ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No. Acd./ 1282/IAPC-77 Dated: December 10 , 2019

Head, Department of Computer Science & Engineering
(through e-mail)

The IAPC in its 77th meeting held on 29.11.2019 vide **Item No. 77.2.6** considered the proposal of Department of Computer Science & Engineering to introduce a new PEC CSN-526: Machine Learning for M.Tech. (I Yr) and B.Tech. students.

The IAPC accepted the proposal with modifications. Duly modified syllabus is attached as **Appendix-A**.

Assistant Registrar (Curriculum)

Encl: as above

Copy to (through e mail):-

1. All faculty
2. All Heads of Departments/ Centres
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Computer Science and Engineering**

1. Subject Code: **CSN-526** Course Title: **Machine Learning**

2. Contact Hours: **L: 3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory 3** **Practical 0**

4. Relative Weightage: **CWS: 20-35** **PRS: 0** **MTE: 20-30** **ETE: 40-50** **PRE: 0**

5. Credits**: 4** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective: To provide an understanding of the theoretical concepts of machine learning and prepare students for research or industry application of machine learning techniques.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Introduction, What is ML, Supervised Learning, Unsupervised Learning, Problems, Data, Tools Overview for ML	4
2	Linear Regression, Polynomial Regression, Features, Scaling, Cost Function, Gradient Descent, Learning Rate	4
3	Supervised Learning, Linear classifier, Logistic Regression, Decision Boundary, Cost Function Optimization, Multi-class Classification, Bias and Variance, L1 and L2 Regularization	6
4	Performance Measure, Error Analysis, Confusion Matrix, Precision and Recall Tradeoff, F1 Score, Macro F1, Accuracy, Skewed Classes	4
5	Unsupervised Learning, Clustering, K-Means, Optimization Using Evolutionary Techniques, Number of Clusters, Advanced discussion on clustering, Expectation Maximization, Dimensionality Reduction	8
6	Discriminative Vs Generative Models, Probability Theory Basics: Marginalization, Conditioning, Normalization, and Conditional Independence, Bayes Theorem, Markov Random Field, Naive Bayes Model, Decision Tree, Random Forest Classifier	8

7	VC Dimensions, Large Margin Classifiers, Support Vector Machines and Kernel Methods, Neural Networks Learning, Forward Propagation, Backward Propagation, Introduction to Deep Neural Networks	8
	TOTAL	**42**

11. Suggested Books.

Sl. No.	**Name of Books / Authors**	**Year of Publication**
1	Mohri Mehryar, Afshin Rostamizadeh, and Ameet Talwalkar. "Foundations of machine learning", MIT press	2018
2	Sammut, Claude, and Geoffrey I. Webb. "Encyclopedia of machine learning and data mining", Springer	2017
3	Witten Ian H., Eibe Frank, Mark A. Hall, and Christopher J. Pal. "Data Mining: Practical machine learning tools and techniques", Morgan Kaufmann	2016
4	Müller Andreas C. and Sarah Guido. "Introduction to Machine Learning with Python: A Guide for Data Scientists"	2016
5	Christopher M. Bishop. "Pattern Recognition and Machine Learning", Springer	2013
6	Ethem A lpaydin. "Introduction to Machine Learning" Second Edition, PHI Learning	2012
7	Trevor Hastie, R. Tibshirani, J . Friedman. "The Elements of Statistical Learning" Second Edition, Springer	2008
8	Mitchell Tom M. "Machine Learning", Tata McGraw-Hill	1997