## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

| COURSE PLAN – PART I | | | |
|---|---|---|---|
| **Name of the programme and specialization** | **B.Tech Computer Science and Engineering** | | |
| **Course Title** | **Machine learning** | | |
| **Course Code** | **CSPE21** | **No. of Credits** | **3** |
| **Course Code of Pre-requisite subject(s)** | **CSPC25** | | |
| **Session** | **July 2019** | **Section (if, applicable)** | **A & B** |
| **Name of Faculty** | **Rajeswari Sridhar** | **Department** | **Computer Science and Engineering** |
| **Email** | **srajeswari@nitt.edu** | **Telephone No.** | |
| **Name of Course Coordinator(s) (if, applicable)** | **----** | | |
| **E-mail** | | **Telephone No.** | |
| **Course Type** | ☐ **Core course** | ☑ **Elective course** | |

**Syllabus (approved in BoS)**

**2015**

**COURSE OBJECTIVES**

- To understand the basic building blocks and general principles that allow one to design machine learning algorithms
- To become familiar with specific, widely used machine learning algorithms
- To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance

**COURSE OUTCOMES (CO)**

| **Course Outcomes** | **Aligned Programme Outcomes (PO)** |
|---|---|
| | |
| 1. Ability to implement and apply machine learning algorithms to real-world applications. | $PO_1$, $PO_5$, $PO_6$ |
| 2. Ability to identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems. | $PO_1$, $PO_3$, $PO_4$, $PO_5$ |
| 3. Ability to understand how to perform evaluation of learning algorithms and model selection. | $PO_1$, $PO_3$, $PO_4$, $PO_5$, |

| COURSE PLAN – PART II | | | |
|---|---|---|---|
| **COURSE OVERVIEW** | | | |
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| **COURSE TEACHING AND LEARNING ACTIVITIES** | | | |
| **S.No.** | **Week/Contact Hours** | **Topic** | **Mode of Delivery** |
| 1 | 22/07/2019 to 26/07/2019 1 hour | Unit 1: Introduction to Machine learning (ML) techniques – Types, differences | **Lecture** |
| 2 | 22/07/2019 to 26/07/2019 2 hours | Application of ML, Design perspectives, Issues in ML | **Lecture** *Chalk and Talk* |
| 3 | 29/07/2019 to 02/08/2019 1 hour | Formal learning model | **Lecture** *Chalk and Talk* |
| 4 | 29/07/2019 to 02/08/2019 2 hours | Applications concerned with Supervised, Unsupervised learning and issues | **Lecture** *Chalk and Talk* |
| 5 | 05/08/2019 to 09/08/2019 1 hour | Run-time learning | **Lecture** *Chalk and Talk* |
| 6 | 05/08/2019 to 09/08/2019 2 hours | Unit 2: Model representation, decision boundary, cost function, gradient descent | **Lecture** *Chalk and Talk* |
| 7 | 12/08/2019 to 16/08/2019 1 hour | Debugging a learning algorithm, evaluating a hypothesis | **Lecture** *Chalk and Talk* |
| 8 | 12/08/2019 to 16/08/2019 1 hour | Diagnostic, Bias/ Variance methods, trade off, bias/variance learning curves | **Lecture** *Chalk and Talk, Power point presentation* |
| 9 | 19/08/2019 to 23/08/2019 1 hour | Accuracy measure, precision, recall, confusion matrix, trade-off, TF/IDF | **Lecture** *Chalk and Talk* |

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|---|---|---|---|
| 10 | 19/08/2019 to 23/08/2019<br>2 hours | Regression models | **Lecture**<br><br>*Chalk and Talk* |
| 11 | 26/08/2019 to 30/08/2019<br>1 hour | Unit 3: Decision trees as classifier | **Lecture**<br><br>*Chalk and Talk* |
| 12 | 26/08/2019 to 30/08/2019<br>2 hours | Decision trees – pruning, learning rules | **Lecture**<br><br>*Chalk and Talk* |
| 12 | 02/09/2019 to 06/09/2019<br>1 hour | Naiver Baye's classifier, maximum likelihood estimation | **Lecture**<br><br>*Chalk and Talk* |
| 13 | 02/09/2019 to 06/09/2019<br>1 hour | Maximum likelihood estimation, nearest neighbor classifier | **Lecture**<br>*Chalk and Talk* |
| 14 | 09/09/2019 to 13/09/2019<br>1 hour | Nearest neighbor classifier | **Lecture**<br><br>*Chalk and Talk* |
| 15 | **09/09/2019 to 13/09/2019<br>1 hour** | **Cycle Test 1** | **Written** |
| 16 | 16/09/2019 to 20/09/2019<br>1 hour | Support vector machines, Neural networks as classifiers | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 17 | 16/09/2019 to 20/09/2019<br>2 hours | Neural network model as classifiers | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 18 | 23/09/2019 to 27/09/2019<br>3 hours | Unit 4: Unsupervised learning, Similarity and distance measures, k-means clustering, problems | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 19 | 30/09/2019 to 04/10/2019<br>1 hour | Variations of k-means clustering, K-medoids, fuzzy k-means clustering | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 20 | 30/09/2019 to 04/10/2019<br>2 hours | Variations of k-means, Fuzzy c/k means, EM algorithm | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 21 | 07/10/2019 to 11/10/2019<br>1 hour | EM algorithm – algorithm, example | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |

