

**Maharashtra Institute of Technology, Aurangabad**  
**(An Autonomous Institute)**

**Maharashtra Institute of Technology**  
**(An Autonomous Institute)**

**Proposed Honours\* in “Artificial Intelligence  
and Machine Learning”**

**Major Disciplines in**

**Bachelor in Computer Science and Engineering**

**Bachelor in Computer Science and Design**

**(With effect from A.Y.2022-23)**



# Maharashtra Institute of Technology, Aurangabad (An Autonomous Institute)

## Honours \* in Artificial Intelligence and Machine Learning

Year & Semester	Course Code	Course	Teaching Scheme Hours/Week			Examination Scheme and Marks							Credit Scheme		
			Theory	Tutorial	Practical	Mid-Sem Exam-I	Mid-Sem Exam-II	Continuous Internal Evaluation	Teachers Assessment	End-Semester Exam	Practical	Total Marks	Theory/Tutorial	Practical	Total Credit
SY Sem_IV	EST901	Introduction to Artificial Intelligence and Machine Learning	04	-	--	15	15	10	10	50	--	100	04	--	04
	EST971	Laboratory	--	-	02	--	--	--	25	--	--	25	--	01	01
	<b>Total</b>			04	-	02	125					--	125	04	01
<b>Total Credits=05</b>															
TY Sem_V	EST902	Introduction to Data Analytics	04	-	--	15	15	10	10	50	--	100	04	--	04
	<b>Total</b>			04	-	-	100					--	100	04	--
<b>Total Credits=04</b>															
TY Sem_VI	EST903	Artificial Neural Networks and Deep Learning	04	-	--	15	15	10	10	50	--	100	04	--	04
	EST972	Laboratory	--	-	02	--	--	--	25	--	--	25	--	01	01
	<b>Total</b>			04	-	02	125					--	125	04	01
<b>Total Credits=05</b>															
Final B.Tech Sem_VII	EST904	Methods and Applications in Artificial Intelligence	04	-	--	15	15	10	10	50	--	100	04	--	04
	<b>Total</b>			04	--	--	100					--	100	04	--
<b>Total Credits=04</b>															
Final B.Tech. Sem_VIII	EST973	Mini Project	--	-	04	--	--	--	25	--	25	50	--	02	02
	<b>Total</b>			--	--	04	--	--	--	25	--	25	50	--	02
<b>Total Credits=02</b>															
<b>Total Credit for Semester IV+V+VI+VII +VIII=20</b>															

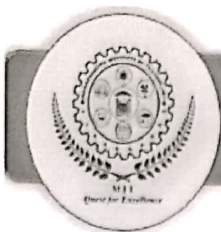
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Syllabus of Honours/Minors - Artificial Intelligence & Machine Learning 2022-23

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Department of Emerging Science & Technology	
Syllabus of S. Y. B. Tech. (Honours* in Artificial Intelligence & Machine Learning) Semester-IV	
Course Code: EST901 Course: Introduction to Artificial Intelligence and Machine Learning <b>Teaching Scheme:</b> Theory: 04 Hrs/week Tutorial: 00 Hr/week	Credits: 4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
<b>Prerequisite</b>	Linear Algebra, Calculus
<b>Objectives</b>	To review and strengthen important concepts required for AI & ML. Introduce the concept of Machine Learning algorithms.
<b>Unit-I</b>	<b>Introduction to AI:</b> Define Artificial Intelligence, Define AI techniques, Problem solving using State Space Search, applying Heuristics, Hill climbing, Search using BFS, DFS. (08 Hrs)
<b>Unit-II</b>	<b>Knowledge representation and Logic Programming:</b> Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Forward vs Backward reasoning, Logic Programming-Predicate Logic (08 Hrs)
<b>Unit-III</b>	<b>Mathematical foundations:</b> Matrix Theory and Statistics for Machine Learning. Idea of Machine learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning. (08 Hrs)
<b>Unit-IV</b>	<b>Linear Regression:</b> Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice. (08 Hrs)



