UG Curriculum
for
B.Tech. in Artificial Intelligence and Data Science

Department of Computer Science and Engineering (CSE)

Indian Institute of Technology Jodhpur

1. Introduction

This BTech program combines two broad areas, Artificial Intelligence and Data Science, while building a strong foundation in Computer Science. Artificial Intelligence (AI) aims to create machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act. On the other hand, Data Science (DE) is the art of generating insight, knowledge and predictions by processing data pertaining to a system or a process. As the demand for these areas increases, there is also an increasing need for building the future workforce for Artificial Intelligence and Data Science. IIT Jodhpur will offer this unique program to develop the Artificial Intelligence and Data Science ecosystem in the country. The curriculum includes courses in computer science, mathematics, artificial intelligence, machine learning, and their applications in various domains.

2. Objectives of the program

- The program will offer students with in-depth knowledge of fundamental concepts, as well as application-oriented technologies in the broad areas of Artificial Intelligence and Data Science.
- A student completing this program will be capable of undertaking careers in industry as well as academia. Interested students may also follow entrepreneurial endeavors in concerned areas.
- He/She will have the option to explore a variety of domains including governance, finance, security, transportation, healthcare, energy management, agriculture/food processing, population studies, weather prediction, economics, predictive maintenance, health monitoring, smart manufacturing, education, human and robot interaction/intelligent automation, smart city, and aid for differently abled/accessibility technology.

3. Expected Graduate Attributes

After completing this program, a student will develop an ability to:

- Comprehend fundamental concepts and hands-on knowledge of the state-of-the-art methodologies in AIDE.
- Skill set to clean, process, analyze, manage and handle security and privacy aspects of structured and unstructured data.
- Ability to identify, design and apply appropriate pattern recognition and data mining methods for generating relevant insight from data.
- Design and build real-world AIDE systems, solving application-specific problems, and to reason about them.
- Conceive, design and develop Intelligent multi-modal multi-sensory man-machine interfaces.
- Design, develop, and deploy machine learning based applications using structured and unstructured data (e.g., speech, text, images/videos).
- Capability to follow a unique interdisciplinary approach for solving problems, using knowledge of mathematics, statistics, computing and one or more selected domains among physics, chemistry, biology, engineering sciences, and management.
- Understand and assess reliability, dependability and trust-worthiness of AIDE based systems and their impact on societal and environmental context.
- Design and develop AI applications for resource constrained environments.
- Adhere to evolving ethics and privacy laws across various domains and territories.
- Plan and manage technical projects.

4. Learning Outcomes

The student will have an ability to

- Apply the knowledge of mathematics, science, engineering fundamentals along with artificial intelligence and machine learning knowledge, and an engineering specialization to develop solutions to complex problems.
- Apply appropriate theories, design principles, frameworks, and protocols to develop AIDE based system prototypes.
- Demonstrate hands-on knowledge of modern simulation, and programming tools with an understanding of the limitations.
- Apply to reason informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the society at large by comprehending and writing effective reports and design documentation, making effective presentations and exchanging clear instructions.
- Apply appropriate project and business management principles and tools for real-world problems.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. New skill sets targeted

- Artificial intelligence and data science algorithms for transforming large data into actionable decision
- Building end to end systems for enhancing human capabilities using vision, language, and text processing
- Foundations in ML Optimization
- Ethical, Safe, and Dependable AI/ML Systems
- Familiarity with emerging and futuristic AIDE techniques
- Entrepreneurial capability
- Written and oral communication

6. Course Categories, Credit Distribution, and Structure Of "B.Tech. In Artificial Intelligence and Data Science (AIDE)" Programme

The standard B.Tech. in Artificial Intelligence and Data Science curriculum necessitates 154 credits for degree completion. Consistent with the framework presented in Table 1, the undergraduate academic structure comprises four distinct segments: Institute Core, Programme Core, Open Electives, and Essential Audit components.

a) Institute Core: Accounting for 39 credits, the Institute Core establishes a broad academic base across Engineering, Science, and Humanities. These courses are designed to cultivate the analytical rigour, scientific grounding, and communicative proficiency essential for the engineering profession. This foundational coursework is primarily administered during the 1st year across Semesters I and II, and one course in Semester III.

b) Programme Core: With a weight of 91 credits, the Programme Core represents the specialized disciplinary heart of the curriculum, encompassing both mandatory and elective subjects within Artificial Intelligence and Data Science. This segment fosters expertise in core areas of Artificial

