MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

COURSE PLAN

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)

	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

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 ($L_{1\text{-}16}$ & $T_{y1\text{-}y2}$) **(CO1)** Quiz 2 ($L_{17\text{-}24}$ & $T_{y3\text{-}y4}$) **(CO2)** Quiz 3 ($L_{x5\text{-}x6}$ & $T_{y5\text{-}y6}$) **(CO2)** Quiz 4 ($L_{x7\text{-}x8}$ & $T_{y7\text{-}y8}$) **(CO3)**	Test 1 ($L_{a1\text{-}a2}$ & $T_{b1\text{-}b2}$) **(CO1,CO2, CO3)** Test 2 ($L_{a3\text{-}a4}$ & $T_{b3\text{-}b4}$) **(CO 3, CO 4)**	Comprehensive examination covering full syllabus. Students are expected to answer all questions **(CO1-5)**

Lesson Plan

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	CO1
L4	Linear Regression – Model Specification, Cost functions	CO1
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 Only Definition & Properties	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	Naive Bayesian Classifiers- model fitting, using the model for prediction	CO3
L20	Naive 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	

References:

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)

Date: **25-07-2022**

Approved by: Click or tap here to enter text.

(Signature of HOD)

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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