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Description generated with very high confidence

**Course Plan**

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| **Department :** | Computer Applications |
| **Course Name & code :** | Machine Learning & MCA 5152 |
| **Semester & branch :** | III & MCA |
| **Name of the faculty :** | Mr. Nirmal Kumar Nigam & Mr. S.S. Shameem |
| **No of contact hours/week:** | |  |  |  |  | | --- | --- | --- | --- | | **L** | **T** | **P** | **C** | | 4 | 0 | 0 | 4 | |

**Course Outcomes (COs)**

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|  | ***At the end of this course, the student should be able to:*** | **No. of Contact Hours** | **Marks** |
| CO1: | Understand the basic concepts in Machine Learning | 8 | Marks |
| CO2: | Perform model specification , fitting for various regression models | 5 | Marks |
| CO3: | appy predictive models for various applications | 24 | Marks |
| CO4: | perform clustering on data | 6 | Marks |
| CO5: | Perform dimensionality reduction | 5 | Marks |
|  | **Total** | 48 |  |

**Assessment Plan**

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| **Components** | **Assignments** | **Sessional Tests** | **End Semester/**  **Make-up Examination** |
| **Duration** | 20 to 30 minutes | 60 minutes | 180 minutes |
| **Weightage** | 20 % (4 X 5 marks) | 30 % (2 X 15 Marks) | 50 % (1 X 50 Marks) |
| **Typology of Questions** | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation | Knowledge/ Recall; Understanding/ Comprehension; Application | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation |
| **Pattern** | Answer one randomly selected question from the problem sheet (Students can refer their class notes) | MCQ: 10 questions (0.5 marks)  Short Answers: 5 questions (2 marks) | Answer all 5 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks |
| **Schedule** | 4, 7, 10, and 13th week of academic calendar | Calendared activity | Calendared activity |
| **Topics Covered** | Quiz 1 (L 1-16& T **y1-y2**) **(CO1)** | Test 1  (L **a1-a2**& T **b1-b2**)  **(CO1,CO2, CO3)** | Comprehensive examination covering full syllabus. Students are expected to answer all questions **(CO1-5)** |
| Quiz 2 (L **17-24**& T **y3-y4**) **(CO2)** |
| Quiz 3 (L **x5-x6**& T **y5-y6**) **(CO2)** | Test 2  (L **a3-a4**& T **b3-b4**)  **(CO 3, CO 4)** |
| Quiz 4 (L **x7-x8**& T **y7-y8**) **(CO3)** |

**Lesson Plan**

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| **L. No.** | **Topics** | **Course Outcome Addressed** |
| **L0** | Introduction to Machine Learning, Parametric vs Non-parametric models | CO1 |
| **L1** | Brief review of Probability Theory, Common Discrete Distributions | CO1 |
| **L2** | Common Continuous Distributions, Joint Probability Distributions | CO1 |
| **L3** | Tranformation of random variables , Monte Carlo Approximation | C01 |
| **L4** | Linear Regression – Model Specification, Cost functions | C01 |
| **L5** | Linear Regression – Gradient Descent, Batch Gradient Descent | CO1 |
| **L6** | Linear Regression – Maximum Likelihood Estimation, Model Selection | CO1 |
| **L7** | Estimators- sampling distribution, Bayes Risk, Desirable Properties, No free lunch theorem | CO1 |
| **L8** | Linear Regression - Union and Chernoff bounds, VC dimensions. | CO2 |
| **L9** | Logistic Regression – Model Specfication | CO2 |
| **L10** | Logistic Regression – Model Fitting | CO2 |
| **L11** | Generalised Linear Models – The exponential Family | CO2 |
| **L12** | GLMS - Basics , ML and Map estimation, Bayesian Inference | CO2 |
| **L13** | Information Theory – Entropy, KL divergence, Mutual Information | CO3 |
| **L14** | Generative Models for Discrete Data – Bayesian Concept Learning | CO3 |
| **L15** | The beta-binomial model | CO3 |
| **L16** | The Dirichlet-multinomial model | CO3 |
| **L17** | Bayesian Model Selection | CO3 |
| **L18** | Hierarchical Bayes, Empirical Bayes, Bayesian Decision Theory | CO3 |
| **L19** | Naïve Bayesian Classifiers- model fitting, using the model for prediction | CO3 |
| **L20** | Naïve Bayesian Classifiers- model fitting, using the model for prediction | CO3 |
| **L21** | Directed Graphical Models – Chain rule, Conditional independence, Inference | CO3 |
| **L22** | Dimensionality Reduction - Subset Selection | CO5 |
| **L23** | Dimensionality Reduction - PCA | CO5 |
| **L24** | Dimensionality Reduction - Factor Analysis, Multidimensional Scaling | CO5 |
| **L25** | Dimensionality Reduction - Linear Discriminant Analysis, | CO5 |
| **L26** | Dimensionality Reduction - Subset Selection, PCA, FactoLinear Discriminant Analysis, | CO5 |
| **L27** | Markov Models – Transition Matrix | CO3 |
| **L28** | Markov Models – Case Study - Language modeling | CO3 |
| **L29** | Hiden Markov models | CO3 |
| **L30** | Hiden Markov models - Applications | CO3 |
| **L31** | Inference in HMMs | CO3 |
| **L32** | Learning for HMMs | CO3 |
| **L33** | Generalization of HMMs | CO3 |
| **L34** | Clustering – Introduction, measuring dissimilarity | CO4 |
| **L35** | Clustering – Dirichlet process mixture models | CO4 |
| **L36** | Clustering – Affinity propagation | CO4 |
| **L37** | Spectral Clustering | CO4 |
| **L38** | Hierarchical Clustering | CO4 |
| **L39** | Clustering datapoints and features | CO4 |
| **L40** | Adaptive Basis Function Models - CART | CO3 |
| **L41** | Random Forests | CO3 |
| **L42** | Feed forward Neural Networks – back propagation | CO3 |
| **L43** | Introduction to Convolutional Neural Networks | CO3 |
| **L44** | Introduction to deep learning | CO3 |
| **L45** | Introduction to deep learning | CO3 |
| **L46** | Introduction to reinforcement Learning models | CO3 |
| **L47** | Boosting – AdaBoost, LogitBoost, Boosting as a functional gradient descent | C03 |
| **L48** | Ensemble Learning – Stacking | C03 |
| **L49** | Conclusion |  |
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**References:**

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| 1. | Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012. |
| 2. | Ethem Alpaydin, Introduction to Machine Learning, 3rd Edition, PHI Learning Private Limited, 2018. |
| 3. | Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar, “Foundations of Machine Learning, MIT Press, 2012 |
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| **Submitted by:** | **NIRMAL KUMAR NIGAM & S.S. SHAMEEM** |

**(Signature of the faculty)**

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| **Date:** | **25-07-2022** |

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| **Approved by:** | Click or tap here to enter text. |

**(Signature of HOD)**

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| **Date:** | **25-07-2022** |

**Faculty members teaching the course (IF MULTIPLE sections EXIST):**

|  |  |  |  |
| --- | --- | --- | --- |
| **FACULTY** | **Section** | **FACULTY** | **Section** |
| Mr. Nirmal Kumar Nigam | A |  |  |
| Mr. Shameem | B |  |  |
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