AI & ML ALGORITHM	**Course Code : 315330**

Programme Name/s	: **Artificial Intelligence/ Artificial Intelligence and Machine Learning**
Programme Code	: **AI/ AN**
Semester	: **Fifth**
Course Title	: **AI & ML ALGORITHM**
Course Code	: **315330**

I. RATIONALE

Artificial Intelligence (AI) includes the ability to carry out operations that have historically required human intelligence, such as speech recognition, visual perception, language translation, and decision-making. Machine Learning (ML) is a subset of Artificial Intelligence (AI) which is the study of patterns and structures in data analysis and interpretation. Students will be able to apply AI/ML techniques to real-world problems through projects and case studies.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Classify real world problem and apply knowledge of AI and ML.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Implement relevant search algorithms as applicable to Artificial Intelligence.
- CO2 - Apply method for knowledge representation to make informed decisions for various applications.
- CO3 - Analyze different forms of data with respect to different phases of Machine Learning.
- CO4 - Create data model for Machine Learning Algorithms.
- CO5 - Classify the data by performing different Regression Techniques.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315330	AI & ML ALGORITHM	AMA	DSE	4	-	4	1	9	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the different terminologies of AI. TLO 1.2 Analyze the types of AI agent. TLO 1.3 Explain the process of turing test in AI. TLO 1.4 Explain the functioning of Heuristic Search Techniques by examples. TLO 1.5 Describe beyond classical search algorithms.	**Unit - I Basics of AI and Problem Solving Techniques** 1.1 Basic Definition and Terminology: Foundation and Evaluation of AI, Scope of AI, Components of AI, Types of AI, Application of AI 1.2 Intelligent Agent in AI: Types of AI agent, Concept of Rationality, Nature of environment, Structure of agents, Turing Test in AI 1.3 Search Algorithms in Artificial Intelligence: Properties of Search Algorithms, Types of Search Algorithms 1.4 Heuristic Search Techniques: Generate-and-Test; Hill Climbing. Properties of A* algorithm, Depth-First Search, Best-First Search, Greedy Best-First, Problem Reduction 1.5 Beyond Classical Search: Local search algorithms and optimization problem, Local search in continuous spaces, Searching with nondeterministic action and partial observation, Online search agent and unknown environments	Lecture Using Chalk-Board Presentations Flipped Classroom
2	TLO 2.1 Describe the architecture of knowledge-based agent in AI. TLO 2.2 Explain forward and backward chaining in AI. TLO 2.3 Explain the different types of Reasoning in AI. TLO 2.4 Apply Bayes' theorem for probabilistic reasoning.	**Unit - II Knowledge and Reasoning** 2.1 Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge-based agent, Techniques of knowledge representation, Propositional logic, Rules of Inference, First-Order Logic, Forward Chaining & Backward Chaining in AI 2.2 Reasoning in Artificial intelligence: Definition of Reasoning, Types of Reasoning 2.3 Probabilistic reasoning in AI: Uncertainty, Causes of Uncertainty, Need of probabilistic reasoning in AI, Bayes' Theorem	Lecture Using Chalk-Board Presentations Flipped Classroom
3	TLO 3.1 Differentiate between AI and ML. TLO 3.2 Explain different phases of Machine Learning Life Cycle. TLO 3.3 Explain different forms of data. TLO 3.4 Explain different data preprocessing methods. TLO 3.5 Differentiate Training vs Testing data set. TLO 3.6 Explain the techniques of Data Cleaning.	**Unit - III Introduction to ML** 3.1 History and Evaluation of ML, AI vs ML 3.2 Machine Learning Life Cycle: Gathering data, Data Preparation, Data Wrangling, Data Analysis, Train Model, Test Model, Deployment 3.3 Different forms of Data: Data Mining, Data Analytics, Statistics Data, Statistics vs. Data Mining, Data Analytics vs Data Science 3.4 Dataset for ML: Training Dataset, Testing Datasets, Training vs Testing 3.5 Data Cleaning: Missing Data, Outliers	Lecture Using Chalk-Board Presentations Demonstration