Intelligence and Data Science. These discipline-specific courses are scheduled throughout the 2nd and 3rd years of the programme.

c) Open Electives: This 12-credit component offers students the latitude to engage in interdisciplinary study, encouraging innovation through exposure to diverse technological fields. The credits under this component are available in the 4th year (Sem VII & VIII) of the B.Tech. programme.

d) Essential Audit: The Essential Audit segment consists of 12 non-graded credits, including internships, design projects, and audit courses in humanities and engineering. This component focuses on professional development, industry readiness, practical exposure, product design skills, and experiential learning – essential for contemporary engineering practices. The credits under this component are spread across the four years of the B.Tech. programme.

Table 1. Proposed B.Tech-AIDE Curriculum Structure

S.No.	Course Type	Course Category	Credits	Total Credits
1	Institute Core (I)	Engineering (IE)	16	39 (27.5%)
		Science (IS)	17	
		Humanities (IH)	06	
2	Programme Core (P)	Programme Compulsory (PC)	67	91 (64.1%)
		Programme Elective (PE)	18	
		(B.Tech.) Project (PP)	06	
3	Open (O)	Open Elective (OE)	12	12 (8.4%)
Total Graded				**142 (100%)**
4	Compulsory Audit	Humanities (NH)	3	12
		Engineering (NE)	3	
		Industry-Academia Summer Internship outside IIT Jodhpur (two summers, minimum 45 days)	4	
		Design Credit (during regular semester after Semester II)	2	
Total for Award of Degree (Graded + Compulsory Audit)				**154**

7. Course Categories, Credit Distribution And Structure Of "B.Tech. With Minor" Programme

At the Indian Institute of Technology Jodhpur, the B.Tech with Minor programme enables students to pursue their primary B.Tech degree in their parent academic unit while undertaking an interdisciplinary specialization (Minor) in a different academic unit. The Minor is awarded upon completion of the prescribed courses of the parent unit, and an additional 18 credits from the academic unit offering the Minor. Consequently, the open elective credit requirement for students pursuing a 'B.Tech with Minor' programme is reduced to zero, as is presented in Table 2. The remaining course requirements (viz. Institute Core, Programme Core, and Essential Audit) remain the same as those in the institute-wide regular B.Tech curriculum structure.

Table 2. Proposed "B.Tech with Minor" and "Dual-Degree (B.Tech + Ph.D.)" Curriculum Structure

S.No.	Course Type	Course Category	B.Tech. Regular	Dual Degree (B.Tech. + Ph.D.)	B.Tech with Minor
1	Institute Core (I)	Engineering (IE)	16	16	16
		Science (IS)	17	17	17
		Humanities (IH)	06	06	06
2	Programme (P)	Compulsory (PC)	67	67	67
		Electives (PE)	18	18	18
		B.Tech. Project (PP)	6	6	6
3	Open (O)	Electives (OE)	12	12	0
4	Additional Credits	Programme Compulsory (PC) (Selected courses prescribed by the offering academic unit.)	NA	NA	18
5	Ph.D.	Compulsory (DC)	NA	12	NA
		Electives (DE)		12	
		Ph.D. Thesis (DT)		64	
Total Graded			**142**	**230**	**148**
6	Essential Audit (Non-taught)	Humanities (NH)	3	3	3
		Engineering (NE)	3	3	3
		Industry-Academia Summer Internship outside IIT Jodhpur (two summers, minimum 45 days - after 2nd and 3rd Year)	4	4	4
		Design/Practical Experience (ND) (during regular semester after 1st Year)	2	2	2
Total Graded + Essential Audit Credits			**154**	**242**	**160**

8. List Of Institute-wide Courses For Engineering (IE), Science (IS) And Essential Audit courses In Engineering (NE) And Humanities (NH)

Table 3 presents the list of all compulsory Institute-wide courses in Engineering and Science, and essential audit courses in Engineering and Humanities. These courses are mostly done during Semester I and II, with a few done in Semester III and V.

