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

MCA

COURSE PLAN: MACHINE LEARNING

Department:	Data Science & Computer Applications			
Course Name & code:	**Machine Learning / MCA 5152**			**Core/~~PE/OE~~**
Semester & branch:	**III / MCA**			
Name of the faculty:	**Mr. Nirmal Kumar Nigam**			
No of contact hours/week:	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

Course Outcomes (COs/CLOs)

CO/ CLO	At the end of this course, the student should be able to:	No. of Contact Hours	Marks	Program Outcomes (PO's)	Program Specific Outcomes (PSO)	Learning Outcomes (LOs)**	BL
CO1	Understand the basic concepts in Machine Learning	8	20	1	1, 2		2
CO2	Apply regression techniques, for parameter estimation, model selection, and prediction.	5	20	1, 2	1, 2		3
CO3	Apply predictive models for various applications	24	40	1, 2, 3, 4	1, 2		4
CO4	Apply different clustering algorithms to group similar data points together.	6	10	1, 2, 3, 4, 5	1, 2		3
CO5	Utilize imensionality reduction techniques to transform high-dimensional data to optimized representation.	5	10	1, 2, 3, 4, 5	1, 2		3
	Total	**48**	**100**				

***** Delete this column if not relevant***

Course Articulation Matrix

CO/CLO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					
CO2	1	2				
CO3	1	1	2	1		
CO4	1	1	1	1	2	
CO5	1	1	1	1	2	
Average Articulation Level	1.20	1.25	1.33	1.00	2.00	

ICT Tools used in delivery and assessment.

Sl. No	Name of the ICT tool used	Details of how it is used
1	**BlackBoard**	To explain concepts, formulas, and solving problem
2	**Microsoft Teams**	To share study materials and case study; perform quiz/assignment.
3	**Microsoft PowerPoint**	To explain concepts, formulas, and solving problem
4	**YouTube**	To refer some interesting expert explanation video on the relevant topic

Delivery and assessment Plan of LOs

Learning Outcome (LO) mapped to the course		**Delivery and assessment Plan**
LO	**LO statement**	

 # Applicable to IET Accredited Program

Assessment Plan

Components	Sessional 1	Sessional 2	Flexible Assessments (2 – 3 in number).	End semester/Makeup examination
Duration	120 minutes		3	180 minutes
Weightage	30%:		20%	50%
Typology of questions	Understanding; Applying; Analysing;		Understanding; Applying; Analysing.	Understanding; Applying; Analysing;
Pattern	Answer all questions		Assignment. Answer all questions. MCQ and Short Answers.	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	Calendar activity; 10^{th} week of academic calendar		Calendar activity; 4^{th}, 7^{th}, 13^{th} week of academic calendar	Calendar activity;
Topics covered	L1 - L25 (CO1, CO2, CO3, CO5)		Quiz 1- L1 - L11 (CO1, CO2) Quiz 2- L12 - L24 (CO2, CO3, CO5) Quiz 3- L25 - L39 (CO3, CO4, CO5)	Comprehensive examination covering the full syllabus. Students are expected to answer all questions

Note: Fine tune the assessment plan as per the guidelines, issued by AD(A), from time to time.

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	Transformation 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 Specification	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	CO5
L28	Markov Models – Case Study - Language modeling	CO5
L29	Hiden Markov models	CO5
L30	Hiden Markov models - Applications	CO5
L31	Inference in HMMs	CO3
L32	Learning for HMMs	CO3
L33	Generalization of HMMs	CO3

L34	Clustering – Introduction, measuring dissimilarity	CO3
L35	Clustering – Dirichlet process mixture models	CO3
L36	Clustering – Affinity propagation	CO3
L37	Spectral Clustering	CO3
L38	Hierarchical Clustering	CO4
L39	Clustering datapoints and features	CO4
L40	Adaptive Basis Function Models - CART	CO4
L41	Random Forests	CO4
L42	Feed forward Neural Networks – back propagation	CO4
L43	Introduction to Convolutional Neural Networks	CO4
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	CO3
L48	Ensemble Learning – Stacking	CO3

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**