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Differentiate characteristics of Supervised and Unsupervised Learning. TLO 4.2 Explain Supervised Machine Learning Algorithms. TLO 4.3 Explain Unsupervised Machine Learning Algorithms. TLO 4.4 Test the validity of Datasets by applying the Cross-Validation.	**Unit - IV Types of Learning** 4.1 Types of Learning: Supervised, Unsupervised, Semi-Supervised Learning 4.2 Supervised Learning: Learning a Class from Examples, Introduction of different types of Supervised Machine Learning Algorithms: Linear Regression, Logistic Regression, Decision Tree, K - Nearest Neighbors, Random Forest 4.3 Unsupervised Learning: Introduction of different types of Unsupervised Learning Algorithm: K-means clustering, KNN (k-Nearest Neighbors), Hierarchical Clustering, Neural Networks 4.4 Model evaluation: Introduction of Cross-validation, benefits of cross-validation, Positive and Negative class cross-validation	Lecture Using Chalk-Board Presentations Demonstration
5	TLO 5.1 Describe different types of Regression. TLO 5.2 Differentiate between overfitting and underfitting by example. TLO 5.3 Explain the logistic regression techniques. TLO 5.4 Create classification matrix for given Dataset.	**Unit - V Regression and Classification** 5.1 Linear Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting 5.2 Multiple Linear Regression: Multiple Linear regression equation, Implementation of multiple linear regression 5.3 Metrics for Regression: Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) 5.4 Logistic Regression: Binary and Multiclass Classification, Assessing Classification Performance, Handling more than two classes, Multiclass Classification: One vs One, One vs Rest 5.5 Metrics for Classification: Confusion Matrix, AUC/ROC Curve, F1 Score, Accuracy, Precision, Recall	Lecture Using Chalk-Board Presentations Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install given IDE for python.	1	* Install given Python IDE software and Python "scikit learn" for ML	2	CO1
LLO 2.1 Implement Breadth First Search Algorithm.	2	Write program to Implement Breadth First Search Algorithm (Uninformed) in Python	2	CO1
LLO 3.1 Develop Depth First Search Algorithm.	3	*Write program to implement Depth First Search Algorithm (Uninformed) in Python	2	CO1
LLO 4.1 Implement Greedy Best-First Search Algorithm.	4	Write program to implement Greedy Best-First (Informed Type) Search Algorithm in python	4	CO1
LLO 5.1 Develop A* search Algorithm.	5	* Write program to implement A* search (Informed Type) Algorithm in Python	2	CO1
LLO 6.1 Develop a program using Bayes's theorem.	6	* Write program to implement Bayes' Theorem	4	CO2
LLO 7.1 Analyze the process of turing test for given Dataset.	7	Analyze the given Case study: How Turing test is performed between Responder and an Interrogator?	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 8.1 Analyze different datasets with respect to its use.	8	* Explore different dataset finders e.g. Google Dataset Search, Kaggle	2	CO3
LLO 9.1 Develop program based on training and testing datasets.	9	* Write program in python to split any dataset into train and tests sets	4	CO3
LLO 10.1 Analyze the mail filtering process.	10	Analyze E-mail spam and non-spam filtering using Machine Learning through case study	4	CO3
LLO 11.1 Implement Supervised Learning.	11	*Create and display a Decision Tree on given dataset	2	CO4
LLO 12.1 Develop program on Unsupervised Learning.	12	Write program to implement K-means Algorithm	2	CO4
LLO 13.1 Implement cross validation in python.	13	* Write program to calculate cross validation score for any Dataset like IRIS	2	CO4
LLO 14.1 Develop program for Simple Linear Regression.	14	*Write program to implement Simple Linear Regression using Python	2	CO5
LLO 15.1 Implement Multiple Linear Regression in Python.	15	Write program to implement Multiple Linear Regression using Python	2	CO5
LLO 16.1 Implement program for confusion matrix.	16	*Write program to create confusion matrix to calculate different measures to quantify the quality of the model	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop a micro project for Movie Recommendation System: Use a dataset like the MovieLens dataset, preprocess the data (split into training and test sets),train a collaborative filtering model and generate and evaluate recommendations for users.
- Develop a micro project for Simple Chatbot: define a set of intents and responses and train a dataset to classify user inputs.
- Develop a micro project for Spam Email Classifier in which collect a dataset of labelled emails (spam or not spam), pre-process the text data (remove stop words, tokenize, etc.)
- Case study on Natural Language Generation (NLG) for E-commerce Product Descriptions

