Seat No.:		Q. Paper Code: FTC-A-018	SET	A

Fabtech Technical Campus, College of Engineering & Research, Sangola

(An Autonomous Institute)

Electronics and Telecommunication Engineering

Academic Year: -2025-26, Semester-I

Pattern Recognition and Machine Learning (25PET11272)

Regular End Semester Examination Winter 2025-26 [Dec./Jan]

Class:	F. Y. M. Tech.	**Day & Date:**	Wednesday, 07/01/2026
Duration:	03 Hrs.	**Max. Marks:**	60 Marks
Time:	11: 00 AM TO 02:00 PM		

Instructions:

1) All Questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat diagram wherever necessary.
4) Make suitable assumptions if necessary and state it clearly.
5) Use of non-programmable calculator is allowed.

Q. No.	Questions	Marks	CO	BL
Q. 1	**Attempt any two of the following**	**12**		
1	Explain design cycle in Pattern Recognition	**6**	1	2
2	Draw and explain the Pattern recognition System in brief.	**6**	1	2
3	Enlist and explain the various applications of pattern recognition	**6**	1	2
Q. 2	**Attempt any two of the following**	**12**		
1	Which of the following are binomial experiments? (a) A player rolls a pair of fair die 10 times. The number X of 7's rolled is recorded. (b) The 11 largest airlines had an on-time percentage of 84.7% in November, 2001 according to the Air Travel Consumer Report. In order to assess reasons for delays, an official with the FAA randomly selects flights until she finds 10 that were not on time. The number of flights X that need to be selected is recorded. (c) In a class of 30 students, 55% are female. The instructor randomly selects 4 students. The number X of females selected is recorded.	**6**	2	4
2	A candy company distributed boxes of chocolates with a mixture of creams, toffees, and nuts coated in both light and dark chocolate. For a randomly selected box, let X and Y, respectively, be the proportions of the light and dark chocolates that are creams and suppose that the joint density function is	**6**	2	3

	a) Verify whether $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)dxdy = 1$ b) Find P[(X,Y) ∈ A], where A is the region {(x,y) | 0<x<½, ¼<y<½}.			
3	Explain the criterion for Binomial distribution with suitable notation?	**6**	2	2
Q. 3	**Attempt any two of the following**	**12**		
1	What is likelihood ratio? Explain with the help of Two Category Classification	**6**	3	2
2	Explain Bayesian Decision Theory for continuous feature.	**6**	3	2
3	What are Classifiers, Discriminant Functions and Decision Surfaces?	**6**	3	2
Q. 4	**Attempt any two of the following**	**12**		
1	A dataset contains 1000 samples with 50 features each. After applying PCA, you observe that the first 3 principal components capture 85% of the total variance, while the first 10 components capture 95% of the variance. (a) Explain the mathematical objective that PCA optimizes and how eigenvalues relate to variance explained. (b) If you need to reduce dimensionality for a classification task, discuss the trade-offs between choosing 3 versus 10 principal components. (c) How does PCA handle correlated features, and why is data standardization important before applying PCA?	**6**	4	4
2	What are the advantages of using SVD over traditional eigenvalue decomposition for PCA, especially for high-dimensional data	**6**	4	2
3	Define and compare three class separability measures: Divergence, Bhattacharyya Distance, and Chernoff Bound. What does each measure quantify?	**6**	4	3
Q. 5	**Attempt any two of the following**	**12**		
1	Define a Markov model and explain the Markov assumption. What are the three fundamental problems in HMMs that need to be solved?	**6**	5	2
2	Compare and contrast K-means clustering and hierarchical clustering. Discuss the advantages and disadvantages of each approach	**6**	5	4
3	Explain the difference between agglomerative and divisive hierarchical clustering. For agglomerative clustering, describe three different linkage criteria (single, complete, average) and how they affect the resulting clusters.	**6**	5	3