Name of School/ Department: CS&IT	
Name of Program: Bachelor of Technology	**Branch/ Specialization:** Computer Science and Engineering

COURSE PLAN

Name of Course	Course Code	Semester	Credit	Contact	L	+	T	+	P	=	Total
Pattern Recognition	CS-405C	7th	4	4	3	+	1	+	0	=	4

Name of the Faculty Member	Designation	Employee ID
Dr. Manisha Vashisht	Associate Professor	2538

Academic Year	Email ID	Mobile Number
2023-2024	**manishavashisht@lingayasvidyapeeth.edu.in**	**9899762669**

Prerequisite Course:

Knowledge of programming languages, basics of mathematics, organizing and problem-solving ability.

Teacher Centric Approach

TC1: Chalk and Talk,   **TC2: PPT,**   **TC3: Video Lectures**   **TC4: Blended learning**

Learner Centric Approach:

LC1: Assignment.   **LC2: Mini project.**   **LC3: Quiz/Class test.**   **LC 4: Seminar on recent trends.**

LC5: Group Task.   **LC6: Others**

Name of School/ Department: CS&IT	
Name of Program: Bachelor of Technology	Branch/ Specialization: AI/ML

VISION:

To bring forth cultured graduates meeting the expectation of national and multi-national industries exceling in the field of computing as well as in higher studies and research.

MISSION:

1. To provide strong theoretical knowledge of computer science with practical training which meets the industries expectations.

2. To train necessary skills to further higher studies and professional growth.

3. To inculcate ethical valued in graduates through various social-cultural activities.

PROGRAM OUTCOMES:

PO1- Engineering Knowledge: Apply the knowledge of mathematics, science, engineering and Application fundamentals, and an engineering and Application specialization to the solution of complex engineering problems.

PO2- Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3-Design/development of solutions: Design solutions for complex engineering problems and design system components or processes

that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4- Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5- Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6- The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7- Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10- Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11- Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12- Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFICOUTCOMES:

PSO1: To equip the students with theoretical and implementation knowledgebase in all the latest areas of Computer Science; Engineering for a Successful career in software industries, pursuing higher studies, or entrepreneurial establishments.

PSO2: To nurture the students with the critical thinking abilities for better decision making by offering them a socially acceptable solutions to real life Problems through computing paradigm.

PSO3: To nurture the students with the comprehensive analytical and design abilities by offering them techno- commercially feasible solutions of real business problems through computing.

COURSE DESCRIPTION:

To provide the knowledge pattern recognition and cluster

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COURSE OUTCOMES:

SNO	DESCRIPTION	PO(1..12) MAPPING	PSO(1..3) MAPPING
CO1	Explain and compare a variety of pattern classification, structural pattern recognition. and pattern classifier combination techniques	PO1,PO2	PSO1
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing	PO1,PO2,PO3	PSO1,PSO2
CO3	Apply performance evaluation methods for pattern recognition, and critique. comparisons of techniques made in the research literature	PO1,PO2,PO3,PO4,PO5	PSO1,PSO2
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition classifier combinations, and structural	PO1,PO2,PO3	PSO1,PSO2
CO5	Implement simple pattern classifiers, pattern recognizers	PO1,PO2,PO3,PO4,PO5	PSO1,PSO2
COURSE OVERALL PO/PSO MAPPING:			

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

SNO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1											2		
CO2	2	1	1										2	1	
CO3	2	2	1	1	1								2	2	
CO4	2	1	1										2	2	
CO5	2	1	1	1	1								2	2	
CO*															

SYLLABUS:

UNIT	DETAILS	Contact Hours
1	**INTRODUCTION**: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	8
2	**STATISTICAL PATTEN RECOGNITION**: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions.	5
3	**PARAMETER ESTIMATION METHODS**: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods -Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	7
4	**NONPARAMETRIC TECHNIQUES**: Density Estimation, Parzen Windows, K-Nearest NeighborEstimation, Nearest Neighbor Rule, Fuzzy classification.	6
5	**UNSUPERVISED LEARNING & CLUSTERING**: Criterion functions for clustering, Clustering Techniques:Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.	10
	Total Contact Hours	**36**

COURSE COMPLETION PLAN

Total Class room sessions	36
Total Quizzes	2
Total Test	2
Total Assignment	5

One Session = 50 Minutes

EVALUATION & GRADING

- Students will be evaluated based on the following stages.
- Internal Assessment= 40%
- End Semester Examination = 60%

DETAILED SESSION PLAN

Lecture session/ Number	Topics to be covered	Planned Date	Execution Date	Teacher Centric Approach	Learner Centric Approach	References	Relevance with POs and PSOs
1	Basics of pattern recognition	08/08/2023	21/08/23	TC1, TC2	LC1,LC3	T1/T2/R1	1
2	Design principles of pattern recognition system,	09/08/2023	23/8/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1	1
3	Learning and adaptation,	16/08/2023	24/8/23	TC1,TC2	LC1,LC3	T1/T2/R1/R2	2