Table 3. List of IE, IS, NE, NH Courses for B.Tech-AIDE

Course Category	Course Name	Semester	L-T-P	Contact Hours	Credit
Institute-wide Engineering (IE) Courses (16 credits)	1. Engineering Mechanics	I	3-0-0	3	3
	2. Introduction to Computer Science	I	3-0-2	5	4
	3. Introduction to Machine Learning	II	3-0-2	5	4
	4. Engineering Drawing	II	0-0-2	2	1
	5. Engineering Workshop	I	0-0-2	2	1

	6. Environment and Sustainability	III	3-0-0	3	3
Institute-wide Science (IS) Courses (17 credits)	1. Physics	I	3-0-0	3	3
	2. Physics Lab	I	0-0-2	2	1
	3. Chemistry	II	3-0-0	3	3
	4. Chemistry Lab	II	0-0-2	2	1
	5. Mathematics I	I	2-1-0	3	3
	6. Mathematics II	II	2-1-0	3	3
	7. Introduction to Bioengineering	II	2-0-2	4	3
Institute-wide Humanities & Social Science (IH) Courses (6 credits)	1. HSS I	I	3-0-0	3	3
	2. HSS II	II	3-0-0	3	3
Institute-wide NH courses (3 credits)	1. Communication Skills	I	0-0-2	2	1
	2. Performing Arts /Sports	I	0-0-1	1	0.5
	3. Social Connect and Responsibilities	I	0-0-1	1	0.5
	4. Professional Ethics	V	1-0-0	1	1
Institute-wide NE courses (3 credits)	1. Engineering Design I	I	0-0-2	2	1
	2. Engineering Design II	II	0-0-2	2	1
	3. Introduction to Profession	II	0-0-2	2	1
				Total	**45**

9. List Of Programme Compulsory (PC) Courses of B.Tech-AIDE (Regular)

The list of Programme Compulsory (PC) courses for the B.Tech in Artificial Intelligence and Data Science is presented in Table 4 for the regular programme. Table 5 presents the list of compulsory courses (equating to 18 additional credits) for students aiming to pursue a B.Tech with a Minor in Artificial Intelligence and Data Science.

Table 4. Programme Compulsory (PC) Courses for B.Tech-AIDE

Sr. No.	Course Name	Semester	L-T-P	Contact Hours	Credit
1	Probability Statistics and Stochastic Process	III	3-1-0	4	4
2	Discrete Mathematics	III	3-1-0	4	4
3	Principles of Computer Systems - 1	III	3-0-0	3	3
4	Data Structures and Algorithms	III	3-0-0	3	3
5	AIDE Lab 1	III	0-0-4	4	2
6	Principles of Computer Systems - 2	IV	3-0-0	3	3
7	Data Engineering	IV	3-0-0	3	3
8	Data Visualization	IV	3-0-0	3	3
9	Artificial Intelligence	IV	3-0-0	3	3
10	Signals and Systems	IV	3-1-0	4	4
11	AIDE Lab 2	IV	0-0-6	6	3

12	Human Computer Interaction	V	3-0-0	3	3
13	Design and Analysis of Algorithms	V	3-1-0	4	4
14	Deep Learning	V	3-0-0	3	3
15	Optimization for Machine Learning	V	3-0-0	3	3
16	AIDE Lab 3	V	0-0-6	6	3
17	Computer Vision	VI	3-0-0	3	3
18	Responsible AI	VI	3-0-0	3	3
19	Autonomous Systems	VI	3-0-0	3	3
20	Robotic Intelligence	VI	3-0-0	3	3
21	Natural Language Processing	VI	3-0-0	3	3
22	AIDE Lab 4	VI	0-0-2	2	1
				Total	67

Table 5. Ordered list of compulsory courses for B.Tech with Minor in AIDE (applicable to UG programs other than B.Tech-AIDE). The prescribed order needs to be followed strictly for completing the minimum credit requirements.

Sr. No.	Course Name	Sem for Regular	Sem for Minor	L-T-P	Contact Hours	Credit
M1	Principles of Computer Systems - 1	III	III/V/VII	3-0-0	3	3
M2	Principles of Computer Systems - 2	IV	IV/VI/VIII	3-0-0	3	3
M3	Artificial Intelligence	IV	IV/VI/VIII	3-0-0	3	3
M4	Deep Learning	V	V/VII	3-0-0	3	3
M5	Responsible AI	VI	VI/VIII	3-0-0	3	3
M6	Optimization for Machine Learning	V	V/VII	3-0-0	3	3
					Total Additional Credits	**18**

* Only when some program already has one or more of the above listed courses as its PC, a student will be required to take other non-overlapping course(s) as in the following ordered list of augmented courses to fulfil the minimum credit requirement of 18 for Minor in B.Tech-AIDE. The prescribed order needs to be followed strictly for completing the minimum credit requirements.

