Lingaya's Vidyapeeth

Deemed-to-be-University u/s 3 of UGC Act 1956, Government of India
NAAC ACCREDITED
Approved by MHRD / AICTE / PCI / BCI / COA / NCTE
Nachauli, Jasana Road, Faridabad- 121002 (Haryana)
Website: www.lingayasvidyapeeth.edu.in | Ph: 0129-2598200-05

COURSE PLAN & COURSE DATA SHEET

PROGRAM: B.Tech - VI Sem	DEGREE: B.Tech
COURSE: Statistical Learning Theory	SEMESTER: 6th CREDITS: 3
COURSE CODE: CS-302 REGULATION:	COURSE TYPE: CORE
COURSE AREA/DOMAIN: Computer Applications	CONTACT HOURS: 42
CORRESPONDING LAB COURSE CODE (IF ANY): CS-352	LAB COURSE NAME (IF ANY): Statistical Learning Theory Lab

PROGRAM EDUCATIONAL OBJECTIVES:

The main goal of statistical learning theory is to provide a framework for studying the problem of inference, that is of gaining knowledge, making predictions, making decisions or constructing models from a set of data.

SYLLABUS:

UNIT	DETAILS	HOURS
I	Probabilistic formulations of prediction problems, Plug-in estimators, empirical risk minimization linear threshold functions, perceptron algorithm	8
II	Risk bounds, Concentration inequalities, Uniform convergence, Rademacher averages; combinatorial dimensions, Convex surrogate losses for classification	9
III	Game-theoretic formulations of prediction problems, Minimax strategies for log loss, linear loss, and quadratic loss, Universal portfolios, Online convex optimization	8
IV	Neural network, Stochastic gradient methods, Combinatorial dimensions and Rademacher averages,Hardness results for learning,Efficient learning algorithms	8
V	Kernel methods, Reproducing kernel Hilbert spaces, Mercer's theorem, Convex optimization for kernel methods, Representer theorem, Ensemble methods, AdaBoost, AdaBoost as Iprojection, Convergence and consistency of AdaBoost	9
	TOTAL HOURS	42

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Teacher Centric Approach			
TC1: Chalk and Talk, Blended learning	TC2: PPT,	TC3: Video Lectures	TC4:
Learner Centric Approach:			
LC1: Assignment. recent trends.	LC2: Mini project.	LC3: Quiz/Class test.	LC 4: Seminar on
LC5: Group Task.	LC6: Others		

DETAILED SESSION PLAN

Lecture session/ Number	Topics to be covered	CO addressed	Teacher Centric Approach	Learner Centric Approach	References	Relevance with POs and PSOs
1	Probabilistic formulations of		TC1	LC1,LC3	T1/R1/W1	
2	Plug-in estimators		TC1	LC1,LC3	T1/R1/W1	
3	empirical risk minimization linear		TC1	LC1,LC3	T1/R1/W1	
4	perceptron algorithm		TC1	LC1,LC3	T1/R1/W1	
5	Risk bounds		TC1	LC1,LC3	T1/R1/W1	
6	Concentration inequalities		TC1	LC1,LC3	T1/R1/W1	
7	Uniform convergence		TC1	LC1,LC3	T1/R1/W1	
8	Rademacher averages		TC1	LC1,LC3	T1/R1/W1	
9	combinatorial dimensions		TC1	LC1,LC3	T1/R1/W1	
	Convex surrogate losses for		TC1	LC1,LC3	T1/R1/W1	

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10	Game-theoretic formulations of prediction problems prediction problems		TC1	LC1,LC3	T1/R1/W1	
11	Minimax strategies for log loss		TC1	LC1,LC3	T1/R1/W1	
12	linear loss and quadratic loss		TC1	LC1,LC3	T1/R1/W1	
13	Universal portfolios		TC1	LC1,LC3	T1/R1/W1	
14	Online convex optimization		TC1	LC1,LC3	T1/R1/W1	
15	Neural network		TC1	LC1,LC3	T1/R1/W1	
16	Stochastic gradient methods		TC1	LC1,LC3	T1/R1/W1	
17	Combinatorial dimensions and		TC1	LC1,LC3	T1/R1/W1	
18	Hardness results for learning		TC1	LC1,LC3	T1/R1/W1	
19	Efficient learning algorithms		TC1	LC1,LC3	T1/R1/W1	

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
1	A Probabilistic Theory of Pattern Recognition, Devroye, Gyorfi, Lugosi, Springer
2	The Elements of Statistical Learning, Hastie, et al, Springer
3	Combinatorial methods in density estimation, Devroye and Lugosi, Springer
4	Statistical Learning Theory, Vapnik, Wiley
5	An Introduction to Computational Learning Theory, Kearns and Vazirani, MIT Press

