**Detailed Syllabus**

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| **Subject Code** | 21M71CS112 | | **Semester Even** | **Semester M.Tech I**  **Session 2022- 2023**  **Month from July - December** |
| **Subject Name** | Advances in AI | | | |
| **Credits** | **3** | | **Contact Hours** | **3** |
| **Faculty (Names)** | **Coordinator(s)** | Dr. Ankit Vidyarthi | | |
| **Teacher(s) (Alphabetically)** | Dr. Ankit Vidyarthi | | |

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| **S.No.** | **Description** | **Cognitive Level**  **(Blooms Taxonomy)** |
| C161.1 | Understand the characteristics & significance of AI | Understanding Level (Level III) |
| C161.2 | Analyze several AI/ML techniques to yield and process information from open real-world data sources | Analyzing Level  (Level II) |
| C161.3 | Apply the concept of Machine Learning for industrial applications | Applying Level  (Level IV) |
| C161.4 | Evaluate the use of the Machine Learning algorithms towards pattern mining | Evaluating Level  (Level V) |
| C161.5 | Design algorithmic frameworks for solving time series data patterns | Creating Level  (Level VI) |

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| **Module No.** | **Subtitle of the Module** | **Topics in the module** | **No. of Lectures for the module** |
| **1** | Introduction | Introduction of AI, introduction of Machine Learning, Significance of AI and ML, Application areas, model pipelining | 3 |
| **2** | Mathematical Formulation | Matrices and its operations, Overview of probability theory, Bayes networks, Independece, I-Maps, Undirected graphical models, Bayesian and Markov networks | 5 |
| **3** | Models and Learning | Learning, Types of learning, Local models; Exact inference, Clique trees, Belief propagation, Tree construction, applications solving problems | 6 |
| **4** | Optimization and Inference | Introduction to optimization, Approximate inference: sampling, Markov chains, MAP inference, Inference in temporal models; Learning graphical models | 6 |
| **5** | Estimation | Parameter estimation, Bayesian networks and shared parameters, structure learning, Partially observed data, Dimension reduction: PCA, LDA | 8 |
| **6** | Decision making | Gradient descent, Expected Maximization, Hidden variables, HMM, Undirected models, Undirected structure learning, Causalty, Utility functions, Decision problem, Expected utility | 8 |
| **7** | Classification and Segmentation | KNN, SVM, NN and its types, K-means, FCM, Introduction to Deep learning for classification and segmentation | 6 |
| **Total number of Lectures** | | | **42** |
| **Evaluation Criteria**  **Components Maximum Marks**  T1 20  T2 20  End Semester Examination 35  TA Attendance (15Marks), Assignment/Quiz/Mini-project (10Marks)  **Total 100** | | | |

**Project based learning**: Each student in a group of 2-3 will extract data from real-world domains using data from standard repositories that are globally recognized. For conducting application-based research, the students are encouraged to analyze social/political/financial/disease related data and generate underlying networked structure based on the algorithms of AI.

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| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| **1.** | Michael Negnevitsky, *Artificial Intelligence*, Person Publication, Third Edition, 2011 |
| **2.** | Toshinori Munakata, *Fundamentals of the New Artificial Intelligence*, Springer, Second Edition, 2008 |
| **3.** | Deisenroth, Marc Peter, A. Aldo Faisal, and Cheng Soon Ong. *Mathematics for machine learning*. Cambridge University Press, 2020 |
| **4.** | Valliappa Lakshmanan, Martin Görner, Ryan Gillard - *Practical Machine Learning for Computer Vision\_ End-to-End Machine Learning for Images*, O'Reilly Media, Inc., 2021 |
| **5.** | Laurence Moroney - *AI and Machine Learning for On-Device Development\_ A Programmer's Guide*, O'Reilly Media, Inc., 2021 |