Sr. No.	Course Name	Sem for Regular	Sem for Minor	L-T-P	Contact Hours	Credit
A1	Data Visualization	IV	IV/VI/VIII	3-0-0	3	3
A2	Human Computer Interaction	V	V/VII	3-0-0	3	3
A3	Robotic Intelligence	VI	VI/VIII	3-0-0	3	3
A4	Autonomous Systems	VI	VI/VIII	3-0-0	3	3

10. List of Programme Elective (PE) Courses For B.Tech-AIDE

The program emphasizes on training students in emerging areas through a curated Programme Elective bouquet (presented in Table 6). These courses have taken into consideration national requirements as well as industrial and societal needs.

Table 6: Focus area-wise Programme Elective (PE) courses for B.Tech-AIDE

S. No.	Focus Area	Courses	Level	L-T-P	Credit
1	AI/ML and DS	Computer Graphics	400	3-0-0	3
		Cognitive Architecture	400	3-0-0	3
		Computational Learning Theory	400	3-0-0	3
		Introduction to AR/VR	400	3-0-0	3
		Maths for Big Data	400	3-0-0	3
		Statistical Inference and Simulation Techniques	400	3-0-0	3
		Foundation Model and Generative AI	700	3-0-0	3
		Autonomous Systems	700	3-0-0	3
		Speech Understanding	700	3-0-0	3
		Machine Learning with Big Data	700	3-0-0	3
		ML-DL-Ops	700	2-0-2	3
		Advanced Machine Learning	700	3-0-0	3
		Learning on Graphs and Its Applications	700	3-0-0	3
		AI Security	700	3-0-0	3
2	System for AI	Distributed Systems	400	3-0-0	3
		GPU Programming	400	3-0-0	3
		Embedded Systems	400	3-0-0	3
		Virtualization and Cloud Computing	700	3-0-0	3
		ML Systems	700	3-0-0	3
		Distributed Database Systems	700	3-0-0	3
3	Theory	Computational Social Choice Theory	400	3-0-0	3
		Quantum Computing	400	3-0-0	3
		Advanced Algorithms	700	3-0-0	3

Total Number of 400 level PE Courses	**11**
Total Number of 700 level PE Courses	**12**

Note: 400 level courses are specific to B.Tech. students, while 700 level courses are open to B.Tech., M.Tech, and Ph.D. students as applicable.

12. Open Elective (OE) Courses From Other Academic Units

Open elective courses enable students to explore subjects beyond their core discipline, aiming at broadening their scope - particularly in cross-disciplinary and transdisciplinary generalization.

OE Course	Description
Objective	To encourage interdisciplinary learning and broaden knowledge across different domains
Eligibility	Open to students from different departments, subject to prerequisites of the offered courses from the CSE department or other academic units.
Credit Requirement	Students in the regular B.Tech programme are required to complete 12 credits of open elective courses. For a B.Tech. with Minor route, the OE credits are replaced with 18 credits of selected compulsory courses from the minor department.

13. Curriculum Of "Regular B.Tech." And "B.Tech. With Minor" Programmes In Artificial Intelligence and Data Science (AIDE)

Tables 7 and 8 present the semester-wise placement of Institute-wide courses (IE, IS, IH, NE, NH) and Programme Compulsory (PC) courses for the regular B.Tech-AIDE programme and B.Tech with Minor in AIDE, respectively.

Table 7. Semester-wise plan for regular B.Tech-AIDE

Cat	Course	LTP	CH	NC	GC	Cat	Course	LTP	CH	NC	GC
I Semester						**II Semester**					
IE	Engineering Mechanics	3-0-0	3	-	3	IE	Introduction to Machine Learning	3-0-2	4	-	4
IE	Introduction to Computer Science	3-0-2	4	-	4	IS	Chemistry	3-0-0	3	-	3
IS	Physics	3-0-0	3	-	3	IS	Introduction to Bioengineering	2-0-2	4	-	3
IH	Humanities I	3-0-0	3		3	IS	Chemistry Lab	0-0-2	2	-	1
IS	Physics Lab	0-0-2	2	-	1	IH	Humanities II	3-0-0	3		3
IS	Mathematics I	2-1-0	3	-	3	IS	Mathematics II	2-1-0	3	-	3
IE	Engineering Drawing	0-0-2	2	-	1	IE	Engineering Workshop	0-0-2	1	-	1
NE	Engineering Design I	0-0-2	2	1	-	NE	Engineering Design II	0-0-2	2	1	-
NH	Communication Skills	0-0-2	2	1	-	NE	Introduction to Profession	0-0-2	2	1	-
NH	Social Connect and responsibilities	0-0-1	1	0.5	-						
NH	Performing Arts / Sports	0-0-1	1	0.5	-						
Total				**3**	**18**	**Total**				**2**	**18**
III Semester						**IV Semester**					