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<b>Unit-V</b>	<b>Logistic Regression:</b> Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting. (08 Hrs)				
<b>Unit-VI</b>	<b>Supervised &amp; Unsupervised learning:</b> Discussion on Clustering and Classification algorithms, Naïve Bayes Theorem, Decision Tree, SVM. (08 Hrs)				
	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>	<b>Year</b>
	1	Artificial Intelligence	Rich and Knight	MGH	2010
	2	“Practical Workbook Artificial Intelligence and Soft Computing for beginners	Anindita Das Bhattacharjee	Shroff Publisher-X team Publisher	2018
	3	“Python Machine Learning by Example”	Yuxi (Hayden) Liu	Packet Publishing Limited	2017
	4	Machine Learning	Tom Mitchel	McGraw Hill	2017
	5	Pattern Recognition and Machine Learning,	Christopher M. Bishop,	Springer	2011
	6	The Elements of Statistical Learning	T. Hastie, R. Tibshirani, J. Friedman	Springer	2011

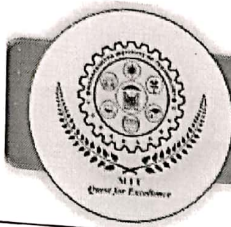


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Department of Emerging Science & Technology	
<b>Syllabus of S. Y. B. Tech. (Honours* in Artificial Intelligence &amp; Machine Learning) Semester-IV</b>	
Course Code: EST971 Course: Laboratory Introduction to Artificial Intelligence and Machine Learning Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks
<b>Prerequisite</b>	Any programming language Python/R/Matlab
<b>Objectives</b>	Implement AI & ML concepts.
<b>List of Practical</b>	<ol style="list-style-type: none"><li>1. Implementation of logical rules in Python.</li><li>2. Using appropriate data apply the concept of Linear regression</li><li>3. Using appropriate data apply the concept of Gradient decent</li><li>4. Using appropriate data apply the concept of Logistic regression</li><li>5. To add the missing value in any data set.</li><li>6. Perform and plot under fitting and over fitting in a data set.</li><li>7. Implementation of clustering</li><li>8. Implementation of classification algorithms.</li></ol>

The assessment of teacher assessment shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Practical/Oral examination conducted on the syllabus and term work mentioned above



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**Syllabus of T. Y. B. Tech. (Honours\* in Artificial Intelligence & Machine Learning) Semester-V**

Course Code: EST902	Credits: 4-0-0
Course: Introduction to Data Analytics	Mid Semester Examination-I: 15 Marks
<b>Teaching Scheme:</b>	Mid Semester Examination-II: 15 Marks
Theory: 04 Hrs/week	Continuous Internal Evaluation: 10 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 10 Marks
	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 2 Hrs
<b>Prerequisite</b>	Basics of Statistics
<b>Objectives</b>	Provide the knowledge in Data Analytics. Evaluate data visualizations based on their design and use for communicating stories from data
<b>Unit-I</b>	Introduction to Databases: Databases and relational approach, SQL query language, types of data, Basic analytics, Hadoop, MapReduce (08 Hrs)
<b>Unit-II</b>	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science. (07 Hrs)
<b>Unit-III</b>	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions. (09 Hrs)
<b>Unit-IV</b>	Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms (09 Hrs)
<b>Unit-V</b>	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset. (08 Hrs)

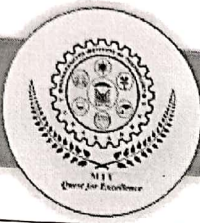


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References	Sr. No.	Title	Author	Publication	Edition
	1.	Data Science from Scratch	Joel Grus	Shroff Publisher /O'Reilly	2 <sup>nd</sup>
	2.	Data Science for the Layman	Annalyn Ng, Kenneth Soo, Numsense	Shroff Publisher	2 <sup>nd</sup>
	3.	Doing Data Science, Straight Talk from The Frontline	Cathy O'Neil and Rachel Schutt	O'Reilly Publisher Media	1 <sup>st</sup>
	4.	Mining of Massive Datasets. v2.1,	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Stanford University	1 <sup>st</sup>
	5.	Python Data Science Handbook,	Jake VanderPlas	Shroff Publisher /O'ReillyPublisher Media	2 <sup>nd</sup>
	6.	Data Analysis with Open Source Tools	Philipp Janert	Shroff Publisher /O'ReillyPublisher Media	2 <sup>nd</sup>

