Indian Institute of Technology Jodhpur

B.Tech. AI & DS Curriculum Structure AY 2020-21

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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 (DS) is the art of generating insight, knowledge and predictions by processing data pertaining to a system or a process. AI and Data Science can feed into each other as evolutionary systems that can continuously learn from data and thereby emulate humans better. 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. The curriculum also provides opportunities to the students to explore specialization areas including visual computing, socio-digital realities, robotics, and AIOT. The program also allows the students to venture into Management specialization with AI and Technology focus, leading to MBA (BTech + MBA dual degree program), as well as entrepreneurial activities. The program also enables the students to build strong industry linkages in terms of practical training program, summer internships, and co-supervision on projects.

2. Objectives of the program

1. BTech in AI&DS 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.
2. 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 AI&DS areas.
3. 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, legal systems, content creation and management systems, weather prediction, economics, predictive maintenance, smart manufacturing, education, human and robot interaction/intelligent automation, smart city, drug discovery, and aid for differently abled/accessibility technology.

3. Expected Graduate Attributes

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

1. Comprehend fundamental concepts and hands-on knowledge of the state-of-the-art AI&DS methodologies.
2. Skill set to clean, process, analyze, manage and handle security and privacy aspects of structured and unstructured data.
3. Ability to identify, design and apply appropriate pattern recognition and data mining methods for generating relevant insight from data.
4. Design and build real-world AI&DS systems, solving application-specific problems, and to reason about them.
5. Conceive, design and develop Intelligent multi-modal multi-sensory Man-Machine interfaces.
6. Design, develop, and deploy machine learning based applications using structured and unstructured data (e.g., speech, text, images/videos).
7. 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.
8. Understand and assess reliability, dependability and trust-worthiness of AI&DS based systems and their impact on societal and environmental context.
9. Design and develop AI applications for resource constrained environments.
10. Adhere to evolving ethics and privacy laws across various domains and territories.
11. Plan and manage technical projects.

4. Learning Outcomes

The student will have an ability to

1. Apply the knowledge of mathematics, science, engineering fundamentals along with artificial intelligence and machine learning knowledge, and an engineering specialization to develop solutions to real-world problems.
2. Apply appropriate theories, design principles, frameworks, and protocols to develop AI & DS based system prototypes.

3. Demonstrate hands-on knowledge of modern simulation, and AI & DS programming tools with an understanding of the limitations.
4. 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.
5. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
6. Communicate effectively on complex engineering activities by comprehending and writing effective reports and design documentation, making effective presentations and exchanging clear instructions.
7. Apply appropriate project and business management principles and tools for real-world problems.
8. 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

1. AI&DS algorithms for transforming large data into actionable decision
2. Building end to end systems for enhancing human capabilities using vision, language, and text processing
3. Foundations in ML Optimization
4. Ethical, Safe, and Dependable AI/ML Systems
5. Familiarity with emerging and futuristic AI&DS techniques
6. Entrepreneurial capability
7. Written and oral communication

6. Topic clouds and Mapping of Topic clouds with proposed courses

Map topics with courses in the table given below:

