Indian Institute of Technology Jodhpur

Course Booklet

for

M.Tech. (AI)

and

Dual degree M.Tech. (AI) + PhD

Programs

offered by the

Department of Computer Science and Engineering

July 2021

Introduction:

Artificial Intelligence (AI) is a branch of computer science that aims to create machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act. The core problems of artificial intelligence include programming computers for certain traits such as Knowledge, Reasoning, Problem-solving, Perception, Learning and Planning. AI technology development and applications are evolving rapidly with major implications for economies and societies. As the demand for such applications increases, there is also an increasing need for building the future workforce for AI. For developing the AI ecosystem, this program will be executed in synergy with other M.Tech programs running in IIT Jodhpur, such as Sensors & IoT, Cyber-Physical Systems, and Advanced Manufacturing and Design.

Objectives:

This M.Tech in AI programme will offer students with deep knowledge of both fundamental AI technologies, as well as application-oriented AI. A student completing this program will be capable to undertake careers in industry as well as academia. He/She will have the option to explore a variety of domains including Manufacturing, Fintech, Healthcare, Agriculture/Food Processing, Education, Retail/Customer Engagement, Human and Robot interaction/intelligent automation, Smart City , Aid for Differently Abled/Accessibility Technology.

Expected Graduate Attributes:

After completing this programme, a student will be able to develop an ability to:

1. Comprehend fundamental concepts and hands-on knowledge of the state-of-the-art AI methodologies.
2. Design and Build real-world AI systems for complex planning, decision making and learning, solving application-specific problems, and to reason about them.
3. Conceive, Design and Develop Intelligent multi-modal multi-sensory Man-Machine interfaces.
4. Design, Develop and Deploy machine learning based applications using structured and unstructured data (e.g., speech, text, images/videos).
5. Understand and Assess reliability, dependability and trust-worthiness of AI-based systems.
6. Design and develop AI applications for resource constrained environments.
7. Adhere to evolving ethics and privacy laws across various domains and territories.
8. Plan and manage technical projects.

Learning Outcome:

1. Understand the fundamentals of Artificial Intelligence, Machine Learning, Inference Engines, Speech, Vision, Natural Language Understanding, Robotics, and Human Computer Interaction.
2. Unify the knowledge of human cognition, AI, Machine Learning and data engineering for designing systems.
3. Demonstrate hands-on knowledge of state-of-the-art AI tools for real-world problem-solving.
4. Ability to develop real-time and robust AI-based systems with specific software, hardware and data requirements.
5. Build solutions to explore fully immersive computer-generated worlds (in VR), and overlay computer graphics onto our view of our immediate environment (AR) along with smart, cognitive functionality.
6. Demonstrate advanced skills to comprehend and communicate effectively.

7. Carry out projects using intelligent cognitive solutions provided by AI algorithms to get more insights in stakeholder management, risk modeling, intelligent resource scheduling and managing project constraints with intelligent use of data models.

Course Structure for
M.Tech. (AI) Program and Dual degree M.Tech. (AI) + PhD

Cat	Code	Course Title	L-T-P	Cr
Semester 0				
* Bridge Course on DSA				
I Semester				
C	MAL7xx0	Optimization	2-0-0	2
C	CSL7xx0	Artificial Intelligence	3-0-0	3
C	CSL7xx0	Advanced Data Structures and Algorithms	2-0-0	2
C	CSP7xx0	Machine Learning	3-0-0	3
C	xxxxx	ML-Ops	0-0-2	1
PE	xxxxx	Program Elective 1	3-0-0	3
NG	xxxxx	Technical Communication	1-0-0	1
		Total Credits: 15		

Cat	Code	Course Title	L-T-P	Cr
II Semester				
C	CSL7xx0	Deep Learning	3-0-0	3
C	CSL7xx0	DL-Ops	0-0-2	1
C	CSL7xx0	Core Bucket: Advanced Artificial Intelligence/ Autonomous Systems	3-0-0	3
PE	xxxxx	Program Elective 2	3-0-0	3
PE	xxxxx	Program Elective 3	3-0-0	3
OE	xxxxx	Open Elective 1	3-0-0	3
NG	xxxxx	Ethics and Professional Life	1-0-0	1
		Total Credits: 17		

