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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

Course Code: 23AM5PCINN **Max Marks: 100**

Course: Introduction to Neural Network

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			CO	*PO*	**Marks**
		UNIT - I			
1	a)	Illustrate the process of building invariances and prior information into the design of neural networks.	*CO1*	*PO1*	**05**
	b)	State Least Mean Square (LMS) algorithm. Derive and determine the stability and rate of convergence condition for LMS algorithm.	*CO2*	*PO2*	**10**
	c)	Illustrate the relationship between inner product and Euclidean distance as measures of similarity between patterns.	*CO1*	*PO1*	**05**
		OR			
2	a)	Derive the perceptron convergence theorem by illustrating the hyperplane as a decision boundary in the context of a two-class pattern classification problem.	*CO2*	*PO2*	**10**
	b)	With suitable diagram describe any twoactivation function used in neural networks.	*CO1*	*PO1*	**04**
	c)	Illustrate three architectures of neural network.	*CO1*	*PO1*	**06**
		UNIT - II			
3	a)	Describe the heuristics required to significantly improve the performance of the back-propagation algorithm.	*CO2*	*PO1*	**08**
	b)	Illustrate the two fundamental signal flows in a fully connected graph of multilayer perceptron.	*CO2*	*PO1*	**06**
	c)	Outline the role of Hessian in Online Learning.	*CO2*	*PO1*	**06**
		OR			
4	a)	Formulate the back-propagation procedure in a multilayer feed forward neural network to determine the local gradients at hidden and output layers.	*CO1*	*PO2*	**10**
	b)	Describe annealing the learning rate in on-line learning and its impact on convergence to the optimal parameter in multilayer perceptron.	*CO1*	*PO2*	**06**
	c)	Differentiate between online and batch learning.	*CO1*	*PO2*	**04**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - III			
	5	a)	Illustrate complexity regularization and network pruning in designing a multilayer perceptron.	*CO3*	*PO3*	**08**
		b)	i. Explain curse of dimensionality, and its implications in high dimensional data analysis. ii. Describe two strategies to mitigate the challenges posed by the curse of dimensionality.	*CO3*	*PO1*	**06**
		c)	Explain how generalization occurs in a nonlinear hypothetical network to produce correct input–output mapping.	*CO2*	*PO1*	**06**
			OR			
	6	a)	Illustrate the formulation of supervised learning in multilayer perceptron's as a problem of numerical optimization.	*CO3*	*PO1*	**08**
		b)	Describe the multifold method of cross-validation to improve the performance of a model.	*CO3*	*PO1*	**06**
		c)	Explain replicator mapping in a multilayer perceptron and its use in data compression.	*CO2*	*PO1*	**06**
			UNIT - IV			
	7	a)	Derive the recursive least squares estimation of the weight vector for radial basis function networks.	*CO3*	*PO3*	**08**
		b)	Design a pattern classifier using an appropriate Radial Basis Function (RBF) network to solve the XOR problem, where the input patterns (1,1) and (0,0) yield an output of '0', and the patterns (0,1) and (1,0) yield an output of '1'.	*CO2*	*PO2*	**06**
		c)	State and derive Cover's theorem on the separability of patterns	*CO2*	*PO2*	**06**
			OR			
	8	a)	Elaborate the procedure that combines k-means clustering and recursive least square algorithm for training RBF network.	*CO3*	*PO1*	**10**
		b)	Illustrate the interpolation problem by considering network representation that maps from the higher-dimensional input space to single-dimensional output space.	*CO3*	*PO3*	**06**
		c)	Describe the structure of a Radial Basis Function Networks with necessary equations.	*CO1*	*PO1*	**04**
			UNIT - V			
	9	a)	i. Illustrate the three essential processes involved in the formation of the self-organizing map. ii. Briefly describe how each of these components is implemented using mathematical equations.	*CO3*	*PO3*	**08**
		b)	Illustrate with mathematical equations, relationship between the Kernel Self-Organizing Map (SOM) and the Kullback–Leibler Divergence (KLD)	*CO3*	*PO1*	**08**
		c)	Explain contextual maps and hierarchical vector quantization.	*CO1*	*PO1*	**04**
			OR			

	10	a)	Illustrate how Kohonen network be used to compress data with minimum loss of information.	*CO3*	*PO2*	**08**
		b)	Discuss density matching and feature selection properties of SOM algorithm.	*CO3*	*PO1*	**08**
		c)	Differentiate between Kohonen model and Willshaw–von der Malsburg's model.	*CO1*	*PO1*	**04**

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