Table 1. Topics and Mapping of Topic with Courses

Area	Topics	Category (Core/ Techniques Technology/ Systems)	Course (IE/IS/PC/PE)
AI and ML	Abstract Data Types, Linear Data Structures, Non Linear Data Structures, Stack, Queue, Link List, Heap, Sorting, Hashing, Algorithm Analysis, Graph, Tree	Core	Data Structures and Algorithms (PC)
	Discrete Structures, Logics, Set, Graph and Trees, Deterministic Finite Automata, Non-deterministic Finite Automata, PushDown Automata, Context Free Grammar, Turing Machine, Lexical and Syntax Analysis, Parsing	Core	Maths for Computing (PC)
	Hardware-Software interaction, Digital circuit design and analysis, Computer system design, Instruction set architecture, Language translation, Semantic analysis	Core	Principles of Computer Systems - 1 (PC)
	Network-OS interaction, Process management, Storage management,	Core	Principles of Computer Systems - 2 (PC)
	Complexity Analysis, Divide-and-conquer, Greedy Algorithms, Dynamic Programming, Linear Programming, Universal Hashing, Max-flow Min-cut, Amortized Analysis, Traveling Salesman Problem, Approximation Algorithms	Core	Design and Analysis of Algorithms (PC)
	Bayes Decision Theory, Regression, Bias variance, Maximum Likelihood Estimation, Bayesian Parameter Estimation, Decision Tree, Random Forest, Artificial Neural Network, Clustering, k-means, SVM, Feature Selection, Dimensionality Reduction	Core and Technique	Pattern Recognition and Machine Learning (IE)
	Uninformed Search Strategies, Informed Search Strategies, Local Search Algorithms, Hill Climbing, Constraint Satisfaction Problems, Backtracking, Adversarial Search, Min-Max algorithms, Propositional Logic, Reasoning Patterns, First-order logic, Syntax, Semantics, Q-value, Policy,	Technique	Artificial Intelligence (PC)
	Neural Networks, Gradient Descent, Optimization, Regularization, Autoencoder, Convolutional Neural Network, Recurrent Neural Network, LSTM, Deep Generative Models, Generative Adversarial Network (GAN), Deep Belief Network, Deep Convolutional GAN, Variational Autoencoder, Representation Learning, Unsupervised Pre-training, Transfer Learning, Distributed Representation, Domain Adaptation, Neural Language Model, Adversarial Learning	Technique	Deep Learning (PC)
	Accuracy-explainabilitytradeoff, Interpretability problem, Predictability, Transparency, Traceability, Causality, Reasoning, Attention and Saliency, Interpretable AI, Prediction Consistency, Adversarial Robustness, Trustworthy AI, Integrity, Reproducibility, Accountability, Bias-free AI, Verified AI, Federated Learning, Differential Privacy,	Technique	Dependable AI (PC)

	Convexity, Linear programming, Duality, Integer programming, Nonlinear programming, Lagrange multipliers, First and second order conditions, Local and global convergence, Gradient descent methods	Core and Technique	Optimization for Machine Learning (PC)
	Decision-making, Utility Theory, Utility Functions, Decision Networks, Sequential Decision Problems, Partially Observable MDP, Game Theory, Reinforcement Learning, Generalization, Policy Search, Hidden Markov Model, Kalman Filter, Knowledge Representation, Ontological Engineering, Situation Calculus, Semantic Networks, Description Logic, Planning graphs, Partial-order Planning, Conditional Planning, Continuous Planning, Multi-agent Planning, Hierarchical Task Network Planning, Non-deterministic Domains	Core	Advanced AI (PE)
	Kernel Machines, Variants of Support Vector Machines, PAC Theory, Boosting, Graphical Models, Structural Predictions, Deep Reinforcement Learning, Sparse Coding	Core and Techniques	Advanced Machine Learning (PE)
	Computational complexity of AI models, Prediction accuracy, Numeric accuracy, Precision, Memory footprints, Edge AI, Memory Optimization of Models, Hardware accelerators for Edge AI, Vision Processing Unit, Streaming Hybrid Architecture Vector Engine, Open Neural Network Exchange	Systems and Technique	Resource-constrained Artificial Intelligence (PE)
	Search Engine Architecture, Retrieval Models, Performance Evaluation, Text Categorization, Text Clustering, Web Information Retrieval, Structured Document Retrieval	Technique	Information Retrieval (PE)
	Graph algorithms, Directed and Undirected graph, Planner graph, Graph coloring, Hamiltonion and Eulorian graph, Bipartite graphs, Trees.	Core	Graph Theoretic Algorithms (PE)
	Streaming Algorithms, Stream mining using Clustering, Massive Data Clustering, Data Stream Classification, Distributed Mining of Streaming Data, Change Diagnosis, Forecasting on Stream, Dimensionality Reduction for Streaming data.	Core and Technique	Stream Analytics (PE)
HCI and Social Sensing	User experience, Prototyping techniques and evaluation, Interface design and interaction,Speculative design, Value sensitive design	Technique and Systems	Human-Machine Interaction (PC)
	Visual World, Geometry, Lights and Optics, Tracking, Motion, Depth, devices and tools	Technique	Introduction to AR and VR (PE)
	Graphs, Network Models, Network Data Generation, Structural Properties, Link Prediction, Community Detection, Information Cascade, Small World Phenomenon, Homophily, Structural Balance, Components, NetworkX, Gephi, Network Evolution, Multi-layer network	Technique	Social Networks (PE)
Data and Distributed Sciences	Representing data, Data science ecosystem, data sources, data storage, data model, Structured data, unstructured data, semi-structured data, Accessing data, SQL, NoSQL databases, parallel data reads/writes for high throughput, distributed database, Analysing data, distributed data processing	Techniques and Systems	Data Engineering (PC)
	Data Visualization, Data representation, feature representations, encoded representations, Spatial data representation, Time-series data representations,	Techniques and Systems	Data Visualization (PC)

