Centre for High Energy Physics
Faculty of Science
University of the Punjab, Lahore
Course Outline

Program	BSCP	**Course Code**	ACS 405	**Credit Hours**	3
Course Title	**Artificial Intelligence**				

Course Introduction

In this course we will explore the domain of artificial intelligence (AI), where the bounds of physics collide with the boundless potential of intelligent machines. In this course, we cross the boundaries between physics and AI to investigate how the principles that control our physical universe might motivate and guide the creation of intelligent systems. Since you are physicists, you already have a solid foundation in mathematical and computational concepts. In this course, we will expand on your knowledge of these concepts to explore the interesting topic of artificial intelligence. This course will enable you to not only comprehend the fundamental ideas of AI but also envision how it can completely transform the field of physics research and problem-solving. Topics covered in this course include the fundamentals of machine learning and neural networks, as well as applications in physics such as data analysis and simulations. Join us for this fascinating investigation of artificial intelligence as we reveal how the rules of physics and AI may work together to improve our knowledge of the cosmos.

Learning Outcomes

On the completion of the course, the students will:

1. Giving introduction to Artificial Intelligence.
2. Applications and Success stories on artificial intelligence.
3. Approaches to machine intelligence.
4. Intelligent Agents.
5. Machine Learning and Methods.
6. Data preparation and encoding techniques for machine learning.

Course Content

Week 1	Central dogma of artificial intelligence
	Alan Turing's concept of intelligent machines
Week 2	Levels/types of intelligence; weak and strong artificial intelligence
	Neat artificial intelligence, scurfy artificial intelligence
Week 3	Hypothesis for weak artificial intelligence
	Hypothesis for strong artificial intelligence
Week 4	Working of human brain, neuron as a structural unit of brain
	Modeling of neuron and brain using concepts of linear algebra
Week 5	Vector analysis
	Supervised learning through neural networks

Week 6	Unsupervised learning through neural networks
	Application examples of neural networks
Week 7	Algorithm of Artificial Neural Networks
	Simulation of Artificial Neural Networks
Week 8	Simulation of linear digital logic gates using neural networks
	Simulation of non-linear learning of digital logic gates using neural networks
Week 9	Genetic evolution and Darwin theory
	Genetic Algorithm
Week 10	Genetic algorithm for function approximation
	Genetic algorithm for function approximation example
Week 11	Bayesian theorem and Bayesian networks
	Computer vision
Week 12	Face detection using OpenCV
	Machine consciousness and artificial life
Week 13	Models of machines consciousness
	Models of machines consciousness (IDA)
Week 14	Models of machines consciousness (LIDA)
	Models of machines consciousness (QuBIC)
Week 15	Artificial neural networks to solve differential and integral equations.
	Artificial neural networks to solve differential and integral equations example
Week 16	Genetic algorithm to solve differential and integral equations
	Genetic algorithm to solve differential and integral equations example

Textbooks and Reading Material

1. Artificial Intelligence: A Modern Approach, (4th edition) by Stuart Russell and Peter Norvig*, Pearson, 2020.*
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving (Six Edition) by G. F. Lugar, *Addison-Wesley (Pearson Education),* (2008).
3. Pattern Recognition and Machine Learning" by Christopher M. Bishop, *Springer*, (2006).
4. Deep Learning by Ian Goodfellow, YoshuaBengio, and Aaron Courville, *MIT Press* (2016).
5. Python Machine Learning (3rd Edition) by Sebastian Raschka and VahidMirjalili, *Packet Publishing*, (2019).
6. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (2nd Edition) by AurélienGéron, *O'Reilly Media*, (2019).

Teaching Learning Strategies

The instructor is required to make use of FORTRAN/C/C++/Mathematica/Python/C# to teach the concepts through visualization/antimutation and symbolic/numerical calculations. The

students are required to solve a large portion of related exercises/questions/problems of the main textbooks.
Assignments: Types and Number with Calendar
At least two assignments and two quizzes. A course project may also be assigned.
Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. At least fifty percent of the question paper would involve new problems related to the concepts learned in the course. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.