  
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Department of Emerging Science & Technology	
<b>Syllabus of T. Y. B. Tech. (Honours* in Artificial Intelligence &amp; Machine Learning) Semester-VI</b>	
Course Code: EST903	Credits: 4-0-0
Course: Artificial Neural Networks and Deep Learning	Mid Semester Examination-I: 15 Marks
<b>Teaching Scheme:</b>	Mid Semester Examination-II: 15 Marks
Theory: 04 Hrs/week	Continuous Internal Evaluation: 10 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 10 Marks
	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 2 Hrs
<b>Prerequisite</b>	Basics of Artificial Intelligence, Mathematics
<b>Objectives</b>	To get a detail insight of Artificial Neural Networks. To study Deep Learning methods
<b>Unit-I</b>	Characteristics of Neural Networks, Structure and working of a biological neural network, artificial neural network: terminology, models of neurons: Mc Culloch Pitts model, Perceptron model, Adaline model, topology, Basic learning laws. Functional Units for Artificial Neural Network for Pattern Recognition Task (8 Hrs)
<b>Unit-II</b>	Perceptron – Learning and Memory, Learning Algorithms, Error Correction and Gradient Decent Rules, Perceptron Learning Algorithms, Supervised Learning Backpropagation, Multilayered Network Architectures, Back propagation Learning Algorithm, example Applications of feed forward neural networks. (08 Hrs)
<b>Unit-III</b>	Introduction, Associative Learning, Hopfield network, Error Performance in Hopfield networks, simulated annealing, Boltzmann machine and Boltzmann learning, State transition diagram and false minima problem, stochastic update, simulated annealing (08 Hrs)
<b>Unit-IV</b>	Convolutional Neural Networks (CNN), ImageNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Classification using CNN (10Hrs)



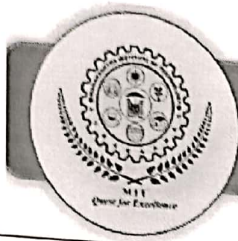


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<b>Unit-V</b>	Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM). Applications of Recurrent Neural Networks in real world. (8 Hrs)				
<b>Unit-VI</b>	Creating and deploying networks using TensorFlow- open source machine learning platform and Keras-python deep learning API (6 Hrs)				
<b>References</b>	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>	<b>Year</b>
	1.	Artificial Neural Network	B. Yegnanarayana	PHI Publication	2012
	2.	Deep Learning, A Practitioner's Approach	Adam Gibson, Josh Patterson	Shroff Publisher O'Reilly Publisher Media	2017
	3.	Neural Networks for Pattern Recognition	Christopher M. Bishop	Oxford University Press	2012
	4.	Neural Smothing- Supervised Learning in Feedforward Artificial Neural Networks	Russell Reed, Robert J MarksII,	MIT Press	2014
	5.	Machine Learning with Python for Everyone	Mark Fenner	Pearson	2020

  
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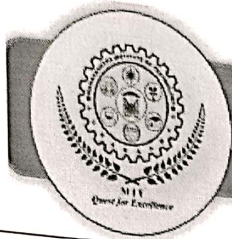
## Department of Emerging Science & Technology

### Syllabus of T. Y. B. Tech. (Honours\* in Artificial Intelligence & Machine Learning) (Semester-VI)

Course Code: EST972	Credits: 0-0-1
Course: Laboratory Artificial Neural Networks and Deep Learning	Teacher Assessment: 25
Teaching Scheme: Practical: 02 Hrs/week	
<b>Prerequisite</b>	Any programming language Python/R/Matlab
<b>Objectives</b>	To implement ANN and Deep Learning concepts.
<b>List of Practical</b>	<ol style="list-style-type: none"><li>1. Implementation of MP model</li><li>2. Implementation of feed forward neural network</li><li>3. Implementation of back propagation neural network</li><li>4. Implement all activation function of neural network for any pattern recognition application</li><li>5. Implement any one of ImageNet or GoogLeNet</li><li>6. Implement a system to recognize hand written character using CNN</li><li>7. Classify images appropriately using CNN</li><li>8. Implement LSTM Neural Network for Time Series Prediction</li></ol>

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- Continuous assessment
- Performing the experiments in the laboratory
- Practical/Oral examination conducted on the syllabus and term work mentioned above