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|---|---|---|---|
| 22 | 07/10/2019 to 11/10/2019<br>2 hours | Bayesian networks, Model construction, algorithm | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 23 | 14/10/2019 to 18/10/2019<br>1 hour | N-gram models, algorithm, Markov property | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 24 | 14/10/2019 to 18/10/2019<br>2 hours | Hidden markov model – types of probability and problem to solve | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 25 | 21/10/2019 to 25/10/2019<br>1 hour | Problems based on Bayesian network, HMM (assignment problem) | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 26 | 21/10/2019 to 25/10/2019<br>2 hours | Conditional Random fields, Algorithms, application | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 27 | **28/10/2019 to 01/11/2019<br>1 hour** | **Cycle Test 2** | **Written** |
| 28 | 28/10/2019 to 01/11/2019<br>2 hour | Combining multiple learners – Boosting and Bagging | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 29 | 04/11/2019 to 08/11/2019<br>2 hours | Unit 5: Reinforcement learning – issues, elements, solution | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 30 | 04/11/2019 to 08/11/2019<br>1 hour | Model-based learning | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 31 | 11/11/2019 to 15/11/2019<br>2 hours | Temporal difference learning, practical applications | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 32 | 11/11/2019 to 15/11/2019<br>1 hour | Introduction to Deep learning, types, principles, issues | **Lecture**<br><br>*Chalk and Talk and Power point presentation* |
| 33 | 11/11/2019 to 15/11/2019<br>2 hour | **Project Demo** | **Demo by students** |

**Text Books**

1. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press, 2014

**Reference books**


1. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2005
2. H. Witten and E. Frank, Data Mining: Practical Machine Learning Tools and TechniquesMorgan Kaufmann, 2000
3. Tom Mitchell, Machine Learning, McGraw-Hill, 1997


**COURSE ASSESSMENT METHODS (shall range from 4 to 6)**

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Cycle Test 1 | 09/09/2019 to 13/09/2019 | 1 hour | 15 |
| 2 | Cycle Test 1 | 28/10/2019 to 01/11/2019 | 1 hour | 15 |
| 3 | Group Project | 11/11/2019 to 15/11/2019 | Full-semester activity | 20 |
| 5 | Assignment Problems | Periodically for Units 3,4 | Two | 10 |
| CPA | Compensation Assessment* | After completion of Cycle Test 2 | 1 hour | 15 |
| 6 | Final Assessment * | End of November | 3 hrs | 40 |

***mandatory; refer to guidelines on page 4**

**COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)**

1. **Students' feedback through class committee meetings**
2. **Feedbacks are collected before final examination through MIS or any other standard format followed by the institute**
3. **Students, through their Class Representatives, may give their feedback at any time to the course faculty which will be duly addressed.**

**COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)**

**MODE OF CORRESPONDENCE (email/ phone etc)**

Email, in-person – after 4.00 pm.

**COMPENSATION ASSESSMENT POLICY**

1. One compensation assessment will be given after completion of Cycle Test 1 and 2 for the students those who are absent for any assessment due to genuine reason.
2. Compensatory assessments would cover the syllabus of Cycle tests 1 & 2
3. The prior permission and required document must be submitted for absence.

**ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

**ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

**ADDITIONAL INFORMATION**

1. The Course Coordinator is available for consultation during the time intimated to the students then and there.
2. Relative grading adhering to the instructions from the office of the Dean (Academic) will be adopted for the course.

**FOR APPROVAL**

**Course Faculty** 29/7/19 **CC-Chairperson** 31/7/19 **HOD** 31/7/19