Programme	Bachelor of Science in Solid State Physics (BS SS Physics)	**Course Code**	**IDAI-301**	**Credit Hours**	3 (3-0)
Course Title	**Artificial Intelligence in Physics**				

Course Introduction

This course is designed to introduce students to the application of artificial intelligence and machine learning techniques in solving physics-related problems. It covers foundational AI methods, including supervised, unsupervised, and reinforcement learning, and their application to various branches of physics, such as quantum mechanics, astrophysics, and condensed matter physics. The course emphasizes developing models that can analyze and predict physical systems, with a focus on integrating physical laws into machine learning algorithms, known as physics-informed neural networks (PINNs).

Learning Outcomes

By the end of this course, students will be able to:

1. Understand how AI and machine learning techniques can be applied to physics.
2. Develop skills in data analysis and model building specifically for physical data.
3. Learn to integrate physical principles into AI models to enhance their performance and interpretability.
4. Explore cutting-edge applications of AI in various physics disciplines.

	Course Content	**Assignments/Readings**
Week 1	**Unit-I** 1.1 Introduction to Machine Learning and AI	What is machine learning
Week 2	**Unit-II** 2.1 Overview of AI and machine learning fundamentals, including neural networks, decision trees, and support vector machines.	Fundamentals of AI
Week 3	**Unit-III** 3.1 Data in Physics	Physics and AI
Week 4	**Unit-IV** 4.1 Understanding the nature and sources of data in physics, including experimental, observational, and simulation data	Collect Experimental data of physics
Week 5	**Unit-V** 5.1 Machine Learning for Experimental Physics	Exercise

Week 6	**Unit-VI** 6.1 Techniques for analyzing experimental data, including pattern recognition, anomaly detection, and parameter estimation	Analyze some data
Week 7	**Unit-VII** 7.1 Simulations and Predictions in Theoretical Physics	Simulate any problem
Week 8	Mid Term Exams	
Week 9	**Unit-VIII** 8.1 Using machine learning to simulate physical systems, predict new phenomena, and solve complex equations in fields like quantum mechanics and cosmology	Use machine learning to solve problems
Week 10	**Unit-IX** 9.1 Physics-Informed Machine Learning	
Week 11	**Unit-X** 10.1 Introduction to incorporating physical laws and principles into machine learning models to improve their accuracy and interpretability	How machine learning improve accuracy
Week 12	**Unit-XI** 11.1 Case Studies and Applications	Apply machine learning in AI
Week 13	**Unit-XII** 12.1 Exploration of real-world applications of AI in physics, such as discovering new materials, analyzing astronomical data, and optimizing particle accelerators	How new materials can be identified using AI
Week 14	**Unit-XIII** 13.1 Ethical Considerations and Future Directions	Future applications of AI
Week 15	**Unit-XIV** 14.1 Discussion of the ethical implications of AI in scientific research and the future potential of AI in advancing physics	Practice
Week 16	Final Term Exams	
Textbooks and Reading Material		
1. AI Made Simple: A Beginner's Guide to Generative Intelligence -by- R. Kumar, 2023, Rinity Media Publishers		

2. ChatGPT Made Simple: How Anyone Can Harness AI To Streamline Their Work, Study & Everyday Tasks To Boost Productivity & Maintain Competitive Edge By Mastering Prompt Engineering -by- D. Nardo, 2023
3. AI for Beginners: Unlocking the Future with Artificial Intelligence: A Comprehensive Guide to Understanding, Applying, and Embracing AI's Potential for Personal Growth and Expertise -by- G. Adams (Ed), 2023

Teaching Learning Strategies

1. Course Teaching
2. Presentations
3. Quiz

Assignments: Types and Number with Calendar

1.
2.
3.
4.

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. 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.