Unsupervised Learning	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-4	ML-465T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To learn about unsupervised learning and clustering algorithms
2.	To learn about Gaussian mixture models and linear dimensional reduction methods
3.	To learn about autoencoders and generative adversarial network
4.	To learn about outlier detection,density estimation methods and unsupervised learning networks

Course Outcomes (CO)

CO 1	Applying clustering algorithms for the real world data
CO 2	Applying Dimensional reduction techniques for feature extraction and learn,Gaussian mixture models
CO 3	Learn about Autoencoders and Genearative adversarial network
CO 4	Applying outlier and novelty detection,density estimation methods to real world data and learn about unsupervised learning networks

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	3	3	3	2	2	-	-	-	-	2
CO 2	3	2	3	3	3	2	2	-	-	-	-	2
CO 3	3	2	3	3	3	2	2	-	-	-	-	2
CO 4	3	2	3	3	3	2	2	-	-	-	-	2

UNIT-I

Unsupervised learning - Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning,

Clustering –Clustering as a Machine Learning task, Different types of clustering techniques, Partitioning methods, Hierarchical clustering, Density-based methods: DBSCAN

Biclustering :Spectral co-clustering,spectral biclustering

Finding Pattern using Association Rule - Definition of common terms, Association rule, Apriori algorithm.

UNIT-II

Gaussain Mixture Models: Gaussian mixture ,Variational Bayesian Gaussian mixture

Manifold learning:Introduction,Isomap,Locally linear embedding,Modified locally linear embedding,Spectral embedding,MDS(Multi dimensional scaling, t-distributed Stochastic Neighbor Embedding (t-SNE)

Decomposing signals in components (matrix factorization problems):PCA(Principal component Anlysis),Factor Analysis, Kernel Principal Component Analysis (kPCA), Truncated singular value decomposition and latent semantic analysis, Independent component analysis (ICA), Non-negative matrix factorization (NMF or NNMF), Latent Dirichlet Allocation (LDA)

UNIT-III

Autoencoders: Architecture,Layers in autoencoder ,training of autoencoder ,Sparse Coding, Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.
Generative Adversarial Networks: Generative Vs Discriminative Modeling, Probabilistic Generative Model, Generative Adversarial Networks (GAN), GAN challenges: Oscillation Loss, Mode Collapse, Uninformative Loss, Hyperparameters, Tackling GAN challenges, Wasserstein GAN, Cycle GAN, Neural Style Transfer

UNIT - IV

Novelty and outlier detection:Overview of outlier detection methods,Novelty detection,outlier detection
Density estimation:Histograms and kernel density estimation
Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps – architecture, training algorithm, Kohonen Self-Organizing Motor Map,Restricted Boltzmann machine(neural network model)

Textbook(s):
1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Benyamin Ghojogh, Mark Crowley, Fakhri Karray, ، Ali Ghodsi , Elements of Dimensionality Reduction and Manifold Learning,Springer

References:
1. C. M. BISHOP (2006), "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition
2. Kevin Murphy, *Machine learning: a probabilistic perspective*.
3. Jennifer Grange ," Machine Learning for Absolute Beginners: A Simple, Concise & Complete Introduction to Supervised and Unsupervised Learning Algorithms",Kindle