments with Weights</b> (homeworks, quizzes, sessional exams, final exam, assignments, etc.)	Assessment with the weight.	
	<b>Assessment Type</b>	<b>Weight</b>
	Quiz (4)	7
	Assignments (4)	5
	Sessional Exams 1	12.5
	Sessional Exams 2	12.5
	Project	10
	Final Exam	40
	Lab Work	10
	Class Participation	-

<b>Course Coordinator</b>	Hafeez ur Rehman																																	
<b>URL (if any)</b>																																		
<b>Course Catalog Description</b>	This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence. Upon completion, students should be able to develop intelligent systems by assembling solutions to concrete computational problems; understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering; and appreciate the role of problem solving, vision, and language in understanding human intelligence from a computational perspective.																																	
<b>Textbook</b>	Artificial Intelligence: A Modern Approach, 3rd ed. S. Russell and P. Norvig, Prentice Hall																																	
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<b>Course Goals</b>	<table border="1"> <tr> <th colspan="3">A. Course Learning Outcomes (CLOs)</th></tr> <tr> <td colspan="3">After course completion, the students shall be able to:</td></tr> <tr> <td>1.</td><td>Understand the notions of rational behavior and intelligent agents.</td><td></td></tr> <tr> <td>2.</td><td>Develop a general appreciation of the goals, subareas, achievements and difficulties of AI.</td><td></td></tr> <tr> <td>3.</td><td>Knowledge of methods of blind as well as informed search and ability to practically apply the corresponding techniques.</td><td></td></tr> <tr> <td>4.</td><td>General understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.</td><td></td></tr> <tr> <td>5.</td><td>Developing programming skills for AI applications.</td><td></td></tr> <tr> <th colspan="3">B. Program Learning Outcomes (PLOs)</th></tr> <tr> <td><b>PLO 1</b></td><td>Computing and Cybersecurity Knowledge</td><td>Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of problems using computer networks and cybersecurity techniques.</td></tr> <tr> <td><b>PLO 2</b></td><td>Problem Analysis</td><td>Identify, formulate, research literature, and analyze complex problems, reaching substantiated conclusions using fundamental mathematics, natural sciences, computing, and cybersecurity.</td></tr> <tr> <td><b>PLO 3</b></td><td>Design/Develop Solutions</td><td>Design solutions for complex computing problems and systems components, and processes that meet specified needs and take into consideration for public health and safety, cultural, social, and environmental considerations.</td></tr> </table>	A. Course Learning Outcomes (CLOs)			After course completion, the students shall be able to:			1.	Understand the notions of rational behavior and intelligent agents.		2.	Develop a general appreciation of the goals, subareas, achievements and difficulties of AI.		3.	Knowledge of methods of blind as well as informed search and ability to practically apply the corresponding techniques.		4.	General understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.		5.	Developing programming skills for AI applications.		B. Program Learning Outcomes (PLOs)			<b>PLO 1</b>	Computing and Cybersecurity Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of problems using computer networks and cybersecurity techniques.	<b>PLO 2</b>	Problem Analysis	Identify, formulate, research literature, and analyze complex problems, reaching substantiated conclusions using fundamental mathematics, natural sciences, computing, and cybersecurity.	<b>PLO 3</b>	Design/Develop Solutions	Design solutions for complex computing problems and systems components, and processes that meet specified needs and take into consideration for public health and safety, cultural, social, and environmental considerations.
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	<b>PLO 4</b>	Investigation & Experimentation	Conduct investigation of complex computing and security research-based knowledge and research-based methods																																																																																																													
	<b>PLO 5</b>	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and computing and cybersecurity tools for complex security problems																																																																																																													
	<b>PLO 6</b>	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to computing problems																																																																																																													
	<b>PLO 7</b>	Environment and Sustainability	Understand and evaluate sustainability and impact of computing and cybersecurity work in solving complex computing problems																																																																																																													
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	<b>PLO 9</b>	Individual and Team Work	Function effectively as an individual, and as a member of teams and in multi-disciplinary settings																																																																																																													
	<b>PLO 10</b>	Communication	Communicate effectively on complex computing and cybersecurity issues with the cybersecurity community and with society at large																																																																																																													
	<b>PLO 11</b>	Project Management and Finance	Demonstrate knowledge and understanding of management and economic decision making and apply these to one's own or a team																																																																																																													
	<b>PLO 12</b>	Life Long Learning	Recognize the need for, and have the preparation and motivation for, independent and life-long learning in the broadest context of technological change																																																																																																													
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<b>Topics covered in the course</b>		<b>Topics to be covered:</b>																																																																																																														

(assume 15-week instruction and 3 contact hours per week)	List of Topics		No. of Weeks	Contact Hours	CLO(s)
	Introduction to AI		1	3	1,2
	Tree Search, Graph Search, BFS, UCS		1	3	2,3
	A* Search, State Spaces, Problems with Search		1	3	2,3,4,5
	Intro to Machine Learning, Supervised learning, Computer vision, K-nearest neighbors for classification		2	6	2,4,5
	Unsupervised learning, K-means clustering		1	3	1,2,4,5
	NLP, Text classification, Naive Bayes, Decision Tree		2	6	2, 4,5
	Genetic algorithms		1	3	2,3,4,5
	Constraint Satisfaction Problems – Backtracking search for CSPs, Problem structure and problem decomposition, Local search for CSPs		1	3	2,3,4
	Adversarial search Minimax and alpha beta pruning,		1	3	2,4,5
	Neural Networks: Perceptron, Multilayer perceptron, Applications of neural networks, Perceptron Learning, Backpropagation Learning Algorithm, Competitive Learning		3	9	2,4,5
	Project Presentations		1	3	1,2,3,4,5
	Total		15	45	
	Programming Language for Assignments	Any preferred programming language but main focus will be on Python			
Class Time Spent (in percentage)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues	
	50	25	20	5	
Oral and Written Communications	Every student is required to submit at least __2__ written reports of typically __5__ pages each and to make __1__ oral presentation of typically __10__ minutes' duration.				

**Lab/ Practical Component of the course**

<b>Weeks</b>	<b>Contents/Topics</b>	<b>Assessment Items (Case Study/ Exercise Assignment/ Quiz etc.)</b>
<b>Week-01</b>	Practical Examples of AI + Basic Python	
<b>Week-02</b>	Python Cont.	
<b>Week-03</b>	Advanced Python	
<b>Week-04</b>	Types of Agents and Environments to Implement	Task-1
<b>Week-03</b>	Problem Solving by Searching – Uninformed/Blind Search Algorithms	Task 2
<b>Week-04</b>	Problem Solving by Searching – Informed search	Task 3, Quiz 1
<b>Week-05</b>	Supervised Learning (KNN)	Task 4, Assignment-1
<b>Week-06</b>	Unsupervised learning	Task 5, Quiz 2
<b>Week-07</b>	Naive Bayes,	Task 6 Assignment-2
<b>Week-08</b>	CSP	Task 7, Quiz 3
<b>Week-09</b>	Adversarial Search	Lab Midterm Exam
<b>Week-10</b>	Linear regression	Task 8, Assignment-3, Quiz 4
<b>Week-11</b>	Logistic Regression	Task 9, Quiz 5
<b>Week -12</b>	Reinforcement Learning	Task 10, Assignment-4,
<b>Week 13</b>	Neural Networks-1	Term Project
<b>Week-14</b>	Neural Networks-2	
<b>Week-15</b>	Demos of Project	