	visualization of multivariate data, geometry, Information illustration, Maps and Graphics, Advanced Visualization, Interactive graphics, infographics, visualization of high dimensional data		
	Multivariate analysis, Sampling theory, Matrix decomposition, Algorithms for big matrices, Data intensive processing	Techniques and Systems	Maths for Big Data (PC)
Decision Sciences and Cognition	Computational Neuroscience Models: Descriptive, Mechanistic and Interpretive models, Synapse, Neural encoding, Neural decoding, Neuron models, Spikes, Modeling connections between neurons, Synaptic plasticity and learning, Unsupervised and supervised learning from the perspective of neurons		Computational Neuroscience (PE)
	Biological signals, Biomedical imaging modalities, Sectioning, Multimodal images, Reconstruction, Image segmentation, Object delineation, Classification, Image registration, Deep Learning for Bio-imaging, Tracking, Interactive image analysis		Bio-imaging (PE)
Applications	Image digitization, Pixel relationships and distances, Camera model and stereo imaging, Image transforms, Image Enhancement: Spatial and Frequency domain, Image Restoration, Image segmentation, Color image processing, image morphology, Image compression and coding, Image features	Technique	Digital Image Processing (PE)
	Spoken language technology, dialog and conversational systems, automatic speech recognition, speech synthesis, affect detection, dialogue management.	Techniques	Speech Understanding (PE)
	Image formation and transformations, Camera calibration, Image restoration, Spatial and Wavelet-based processing, Epipolar Geometry, SfM, Optical flow, Key-point detection, Feature description and matching, Deep learning for vision, Applications	Techniques	Computer Vision (PE)
	Geometric primitives, clipping, viewing, rendering, animation, Shading, Coloring, OpenGL	Technique	Computer Graphics (PE)
	Word representation, NLP tasks, Seq2Seq model, Question Answering, Sentiment Analysis, Dialogue system, Machine Translation, natural language generation, Interpretability, Knowledge Graphs	Applications	Natural Language Understanding (PE)
	Biometric system design, Genesis of biometrics, System architecture, Performance evaluation, Biometric modalities, Biometric security, Biometric devices, Biomedical applications	Applications	Advanced Biometrics (PE)
	Multi-dimensional signals, systems, transforms and sampling; Camera models; Motion and shape estimation; Video segmentation and tracking; Video filtering, compression and restoring; Ego-centric, 360-degree and Streaming video	Applications	Video Processing (PE)

7. Course Categories, credit distribution and Credit Structure of B.Tech. Programmes

Table 2. ProposedCourse Categories and credit distribution in the proposed B.Tech. Programmes

S.N.	Course Type	Course Category	Regular B.Tech.		Double B.Tech.	
			Credit	Total	Credit	Total
1	Institute Core (I)	Engineering (IE)	**34**	**69**	**34**	**59**
		Science (IS)	16		**16**	
		Humanities (IH)	12		9	
2	Programme Linked (L)	Science (LS)	7		0	
3	Programme Core (P)	Programme Compulsory (PC)	**51**	**71**	**47+3**	**71**
		Programme Electives (PE)	**17**		21-3	
		B.Tech. Project (PP)	3		3	
4	Open (O)	Open Electives (OE)	10	**10**	0	**0**
5	Engineering Science (E)	Engineering Science Core (EC)	0	**0**	**22**	**22**
		Engineering Science Elective (EE)	0	**0**	**8,11**	**8**
Total Graded				**150**		**160**
6	Non-Graded (N)	Humanities (NH)	6	**15**	6	**15**
		Engineering (NE)	3		3	
		Design/Practical Experience (ND)	6		6	
Total Graded + Non-Graded				**165**		**175**

8. Credit Structure of B.Tech. Programmes

Table 4. Credit Structure for B.Tech. Programmes (Up 6000 Level)

Type	L-T-P	Distribution of contact and beyond contact hours			Total Credits (TC=TH/3)
		Contact Hours (CH)	Beyond Contact Hours (BCH)	Total Hours (TH)	
1 hour of Lecture	1-0-0	1 hr	2 hr	3 hr	1
1 hour of Tutorial	0-1-0	1 hr	2 hr	3hr	1
1 hour of Lab/Project	0-0-1	1 hr	0.5 hr	1.5 hr	0.5

#Contact hour for projects refers to the involvement of students in the laboratory, discussion, etc.