 # WEB SOURCE REFERENCES (W):

1	https://www.youtube.com/watch?v=pb9LQV3fytE
2	
3	
4	
5	
6	
7	

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
CS-302	**Statistical Learning Theory**	3-0-0	6TH

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COURSE OUTCOMES:

S.NO	DESCRIPTION	PO(1..12) MAPPING	PSO(1..3) MAPPING
Cxxx.1	To learn existing statistical algorithms of Machine Learning (ML) and Pattern Recognition (PR).	PO1,PO2,PO3	PSO1,PSO2,PSO3
Cxxx.2	To understand the difference between Classification and Regression	PO1,PO2,PO3	PSO1,PSO2,PSO3
Cxxx.3	To have hands-on experience in implementing various ML and PR techniques on different datasets.	PO1,PO2,PO3	PSO1,PSO2,PSO3
Cxxx.4	To learn to compare the performance of two learning systems.	PO1,PO2,PO3	PSO1,PSO2,PSO3
Cxxx.5	To study few optimization methods used to estimate the parameters of a model during training.	PO1,PO2,PO3	PSO1,PSO2,PSO3
COURSE OVERALL PO/PSO MAPPING:			

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Cxxx.1	1	1	2	-	-	-	-	-	-	-	-	-	1	2	2
Cxxx.2	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
Cxxx.3	1	2	2	-	-	-	-	-	-	-	-	-	2	2	2
Cxxx.4	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
Cxxx.5	1	1	2	-	-	-	-	-	-	-	-	-	2	1	1

* For Entire Course, PO & PSO Mapping

POs & PSO REFERENCE:

PO1	Engineering Knowledge	PO7	Environment & Sustainability	PSO1	To equip the students with theoretical and implementation knowledgebase in all the existing statistical algorithms of Machine Learning (ML) and Pattern Recognition (PR) , understand the difference between Classification and Regression
PO2	Problem Analysis	PO8	Ethics	PSO2	on experience in implementing various ML and PR techniques on different datasets
PO3	Design & Development	PO9	Individual & Team Work	PSO3	optimization methods used to estimate the parameters of a model during training
PO4	Investigations	PO10	Communication Skills		
PO5	Modern Tools	PO11	Project Mgt. & Finance		
PO6	Engineer & Society	PO12	Life Long Learning		

COs VS POs MAPPING JUSTIFICATION:

S.NO	PO/PSO MAPPED	LEVEL OF MAPPING	JUSTIFICATION
Cxxx.1			
Cxxx.2			
Cxxx.3			
Cxxx.4			

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Cxxx.5			
Cxxx*			

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS, POs & PSOs:

SNO	DESCRIPTION	PROPOSED ACTIONS
1		
2		
3		
4		
5		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	
2	
3	
4	
5	
6	
7	

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☐ STUD. ASSIGNMENT	☐ WEB RESOURCES	☐ NPTEL/OTHERS
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	☐ WEBNIARS

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENTS	☐ STUD. SEMINARS	☐ TESTS/MODEL EXAMS	☐ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☐ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☐ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

INNOVATIONS IN TEACHING/LEARNING/EVALUATION PROCESSES:

1. **Technology Integration:** Embrace and integrate technology tools in the classroom to enhance the learning experience. This can include interactive whiteboards, educational apps, virtual reality, and online collaboration platforms. Utilizing technology allows for more dynamic and interactive lessons, catering to diverse learning styles.
2. **Personalized Learning Paths:** Implement personalized learning approaches that cater to individual student needs and pace of learning. Adaptive learning platforms and data analytics can help tailor educational content, assignments, and assessments based on the strengths and weaknesses of each student, promoting a more customized learning experience.
3. **Active Learning Strategies:** Move away from traditional lecture-based approaches and incorporate active learning strategies. This involves engaging students in hands-on activities, group discussions, problem-solving exercises, and real-world projects. Active learning fosters critical thinking, collaboration, and practical application of knowledge.

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4. **Blended Learning Models:** Adopt blended learning models that combine face-to-face instruction with online resources. This allows for flexibility in learning, enabling students to access materials at their own pace outside the classroom. Flipped classrooms, where students learn new concepts online and engage in discussions and activities during class, are an example of a blended learning approach.

5. **Assessment Innovation:** Rethink assessment methods to go beyond traditional exams and quizzes. Explore alternative forms of assessment, such as project-based assessments, portfolios, presentations, and peer assessments. Additionally, incorporate formative assessments and feedback throughout the learning process to help students track their progress and make improvements.

Prepared by   **Approved by**

(Mr. Monu)   **(HOD)**

 # Additionally, the details to be compiled separately by the Departmental Coordinator for the entire Department.