# Maharashtra Institute of Technology, Aurangabad (An Autonomous Institute)

## Department of Emerging Science & Technology

### Syllabus of Final year B.Tech.(Honours\* in Artificial Intelligence & Machine Learning)(Semester-VII)

Course Code:EST904

Course: Methods and Applications in Artificial Intelligence

Teaching Scheme:

Theory: 4 Hrs/week

Tutorial: 00 Hr/week

Credits: 4-0-0

Mid Semester Examination-I: 15 Marks

Mid Semester Examination-II: 15 Marks

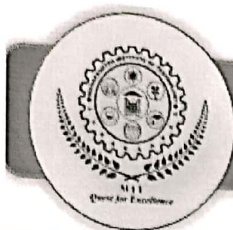
Continuous Internal Evaluation:10 Marks

Teacher Assessment: 10 Marks

End Semester Examination: 50 Marks

End Semester Examination (Duration): 2 Hrs

<b>Prerequisite</b>	Basics of Artificial Intelligence and Machine Learning
<b>Objectives</b>	To give deep knowledge of AI and how AI can be applied in various fields
<b>Unit-I</b>	Bayesian Filtering, Deep Reinforcement Learning, Self-Play Networks, Generative Adversarial Networks (8 Hrs)
<b>Unit-II</b>	Learning from Concept-Drifting Data Streams, Audio Signal Processing, Architectures for second generation knowledge based systems, Distributed AI and its applications (8 Hrs)
<b>Unit-III</b>	An introduction to neurocomputing and its possible role in AI, The role of uncertainty measures and principles in AI (8 Hrs)
<b>Unit-IV</b>	Linguistic aspects of natural language processing, AI and Quantum Computing, Applications of Artificial Intelligence (AI) in business, Robotic Processes Automation for supply chain management (8 Hrs)
<b>Unit-V</b>	Emotion Recognition using human face and body language, AI based system to predict the diseases early, Smart Investment analysis, AI in Sales and Customer Support, AI in Agriculture (10Hrs)



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Unit-VI	AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology & Security using AI (6 Hrs)				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson	3 <sup>rd</sup>
	2.	Artificial Intelligence: Making a System Intelligent	Dr. Nilakshi Jain	John Wiley & Sons	2 <sup>nd</sup>
	3.	AI and Analytics, Accelerating Business Decisions	Sameer Dhanrajani	John Wiley & Sons.	2 <sup>nd</sup>
	4.	Life 3.0: Being Human in the Age of Artificial Intelligence	Max Tegmark	Knopf	2 <sup>nd</sup>
	5.	Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems	Bernard Marr, Matt Ward,	Wiley.	1 <sup>st</sup>
	6.	Artificial Intelligence: A Guide to Intelligent Systems	Michael Negnevitsky	Pearson	3 <sup>rd</sup>



# Maharashtra Institute of Technology, Aurangabad (An Autonomous Institute)

Department of Emerging Science & Technology

Syllabus of Final Year.B.Tech.(Honours\* in Artificial Intelligence & Machine Learning)Semester-VIII

Course Code: EST973

Credits: 0-0-2

Course: Mini Project

Teacher assessment: 25 Marks

Teaching Scheme:

Practical :25 Marks

Practical: 04 Hrs/week

**Prerequisite**

Machine Learning and AI Algorithms, Programming Language.

To carry out a mini project in Artificial Intelligence and Machine learning.  
Each student will have a faculty mentor to guide them.  
There will be three reviews with the following details:

**Guidelines**

Review #	Requirement	Mark Weightage	
		Internal	External
0	Idea Presentation/ Selection	-	-
1	Literature Review / Proposal for Project	10%	-
2	Proposed System Design/ Model	20%	-
3	Implementation and Demonstration	20%	-
End Semester Exam	Final Viva-Voce and Project Demonstration	-	50%



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The assessment of teacher assessment shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

**Note:**

- 1.No additional fees will be charged for students opting for Honours/ Minor Degree
- 2.All the courses in the Honours/ Minor will be conducted in offline mode.
- 3.Re-examination is not applicable in Honours and Minor Scheme. Student failing in any of the Minor or Honours courses, at any stage will be discontinued from the Scheme.
4. Examination Scheme and Passing rules will be as per the academic rules and regulations of B. Tech