9. List of Programme Compulsory Courses

Table 5. Programme Compulsory Courses

Sr. No	Course Name	LTP	Contact Hours	Credit
1	Data Structure and Algorithms	3-0-2	5	4
2	Maths for Computing	3-1-0	4	4
3	Principles of Computer Systems - 1 (Compilers and CA)	2-0-2	4	3
4	Data Engineering	3-0-3	6	4.5
5	Human-Machine Interaction	0-0-4	4	2
6	Design and Analysis of Algorithms	3-1-0	4	4
7	Artificial Intelligence	3-0-0	3	3
8	Optimization for ML	3-0-3	6	4.5
9	Principles of Computer Systems - 2	3-0-2	4	4
10	Data Visualization	3-0-3	6	4.5
11	Deep Learning	3-0-3	6	4.5
12	Dependable AI	3-0-0	3	3
13	DSAI Core Elective 1 (DS + X)	3-0-0	3	3
14	DSAI Core Elective 2 (AI + X)	3-0-0	3	3
15	Maths for Big Data*	2-1-0	3	3
			Total	**51**

*For Core ES + AI&DS program, under DS+X for regular program, Ethics, Policy, Law and Regulations in AI (0- 0-2) is a core course under Professional Ethics - II (Sem VI).

10. Area-wise Programme Elective Courses

Table 6. Stream-wise Programme Electives Courses

S. No.	Stream	Courses	L-T-P	Credit
1	AI and ML	Advanced Artificial Intelligence	3-0-0	3
2		Advanced Machine Learning	3-0-0	3
3		Resource Constrained Artificial Intelligence	3-0-0	3
4		Scalable Machine Learning	3-0-0	3
5		Computational Learning Theory	3-0-0	3
6		Information Retrieval	3-0-0	3
7		Graph Theoretic Algorithms	3-0-0	3
8		Stream Analytics	3-0-0	3
9	Robotics and Automation	Introduction to Robotics	3-0-0	3
10		Planning and Decision Making of Robots	3-0-0	3
11		Multi-Agent Systems	3-0-0	3
12		Autonomous Systems	3-0-0	3
13	Socio-Digital Reality	Multimodal Interfaces	0-0-2	2
14		Introduction to Haptics	3-0-0	3
15		Introduction to AR and VR	3-0-0	3
16		Advanced Human-Machine Interaction	3-0-0	3
17		Social Networks	3-0-0	3
18	Science of Intelligence	Computational Neuroscience	3-0-0	3
19		Connectomics	3-0-0	3
20		Bioimaging	3-0-0	3
21	Applications	Digital Image Processing	3-0-0	3
22		Computer Vision	3-0-0	3
23		Natural Language Understanding	3-0-0	3
24		Speech Understanding	3-0-0	3
25		Computational Linguistics	3-0-0	3
26		Advanced Biometrics	3-0-0	3
27		Computer Graphics	3-0-0	3
28		Video Processing	3-0-0	3
29		Animation	3-0-0	3
30		GPU Programming	3-0-0	3
31	Cyber Physical Systems, Sensors and Internet of Things	Introduction to Cyber Physical Systems	3-0-0	3
32		Embedded Systems Design	3-0-0	3
33		Security in CPS	3-0-0	3
34		Edge and Fog Computing	3-0-0	3
35		Real Time Systems	3-0-0	3
36	Data and Discovery Science	Introduction to Space Science	3-0-0	3
37		Reliability Engineering and Life Testing	3-0-0	3
38		Introduction to Game Theory	3-0-0	3
39		Nonlinear Dynamics and Chaos	3-0-0	3
40		Differential Geometry	3-0-0	3
41		Introduction to Financial Engineering	3-0-0	3
42		Computational Chemistry	3-0-0	3
43	Special Topics	Special Topics in ML	3-0-0	3
44		Special Topics: Advancements in Computer Vision	3-0-0	3
45		Special Topics in Data Science	3-0-0	3