PC	Probability Statistics and Stochastic Process	3-1-0	4	-	4	PC	Principles of Computer Systems - 2	3-0-0	3	-	3
PC	Discrete Mathematics	3-1-0	4	-	4	PC	Artificial Intelligence	3-0-0	3	-	3
PC	Principles of Computer Systems - 1	3-0-0	3	-	3	PC	Data Engineering	3-0-0	3	-	3
PC	Data Structures and Algorithms	3-0-0	3	-	3	PC	Data Visualization	3-0-0	3	-	3
PC	AIDE Lab 1	0-0-4	4	-	2	PC	Signals and Systems	3-1-0	4	-	4
						PC	AIDE Lab 2	0-0-6	6	-	3
IE	Environment and Sustainability	3-0-0	3	-	3						
Total					**19**	**Total**				**-**	**19**
	Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)										
V Semester						**VI Semester**					
PC	Human Computer Interaction	3-0-0	3	-	3	PC	Computer Vision	3-0-0	3	-	3
PC	Deep Learning	3-0-0	3	-	3	PC	Responsible AI	3-0-0	3	-	3
PC	Optimization for Machine Learning	3-0-0	3	-	3	PC	Autonomous Systems	3-0-0	3	-	3
PC	Design and Analysis of Algorithms	3-1-0	4	-	4	PC	Robotic Intelligence	3-0-0	3	-	3
PC	AIDE Lab 3	0-0-6	6	-	3	PC	Natural Language Processing	3-0-0	3	-	3
						PC	AIDE Lab 4	0-0-2	2	-	1
PE	Programme Elective	3-0-0	3	-	3	PE	Programme Elective	3-0-0	3	-	3
NH	Professional Ethics	1-0-0	1	1	-						
Total				**1**	**19**	**Total**					**19**
	Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)										
VII Semester						**VIII Semester**					
PP	B.Tech Project 1	0-0-3		-	3	PP	B.Tech Project 2	0-0-3		-	3
PE	Programme Elective	3-0-0	3	-	3	PE	Program Elective	3-0-0	3	-	3
PE	Programme Elective	3-0-0	3	-	3	PE	Program Elective	3-0-0	3	-	3
OE	Open Elective	3-0-0	3	-	3	OE	Open Elective	3-0-0	3	-	3
OE	Open Elective	3-0-0	3	-	3	OE	Open Elective	3-0-0	3	-	3
Total					**15**	**Total**				**-**	**15**
Total of graded and Non-Graded Credit										**6**	**142**
Non-Graded Design Credits (2) and Summer Internships (4)										**6**	**-**
Grand Total										**12**	**154**

Note: Design Credit is to be done during regular semesters after 1st Year

Table 8. Semester-wise plan for B.Tech with Minor in AIDE

Cat	Course	LTP	CH	NC	GC	Cat	Course	LTP	CH	NC	GC
Semester I - IV: (Same as Table 7) where Programme Compulsory (PC) courses are respective to academic units other than B.Tech-AIDE											
2nd Year and 3rd Year: Summer Semester Internship (Minimum 45 days, Outside IIT Jodhpur)											
V Semester						**VI Semester**					
PC	Programme Compulsory courses offered by academic unit other than AI and DS				15	PC	Programme Compulsory courses offered by academic unit other than AI and DS				16
PE/ OE	Programme / Open Elective / Minor Compulsory Courses*				3	PE/OE	Programme / Open Elective / Minor Compulsory Courses*				3
NH	Professional Ethics I	1-0-0	1	1	-						
Total				**1**	**18**	**Total**					**19**
VII Semester						**VIII Semester**					
PP	B.Tech Project 1	0-0-3			3	PP	B.Tech Project 2	0-0-3		3	3
PE/ OE	Programme / Open Elective / Minor Compulsory Courses*				15	PE/ OE	Programme / Open Elective / Minor Compulsory Courses*				15
Total					**18**	**Total**				**-**	**18**
										Total	**147**
										Essential Audit Credits	**12**
										Grand Total	**159**

** Minor Compulsory Courses will be offered across Semester III-VIII.*

13. Description And Motivation Underlying Programme Core (PC) And Programme Elective (PE) Courses of B.Tech-AIDE

Table 9 and 10 present brief descriptions and general motivation underlying the PC and PE courses, respectively, for the B.Tech-AIDE programme.

