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| Picture1 | ***Academic Administration Lesson Plan***  ***Machine Learning (Elective)– Semester VIII– Computer Engineering***  ***by Prof. Avinash Shrivas*** |

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| **1** | **Scheme** (As specified by the University) |  |

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|  | Theory | IA | Practical | Oral | Term Work | Total |
| Hours/Week | 4 | - | 2 | - | - | 6 |
| Marks | 80 | 20 | - | 25 | 25 | 150 |

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| Academic Year | 2016-2017 | | |
| Branch  CMPN | Semester  B.E. Semester VIII | Subject    Machine learning | |
| Total Subject Load | Theory  4 X 1 Div. = 4 | Practical  2 X 4 Div. = 08 | Tutorial  -- |
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| Proposed Faculty-wise Distribution | Theory | Practical | Tutorial |
| Elective III | AS-4 | AHS-2\*2  SJ-2\*2 | -- |
|  | 4 | 8 | -- |

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| **2** | **Course Outcomes (Institute and University)** |  |

1. Ability to analyze and appreciate the applications which can use Machine Learning

Techniques.

2. Ability to understand regression, classification, clustering methods.

3. Ability to understand the difference between supervised and unsupervised learning

methods.

4. Ability to appreciate Dimensionality reduction techniques.

5. Students would understand the working of Reinforcement learning.

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| **3** | **Syllabus** |  |

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| **Module No.** | **Topics** | **Hours / Duration** |
| 1 | Introduction to Machine Learning  1.1 What is Machine Learning?, Key Terminology, Types of Machine  Learning, Issues in Machine Learning, Application of Machine Learning,  How to choose the right algorithm, Steps in developing a Machine  Learning Application. | 06 |
| 2 | Learning with Regression  2.1 Linear Regression, Logistic Regression. | 04 |
| 3 | Learning with trees  3.1 Using Decision Trees, Constructing Decision Trees, Classification and  Regression Trees (CART). | 08 |
| 4 | Support Vector Machines(SVM)  4.1 Maximum Margin Linear Separators, Quadratic Programming solution to  finding maximum margin separators, Kernels for learning non-linear  functions. | 06 |
| 5 | Learning with Classification  5.1 Rule based classification, classification by backpropoagation, Bayesian  Belief networks, Hidden Markov Models. | 06 |
| 6 | Dimensionality Reduction  6.1 Dimensionality Reduction Techniques, Principal Component Analysis,  Independent Component Analysis. | 06 |
| 7 | Learning with Clustering  7.1 K-means clustering, Hierarchical clustering, Expectation Maximization | 06 |
| 8 | Reinforcement Learning  8.1 Introduction, Elements of Reinforcement Learning, Model based learning,  Temporal Difference Learning, Generalization, Partially Observable  States. | 06 |

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| **4.a** | **Prerequisite Subject/s** |  |

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| No. | Branch | Semester | Name of the Subject |
|  | CMPN | 7 | Artificial Intelligence , Soft computing |
|  | CMPN | 8 | Data warehousing and Mining |

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| **4.b** | **Relevance to future subjects** |

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| No. | Branch | Semester | Name of the Subject |
| 1 | M.E. CMPN | 2 | Computational Intelligence |

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| **4.c** | **Relevance to life** |

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| No. | Real Life Mapping |
| 1 | Recommender systems : suggesting similar people on Facebook/ linkdIn, Similar movies/books on Amazon. |
| 2 | Business applications : Customer segmentation, Customer retention, targeted marketing. |
| 3 | Medical applications : Disease diagnoses |
| 4 | Language translation : speech to text and text to speech |

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| **5** | **Beyond Syllabus** |

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| Sr. No | BSA | Details |
| a. | Guest Lecture | **Week 07**: |
| b. | Quiz | **Week 05:** Multiple Choice Questions (MCQ) Quiz program. |
| c. | Debate | **Week 09:** Debate on different ML algorithms |

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| **6** | **Past Results** |

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| **Year** | **Subject: ML** |
| May-2016 | New subject |

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| **7** | **Topics which bring the result down** |

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| **Sr. No** | **Topics** |
| 1. | New subject |

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| **8** | **Course Administration** |

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| **8.a** | **Books Used and Recommended to Students** |

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| **Text and Reference Books** | |
|  | 1. Peter Harrington “Machine Learning In Action”, DreamTech Press  2. Ethem Alpaydın, “Introduction to Machine Learning”, MIT Press  3. Tom M.Mitchell “Machine Learning” McGraw Hill  4. Stephen Marsland, “Machine Learning An Algorithmic Perspective” CRC Press  5. William W.Hsieh, “Machine Learning Mehods in the Environmental Sciences”, Cambridge  6. Han Kamber, “Data Mining Concepts and Techniques”, Morgann Kaufmann Publishers  7. Margaret.H.Dunham, “Data Mining Introductory and Advanced Topics”, Pearson Education |

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| **8.b** | **Relevant Websites(Reputed Universities and Others) for Notes/Animation/Videos Recommended to Students** |

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| **Web Site and Internet Contents References** | |
|  | |  | | --- | | <http://en.wikipedia.org/wiki/Machine> learning **(INTRODUCTION)** | | [https://www.coursera.org/learn/**machine**-**learning**](https://www.coursera.org/learn/machine-learning) (Module 2 to module 8) | |

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| **8.c** | **Magazines/Journals Used and Recommended to Students** |