Other

- Complete the course Artificial Intelligence and Machine Learning on Infosys Springboard.
- Develop a code for given problem suggested by teacher.

Assignment

- Can Artificial Intelligence replace human Intelligence? Justify it
- Describe role of artificial intelligence in banking.
- Compare OpenAI and ChatGPT.
- Identify & List out the equipment / machine available in your Institute where AI technology is used. Describe the role of AI in that equipment.

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Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer (i5 preferable), RAM minimum 8 GB onwards	All
2	Operating System: Windows-10 onward	All
3	Software: Python IDE	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of AI and Problem Solving Techniques	CO1	8	4	4	6	14
2	II	Knowledge and Reasoning	CO2	6	2	2	8	12
3	III	Introduction to ML	CO3	8	2	4	8	14
4	IV	Types of Learning	CO4	8	2	2	10	14
5	V	Regression and Classification	CO5	10	2	4	10	16
		Grand Total		**40**	**12**	**16**	**42**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering

60% weightage to process

40% weightage to product

- A continuous assessment based on term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	2	2	-	2			
CO2	2	1	2	2	2	1	2			
CO3	2	1	2	1	2	1	2			
CO4	2	1	2	2	2	1	2			
CO5	2	1	2	2	2	1	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Stuart Russell and Peter Norvig, Editors	Artificial Intelligence A modern Approach Third edition	Pearson Education, Inc ISBN-13: 978-0-13-604259-4 ISBN-10: 0-13-604259-7
2	Dr. Jeeva Jose	Introduction to Machine Learning with Python	Khanna Book Publishing Co.(P) Ltd. ISBN 9789389139068 ISBN 9789389139068
3	Dipanjan Sarkar Raghav Bali Tushar Sharma	Practical Machine Learning with Python A Problem-Solver's Guide to Building Real-World Intelligent Systems	Apress publication ISBN-13 (pbk): 978-1-4842-3206-4 ISBN-13 (electronic): 978-1-4842-3207-1
4	Andreas C. Müller & Sarah Guido	Introduction to Machine Learning with Python	O'Reilly Media, Inc ISBN 9352134575 ISBN 9789352134571
5	Manaramjan Pradhan, U Dinesh Kumar	Machine Learning using Python	Wiley India ISBN 978-81-265-7990-7 ISBN 9 788126 579907

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.python.org/downloads/	Python IDE download
2	https://www.pdfdrive.com/machine-learning-step-by-step-guide -to-implement-machine-learning-algorithms-with-python-d15832 4853.html	AI and ML E-Books
3	https://www.geeksforgeeks.org/how-to-install-python-pycharm-on-windows	Guidelines for Installation of python
4	https://stackabuse.com/courses/graphs-in-python-theory-and-i mplementation/lessons/a-star-search-algorithm	A* algorithm
5	https://www.javatpoint.com/turing-test-in-ai	Turing test

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Sr.No	Link / Portal	Description
6	https://www.v7labs.com/blog/best-free-datasets-for-machine-learning	Datasets
7	https://www.geeksforgeeks.org/how-to-split-a-dataset-into-train-and-test-sets-using-python	Training and Testing Dataset
8	https://towardsdatascience.com/email-spam-detection-1-2-b0e06a5c0472	Filtering Dataset

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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