Table 9. Description and Motivation of PC Courses

Sr. No.	Focus Area	Course Name	Description & Motivation
1	Theory	Data Structures and Algorithms	The foundational pillar of the CSE discipline – this course will introduce fundamental techniques focusing on the design and implementation of solutions to problems involving computing systems.
2		Probability Statistics and Stochastic Process	Will cover methods dealing with modeling of uncertainty, analysis of data, and system optimization.
3		Discrete Mathematics	Will deal with understanding and effective design of graphs, logic, and algorithms to

			model, analyze, and solve discrete problems.
4		Design an Analysis of Algorithms	Will enhance understanding of DSA towards improved solution design for complex problems through analysis of algorithm performance.
5	Systems for AI	Signals and Systems	Will cover methodologies underlying mathematical modeling of signals (like real-world multimodal data) and design of efficient computing systems to process signals. Will complement digital design and particularly applies to Systems and AI / ML focus areas.
6		Principles of Computer Systems - 1	Introduces computer architecture, digital systems, and compiler basics. Covers hardware-software interaction and language translation concepts.
7		Principles of Computer Systems - 2	Covers operating systems, networking, and virtualization concepts. Focuses on process management and interconnected systems.
8	AI/ML and DS	Artificial Intelligence	Covers intelligent problem-solving and reasoning techniques. Introduces search algorithms, planning, and machine learning basics.
9		Data Engineering	Focuses on data storage, processing, and big data technologies. Covers SQL, NoSQL, and distributed data systems.
10		Data Visualization	Teaches techniques for presenting and analyzing data visually. Covers interactive dashboards and visualization tools.
11		Optimization for Machine Learning	Introduces optimization algorithms used in machine learning. Covers gradient methods, regularization, and convex optimization.
12		Deep Learning	Introduces neural networks and modern deep learning models. Covers CNNs, RNNs, GANs, and representation learning.
13		Human-Machine Interaction	Focuses on user-centered design and interaction techniques. Covers usability, prototyping, and interface evaluation.
14		Computer Vision	Introduces image processing and visual recognition techniques. Covers object detection, segmentation, and visual understanding.

15		Responsible AI	Focuses on ethical, explainable, and trustworthy AI systems. Covers fairness, privacy, robustness, and AI safety concepts.
16		Autonomous Systems	Covers intelligent autonomous agents and decision-making systems. Introduces sensing, planning, and control mechanisms.
17		Robotic Intelligence	Introduces intelligent robotic systems, sensors, and motion control. Covers robot design, navigation, and automation principles from artificial intelligence perspective.
18		Natural Language Processing	This course covers computational methods for enabling machines to process, understand, and reason over human language. Topics include language representation, syntax, semantics, information extraction, question answering, dialogue systems, machine translation, and large language models. Students gain the foundations required for building systems such as chatbots, search engines, document intelligence, and language assistants.
19	AIDE Lab	AIDE Lab 1	(1) Data Structures and Algorithms Lab (2) Principles of Computer Systems - 1 Lab
20		AIDE Lab 2	(1) Principles of Computer Systems - 2 Lab (2) Data Engineering Lab (3) Data Visualization Lab
21		AIDE Lab 3	(1) Human Computer Interaction Lab (2) Deep Learning Lab (3) Optimization for Machine Learning Lab
22		AIDE Lab 4	(1) Robotic Intelligence Lab

Table 10. Description and Motivation of PE Courses

1	AI/ML and DS	Computer Graphics (Level 400)	Covers 2D/3D graphics, rendering, and visualization techniques. Introduces animation and graphical system design.
2	AI/ML and DS	Cognitive Architecture (Level 400)	Explores computational models of human cognition and behavior. Focuses on AI systems inspired by cognitive science.