11. Specialization to be offered by the department

Table 7a. Specialization and courses

S. No.	Name of Specialization	Specialization Core (8 credits)	Specialization Elective (12 Credits)
1.	Visual Computing (CS, AI&DS, EE)	Computer Graphics (3-0-0), Computer Vision (3-0-0), Visual Computing Lab (0-0-4)	Digital Image Processing, Video Processing and Analysis, Advanced Machine Learning, Introduction to AR and VR, Scalable Machine Learning, Computational Photography, Computational Imaging, Principles of Biological Vision, Bioimaging, Medical Image Analysis, Visual Perception, Advancements in Computer Vision, Animation, Real-time Vision Architecture, Image Synthesis, 3D Shape Analysis, Image and Video Forensics, Selected Topics in Computer Vision, Project (0-0-12)
2.	Socio-Digital Reality (CS, AI&DS, EE)	Social Network (3-0-0), Introduction to AR and VR (3-0-0), Multimodal interface Lab (0-0-4)	Introduction to Haptics, Design Process, Speech Understanding, Computer Graphics, HCI, NLU, Computer Vision, Visual Perception, Image and Video Forensics, Project (0-0-12)
3.	Intelligent Communications and Networking	Jointly with EE	Jointly with EE
4.	Robotics	Jointly with RM-IDRP	Jointly with RM-IDRP
5.	AIOT	Jointly with EE	Jointly with EE
6.	AI (for non-AI, non-CS Students)	AI (3-0-0), Deep Learning (3-0-0), AI Lab (0-0-4)	Algorithm for big data, computer vision, machine learning with big data, edge and fog computing, NLP, GPU Programming, Data Visualization, Introduction to AR and VR, Dependable AI, Resource constrained AI, Social Network Analysis, Optimization, Computer Graphics, Advanced AI, Advanced ML, Project (0-0-12)

***Science of Intelligence, Smart Healthcare, and Language Technologies Specializations will be added in the future**

Table 7b. AI+X courses.

S. No.	Course	Status
1.	AI + Industry 4.0	Jointly with ME
2	Autonomous Systems	IDRP
3.	AI + Transportation	CSE

Table 7c. DS+X (Applied Statistics) courses.

S. No.	Course	Status
1.	Maths for Big Data	CS+Math course
2.	Statistical Inference and Simulation Techniques	Maths course
3.	Introduction to Financial Engineering	Maths course
4.	Time Series Analysis	Math course

12. Curriculum of B.Tech. AI&DS (Regular)

Table 8b. Curriculum of B.Tech. in **AI&DS**

Cat	*Course*	*LTP*	*CH*	*NC*	*GC*	*Cat*	*Course*	*LTP*	*CH*	*NC*	*GC*
	I Semester						**II Semester**				
IE	Introduction to Electrical Engineering	3-0-2	5	-	4	IE	Engineering Mechanics	2-1-0	3	-	3
IE	Introduction to Computer Science	3-0-2	5	-	4	IS	Chemistry	3-0-0	3	-	3
IE	Introduction to Bioengineering	3-0-2	5	-	4	IS	Physics	3-0-0	3	-	3
						IS	Chemistry Lab	0-0-2	2	-	1
						IS	Physics Lab	0-0-2	2	-	1
IS	Mathematics I	3-1-0	4	-	4	IS	Mathematics II	3-1-0	4	-	4
IE	Engineering Visualization	0-0-2	2	-	1	IE	Engineering Realization	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 Skill I	0-0-2	2	1	-	NH	Communication Skill II	0-0-2	2	1	-
NH	Social Connect and responsibilities I	0-0-1	1	0.5	-	NH	Social Connect and responsibilities II	0-0-1	1	0.5	-
NH	Performing Arts I/ Sports I	0-0-1	1	0.5	-	NH	Performing Arts II/ Sports II	0-0-1	1	0.5	-
	Total	**12-1-14**	**27**	**3**	**17**		**Total**	**11-2-12**	**25**	**3**	**16**
	III Semester						**IV Semester**				
LS	PSSP	3-1-0	4	-	4	IE	Materials Science & Engineering (Electronic materials)	1 × 1-0-0	1	-	1
IE	i-Energy materials ii- Computational Materials Design	2X 1-0-0	2	-	2						
PC	Data Structures and Algorithms	3-0-2	5	-	4	IE	Pattern Recognition and Machine Learning	3-0-2	5	-	4
PC	Maths for Computing	3-1-0	4	0	4	IE	Thermodynamics	3-1-0	4	-	4
IE	Signals and Systems	3-1-0	4	-	4	**PC**	HMI PCS-1 PCS-2	0-0-4 2-0-2 3-0-2	4 2 4	- - -	2 3 4
LS	Quantum Info Processing	3-0-0	3	-	3						
NE	Intro. To Profession	0-0-2	2	1		IH	Humanities I	3-0-0	3	-	3
	Total	**17-3-4**	**24**	**1**	**21**		**Total**	**15-1-10**	**24**	**-**	**21**
	V Semester						**VI Semester**				
PC	DA of Algorithms	3-1-0	4	-	4	**PC**	Data Visualization	3-0-3	6	-	4.5
	Artificial Intelligence	3-0-0	3	-	3		Deep Learning	3-0-3	6	-	4.5
	Optimization in ML	3-0-3	6	-	4.5		AI+X / DS+ X	3-0-0	3	-	3
	Data Engineering	3-0-3	6		4.5		Dependable AI	3-0-0	3		3