4	Pattern recognition approaches	18/08/2023	28/8/23	TC1,TC2	LC1,LC3,LC4	T1/T2/T3/R1/R2	2
5	Mathematical foundations - Linear algebra, Probability Theory.	22/08/2023	30/8/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R2	2
6	Expectation, mean and covariance,	23/08/2023	31/8/23	TC1,TC2	LC1,LC3	T1/T2/R1/R2/R3	1
7	Normal distribution,	25/08/2023	4/9/23	TC1,TC2	LC1,LC3,LC4	T1/T2/T3/R1/R2	
8	multivariate normal densities, Chi squared test	29/08/2023	6/9/23	--	--	--	2
9	STATISTICAL PATTEN RECOGNITION:Introduction	30/08/2023	7/9/23	TC1,TC2	LC1,LC3,LC4	T1/T2/T3/R1/R2	2
10	Bayesian Decision Theory	01/09/2023	11/9/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R2	2
11	Classifiers,	05/09/2023	13/9/23	TC1,TC2	LC1,LC3,LC2	T1/T2/T3/R1/R3	1
12	Normal density	06/09/2023	14/9/23	TC1,TC2	LC1,LC3,LC2	T1/T2/R1/R3	2
13	discriminant functions,	08/09/2023	18/9/23	--	--	--	
14	PARAMETER ESTIMATION METHODS :Maximum-Likelihood estimation	12/09/2023	20/9/23	TC1,TC2	LC1,LC3	T1/T2/R1/R3	1
15	Bayesian Parameter estimation	13/09/2023	20/9/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R2	2
16	Dimension reduction methods	19/09/2023	21/9/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R3	2
17	Principal Component Analysis (PCA)	20/09/2023	25/9/23	TC1,TC,2	LC1,LC3	T1/T2/T3/R1/R3	2
18	Fisher Linear discriminant analysis,	22/09/2023	27/9/23	TC1,TC2	LC1,LC3	T1/T2/R1/R2	2

19	Expectation-maximization (EM),	26/09/2023	28/9/23	TC1,TC2	LC1,LC3	T1/T2/R1/R2	
20	Gaussian mixture models	27/09/2023	2/10/23	--	--	--	1
21	NONPARAMETRIC TECHNIQUES: Density Estimation	29/09/2023	4/10/23	TC1, TC2	LC1,LC3	T1/T2/T3/R1/R3	2
22	Parzen Windows	29/09/2023	5/10/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R3	2
23	K-Nearest Neighbor Estimation,.	03/10/2023	16/10/23	TC1,TC2	LC1,LC3, LC4	T1/T2/T3/R1/R2	2
24	Nearest Neighbor Rule.	05/10/2023	18/10/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R2	2
25	Nearest Neighbor Rule.	06/10/2023	19/10/23	TC1,TC2	LC1,LC3	T1/T2/T3/R1/R2	2
26	Fuzzy classification	10/10/2023	23/10/23	TC1,TC2	LC1,LC3	T1/T2/R1/R2	2
27	UNSUPERVISED LEARNING & CLUSTERING	11/10/2023	25/10/23	--	--	--	2
28	Criterion functions for clustering.	27/10/2023	26/10/23	TC1,TC2	LC1,LC3	T1/T2/R1/R3	1
29	Clustering Techniques	31/10/2023	30/10/23	TC1,TC2	LC1,LC3,LC5	T1/T2/R1/R3	1
30	Iterative square error	01/11/2023	1/11/23	TC1,TC2	LC1,LC3,LC5	T1/T2/R1/R2	
31	partitional clustering - K means	03/11/2023	2/11/23	TC1,TC2	LC1,LC3,LC5	T1/T2/R1/R2	1
32	Agglomerative hierarchical clustering,.	07/11/2023	6/11/23	TC1,TC2	LC1,LC3,LC5	T1/T2/R1/R2	2

33	Cluster validation	08/11/2023	8/11/23	TC1,TC2	LC1,LC3	T1/T2/R2/R3	2
34	Revision Class	10/11/2023	9/11/23	--	--	--	--
35	Revision Class	14/11/2023		--	--	--	--
36	Revision Class	15/11/2023		--	--	--	--

REFERENCES:

Text Book	T1	Richard O Duda, Peter E Hart and David G Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
	T2	. C. M. Bishop, "Pattern Recognition and Machine Learning". Springer, 2009
	T3	S. Theodorides and K. Koutroumbas, "Pattern Recognition 4th Edition, Academic
Reference Book	R1	, "Pattern Recognition and Machine Learning".
	R2	
	R3	
Web based materials	W1	Geeksforgeeks
	W2	www.coursera.com
	W3	www.simplilearn.com

Faculty   **HOD**

Dr. Manisha Vashisht   **Dr. Ritu Sindhu**