Cat	Code	Course Title	L-T-P	Cr
III Semester				
P	CSDxx0	Major Project – Part 1	0-0-10	5
PE	xxxxx	Program Elective 4	3-0-0	3
PE	xxxxx	Program Elective 5	3-0-0	3
OE	xxxxx	Open Elective - 2	3-0-0	3
NG	xxxxx	System Engineering and Project Management	1-0-0	1
		Total Credits: 15		

Cat	Code	Course Title	L-T-P	Cr
IV Semester				
P	CSDxx0	Major Project – Part 2	0-0-22	11
PE	xxxxx	Program Elective 6	3-0-0	3
NG	xxxxx	Intellectual Property	1-0-0	1
		Total Credits: 15		

	Credit Distribution	
1	Program Core	18 credits
2	Program Electives	18 credits
3	Open Electives	6 credits
4	Project	16 credits
5	Non-graded	4 credits
	Total	62 credits

	**List of Prescriptive Electives
1	Linear algebra for data science
2	Statistics for Data Science

*The students should have satisfactory performance in the course in order to be eligible for internships and placements opportunities from the institute.

**Depending on the background of students, courses from the prescriptive electives can be recommended for students by the DRC.

Program Electives for M.Tech. (AI) and Dual Degree M.Tech. (AI) + Ph.D. Program

Courses offered by Department of Computer Science and Engineering	
Animation Advanced Artificial Intelligence Advanced Computer Graphics Advanced ML Advanced Biometrics Advancements in Computer Vision Advanced Human-Machine Interaction Algorithms for Big Data Bio-image computing Bioimaging Blockchain Cryptography Computer Graphics Computer Vision Computational Learning Theory Computer Architecture Crowd-sourcing and Human Computing Data Visualization Dependable AI Digital Image Analysis Edge and Fog Computing Ethics, Policy, Law and Regulation in AI Embedded Systems GPU Programming Graph Theory and Applications Graph Theoretic Algorithms	Health Informatics Information Retrieval Introduction to AR and VR Machine Learning with Big Data Medical Image Analysis Natural Language Processing Neuromorphic Computing and Design Principles of Biological Vision Autonomous Systems Reliability Engineering and Life Testing Resource Constrained Artificial Intelligence Scalable Machine Learning Selected Topics in AI - I/II/III Selected Topics in CS - I/II/III Selected Topics in ML - 1/2/3 Social Network Analysis Social Networks (700) Software and Data Engineering Security and its Applications Speech Understanding Stream Analytics Vehicular Ad-hoc Networks Visual Perception Virtualization and Cloud Computing Advanced Data Structures and Algorithms (Fractal 3)

Courses offered by Department of Electrical Engineering	
Adaptive Signal Processing Advanced Digital Signal Processing Compressive Sensing Computational Imaging Digital Signal Processing and Applications Data Compression Cyber Physical System Modelling and Simulation lab	Digital Video Processing Introduction to Haptics Introduction to Cyber-Physical Systems Machine Learning for Communication Introduction to Smart Grid Speech and Audio Signal Processing Statistical Decision Theory Wavelets
Courses offered by Department of Mechanical Engineering	
Robotics	Planning and Decision Making for Robots
Courses offered by Department of Bioscience and Bioengineering	
Bioinformatics	Computational Biology

Courses offered by Department of Mathematics	
Advanced Topics in Computational PDE AI for Finance Computational finance Computational Game Theory Linear Algebra with Data	Linear Algebra for Data Science Statistics for Data Science Stochastic Processes Mathematical modeling and simulations
Courses offered by Department of Physics	
Quantum Information Processing	Quantum Cryptography and Coding
Courses offered by IDRP Digital Humanities	
Analysis of Social Media Networks Human Factors in Interaction Design Digital Methods and Tools	Fundamentals of Digital Humanities: Fractal - 2 (Data and Knowledge representations)
Courses offered by School of AIDE	
Cognitive Architectures Introduction to Financial Engineering Computational Neuroscience Connectomics Computational Cognition & Behavior Modelling	Differential Geometry Introduction to Game Theory Machine Learning for Epidemiology Nonlinear Dynamics and Chaos Optimization in ML Special Topics in Data Science - 1/2/3
Courses offered by School of Management and Entrepreneurship	
AI for Risk Analysis	Risk Management Analytics Stochastic Modelling