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| Magazines | Journals |
| IEEE TPAMI, [IEEE Transactions on Pattern Analysis and Machine Intelligence](http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34) | Journal of machine learning research, [Journal of Machine Learning Research](http://www.jmlr.org/) |
| IEEE TKDE, [IEEE Transactions on Knowledge and Data Engineering](https://www.computer.org/web/tkde) | Pattern recognition, [Journals | Elsevier](http://www.journals.elsevier.com/)**pattern**-**recognition**/ |

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| **9** | **Practicals** |

**Practical Plan**

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| **Pract No.** | **Title** | **CO** |
| 1 | To implement Linear Regression | CO3, CO4 |
| 2 | To implement Logistic Regression | CO1 |
| 3 | To implement ID3. | CO4 |
| 4 | To implement Support Vector Machine. | C05 |
| 5 | To implement Bayesian Classification. | CO1 |
| 6 | To implement K-Nearest Neighbour. | CO1,CO2 |
| 7 | To implement k-means Clustering. | CO1 |
| 8 | To implement Agglomerative Clustering. | CO5 |

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| **10.** | **Rubrics for Grading and Marking Scheme for Term Work** |

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| **Lecture % Attendance Marks** | **Assignments** | **Practical Performance** | **Journal Assessment** | **Class Test (Other than IA)** | **Total** |
| 95 to 100 % -5 marks  90 to 95 % - 4 marks  85 to 90 % - 3 marks  80 to 85 % - 2 marks  75 to 80 % - 1 mark  < 75 % - 0 mark | 5 marks – for Assignments | 5 marks – for experiments | 5 marks – for experiments | 5 marks – for Debate and Quiz | 25 |

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| **11** | **IA Test** |

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| **No. of tests** | **IA Dates** | **Syllabus** | **IA Question Paper Pattern** | **Remedial Policy** |
| 1st IA Test | 27/2/2016- tentative | Module 1,2,3,4 | Q1 – MCQ - 10 Marks  Q2 – 1 numerical 5 Marks  Q3 – 1 numerical 5 Marks  20 marks each for IA 1 & 2 | No Re-test in IA. IA is Head of passing \* |
| 2nd IA Test | 19/4/2017- tentative | Module 5,6,7,8 |

**\* IA failure will have to appear for re-test in next semester.**

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| **12** | **Assignments, Pop Quiz, Mini Project, Seminars** |

**Tutorial / Assignment / Quiz Plan**

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| **Assignment** | **Title** | **Week No.** | **Individual / Group activity ?** | **Reference:**  **book/website /Paper** |
| 1 | Introduction to Machine Learning,  Learning with Regression | 3 | Individual | . Ethem Alpaydın, “Introduction to Machine Learning” |
| 2 | Learning with trees, Support Vector Machines(SVM) | 6 | Individual | [https://www.coursera.org/learn/**machine**-**learning**](https://www.coursera.org/learn/machine-learning) |
| 3 | Learning with Classification, Dimensionality Reduction | 9 | Individual | [https://www.coursera.org/learn/**machine**-**learning**](https://www.coursera.org/learn/machine-learning) |
| 4 | Learning with Clustering, Reinforcement Learning | 12 | Individual | [https://www.coursera.org/learn/**machine**-**learning**](https://www.coursera.org/learn/machine-learning) |

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| **13** | **Consolidated Common Lesson Plan** |

**Comprehensive Lesson Plan**

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| **Week** | **Lecture** | **Topic planned / IV /Guest lecture / Video / any other activity** | **Teaching aid / methodology planned** |
| 1 | 1,2,3,4 | What is Machine Learning?, Key Terminology, Types of Machine  Learning, Issues in Machine Learning, Application of Machine Learning,  How to choose the right algorithm, Steps in developing a Machine  Learning Application. | Brainstorming, Board , PPT, Questionnaire |
| 2 | 5,6,7,8 | Learning with Regression  Linear Regression, Logistic Regression. | Board , PPT, Questionnaire |
| 3 | 9,10,11,12 | Learning with trees  Using Decision Trees, Constructing Decision Trees, Classification and  Regression Trees (CART). | Board , PPT, Questionnaire |
| 4 | 13,14,15,16 | Support Vector Machines(SVM)  Maximum Margin Linear Separators, Quadratic Programming solution to  finding maximum margin separators, Kernels for learning non-linear  functions.  QUIZ | Board , PPT, Questionnaire |
| 5 | 17,18,19,20 | Learning with Classification  Rule based classification, classification by backpropoagation, Bayesian  Belief networks, Hidden Markov Models | Board , PPT, Questionnaire |
| 6 | 21,22,23,24 | IA 1 | |
| 7 | 25,26,27,28 | Dimensionality Reduction  Dimensionality Reduction Techniques | Board , PPT, Questionnaire |
| 8 | 29,30,31,32 | Principal Component Analysis,  Independent Component Analysis. | Brainstorming, Board , PPT, Questionnaire |
| 9 | 33,34,35,36 | Learning with Clustering  K-means clustering,  DEBATE | Brainstorming, Board , PPT, Questionnaire |
| 10 | 37,38,39,40 | Hierarchical clustering, Expectation Maximization | Board , PPT Questionnaire |
| 11 | 41,42,43,44 | Reinforcement Learning  Introduction, Elements of Reinforcement Learning, Model based learning, | Board , PPT, Questionnaire |
| 12 | 45,46,47,48 | Temporal Difference Learning, Generalization, Partially Observable  States. | Brainstorming, Board , PPT, Questionnaire |
| 14 |  | IA 2 | |

*Prepared by …*

Prof. Avinash Shrivas

*Checked & Approved by Cluster Mentor .. Approved by ..*

***Prof. Vipul Dalal* Prof. Sachin Deshande**

*(Name and Signature, Cluster Mentor) (Head, Computer Engineering Dept)*