3	AI/ML and DS	Advanced Machine Learning (Level 400)	Covers advanced machine learning algorithms and optimization methods. Focuses on real-world AI applications.
4	AI/ML and DS	Computational Learning Theory (Level 400)	Introduces theoretical foundations of machine learning. Covers learnability, complexity, and generalization concepts.
5	AI/ML and DS	Introduction to AR/VR (Level 400)	Introduces augmented and virtual reality technologies. Covers immersive interaction and 3D environment design.
6	AI/ML and DS	Maths for Big Data (Level 400)	Covers statistical methods and numerical linear algebra for big data, including multivariate analysis, advanced sampling, matrix decompositions, PCA, low-rank approximations, and algorithms for large-scale datasets.
7	AI/ML and DS	Statistical Inference and Simulation Techniques (Level 400)	Covers methods for drawing conclusions from data using probability, estimation, and hypothesis testing. Topics include simulations, bootstrapping, inference, and resampling methods.
8	AI/ML and DS	Foundation Model and Generative AI (Level 700)	Covers large foundation models and generative AI systems. Focuses on transformers and LLM applications.
9	AI/ML and DS	Autonomous Systems (Level 700)	Introduces intelligent autonomous agents and robotic systems. Covers planning, sensing, and adaptive decision making.
10	AI/ML and DS	Speech Understanding (Level 700)	Covers speech recognition and conversational AI systems. Focuses on audio processing and language understanding.
11	AI/ML and DS	Machine Learning with Big Data (Level 700)	Explores scalable machine learning techniques for massive datasets. Covers distributed processing and big data tools.
12	AI/ML and DS	ML-DL-Ops (Level 700)	Introduces deployment and maintenance of ML/DL systems. Covers pipelines, monitoring, and production workflows.
13	AI/ML and DS	Learning on Graphs and Its Applications (Level 700)	Covers graph machine learning and graph neural networks. Focuses on relational and networked data analysis.
14	AI/ML and DS	AI Security (Level 700)	Introduces security challenges in AI systems. Covers adversarial attacks, defenses, and trustworthy AI.
15	System for AI	ML Systems (Level 400)	Covers scalable system design for machine learning applications. Focuses on efficient training and inference infrastructure.

16	System for AI	Distributed Systems (Level 400)	Introduces distributed computing architectures and protocols. Covers synchronization, scalability, and fault tolerance.
17	System for AI	GPU Programming (Level 400)	Covers parallel programming with GPUs for high-performance computing. Focuses on accelerated AI workloads.
18	System for AI	Embedded Systems (Level 400)	Introduces hardware-software integration in embedded devices. Covers real-time systems and IoT applications.
19	System for AI	Virtualization and Cloud Computing (Level 700)	Covers virtualization technologies and cloud platforms. Focuses on scalable computing infrastructure and services.
20	System for AI	Distributed Database Systems (Level 700)	Introduces distributed storage and database management systems. Covers replication, consistency, and scalability.
21	Theory	Computational Social Choice Theory (Level 400)	Explores algorithmic decision-making in social systems. Covers voting theory, fairness, and collective intelligence.
22	Theory	Quantum Computing (Level 400)	Introductory course exploring computation using quantum-mechanical principles. Topics include qubits, superposition, entanglement, quantum gates, algorithms, error correction, cryptography, and emerging quantum computing applications and hardware.
23	Theory	Advanced Algorithms (Level 700)	Covers advanced algorithmic techniques and complexity analysis. Focuses on efficient solutions for challenging problems.

14. Guidelines for Curriculum Implementation:

- B.Tech project (BTP) 1 and 2 will be done under the same supervisor. Each component will be evaluated in the respective semesters. Since BTPs are part of the program core requirement, the supervisor should be from the department.
- Compulsory Industry-Academia Summer Internship outside IIT Jodhpur: The internship will be after the 4th and 6th semesters during the summer semester break. It is the students' responsibility to complete the internship, which should be for a minimum of 45 days. Students are expected to submit an internship completion certificate, a report, etc., as will be required, to their department.
- B.Tech with Minor: Each academic unit will fix the programme core courses of 18 credits for the minor in its discipline. The departments will circulate the forms to the students at the end of the 2nd, 3rd, and 4th semesters for opting minor. Each department will decide the maximum intake for the minor. Open elective credits will be utilized for completing the minor requirements (12 credits). The students will do (minimum) extra 6 credits to earn a minor in a discipline.
- Design credit will be done during a regular semester after semester-2.