IH	Humanities II	3-0-0	3	-	3	PE	Programme/ Open Elective	6-0-0	6		6
NH	Professional Ethics I	0-1-0		1	-	NH	Ethics, Policy, Law and Regulations in AI	0-0-2		1	-
	Total	**15-2-6**	**22**	**1**	**19**		**Total**	**18-0-4**	**24**	**1**	**21**
	VII Semester						**VIII Semester**				
PP	B. Tech. Project	0-0-6	6	-	3	IH	Humanities IV	3-0-0	3	-	3
PCPE / OE	AI+X / DS+ X Programme/ Open Electives	3-0-0 6-0-0	3 6	-	3 6	PE/ OE	Programme/ Open Electives	15-0-0	15	-	15
IH	Humanities III	3-0-0	3	-	3						
IS	Environmental Sci	2-0-0	2	-	2						
	Total	**14-0-6**	**21**	**-**	**17**		**Total**	**18-0-0**	**18**	**-**	**18**
										Total of graded and Non-Graded Credit	**9**	**150**
										Non-Graded Design Credits	**6**	**-**
										Grand Total	**165**	

13. Curriculum of Double B.Tech. : B.Tech. AI&DS Engineering and Engineering Science

Table 9. Programme structure of Double B.Tech.

Cat	*Course*	*LTP*	*CH*	*NC*	*GC*	*Cat*	*Course*	*LTP*	*CH*	*NC*	*GC*
	I Semester						II Semester				
First two semesters same as Table 8a or 8 b 33 Graded and 6 non graded credits											
	III Semester						IV Semester				
ES	Probability, Statistics, Stochastic Processes	3-1-0	4	-	4	IE	Materials Science & Engineering	3 × 1-0-0	3	-	3
ES	Modern Physics	3-0-0	3	-	3	ES	Embedded Systems and IoT	3-0-2	5	-	4
IE	Thermodynamics	3-1-0	4	-	4	IE	Pattern Recognition and Machine Learning	3-0-2	5	-	4
ES	Data Structures and Algorithms	3-0-2	5	-	4	ES	Design of Experiments	3-0-0	3	-	3
IE	Signals and Systems	3-1-0	4	-	4	ES	Modelling and Simulation	3-0-2	5	-	4
NE	Intro. To Profession	0-0-2	2	1		IH	Humanities I	3-0-0	3	-	3
	Total	15-3-4	22	1	19		Total	18-0-6	24	-	21
	V Semester						VI Semester				
PC	Maths for Comp. DA of Algorithm Artificial Intelligence Optimization in ML HMI	3-1-0 3-1-0 3-0-0 3-0-3 0-0-4	4 4 3 6 4	- - - - 	4 4 3 4.5 2	PC	PCS-1 PCS-2 Data Engg Data Visualization Deep Learning AI+X / DS+ X Dependable AI	2-0-2 3-0-2 3-0-3 3-0-3 3-0-3 3-0-0 3-0-0	2 4 6 6 6 3 3	 - - - 	3 4 4.5 4.5 4.5 3 3
PE	Programme/ Engineering Science Elective/ Multimodal Bouquet (3)	3-0-0	3		3						
IH	Humanities II	3-0-0	3	-	3						
NH	Professional Ethics I	0-1-0		1	-	NH	Ethics, Policy, Law and Regulations in AI	0-0-2		1	-
	Total	18-3-7	27	1	23.5		Total	20-0-15	30	1	26.5
	VII Semester						VIII Semester				
PP	B. Tech. Project	0-0-6	6	-	3	PE/ ES	Programme/ Engineering	14-0-0	14	-	14

							Science Electives				
PC	AI+X / DS+ X Maths for Big Data	3-0-0 2-1-0	3 3	- -	3 3	IH	Humanities III	3-0-0	3	-	3
PE/ OE	Programme/ Engineering Science Electives/ Multimodal Bouquet (3)	9-0-0	9	-	9						
IS	Environmental Science	2-0-0	2	-	2						
	Total	16-1-6	25	-	20		Total	17-0-0	17	-	17
										9	160
										6	-
											175

Note: ES are proposed Engineering Science compulsory courses