	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Bachelor of Technology in Electronics and Communication Engineering**	Year of Regulation	**2018 – 19**
Department	**Electronics and Communication Engineering**	Semester	**VI**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 310	**Artificial Neural Networks and Applications**	**3**	**1**	**0**	**4**	**50**	**50**	**100**	**200**

Course Objectives	To introduce the neural networks for classification and regression	Course Outcomes	CO1	Able to understand the differences between networks for supervised and unsupervised learning
	To give design methodologies for artificial neural networks		CO2	Able to design single and multi-layer feed-forward neural networks
	To demonstrate neural network applications on real-world tasks		CO3	Able to design radial basis function networks and support vector machines for signal processing applications.
			CO4	Able to apply PCA in the reduction of the feature vector dimension and also develop self organizing maps for real world applications.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**-**
2	CO2	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**	**-**
3	CO3	**-**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**
4	CO4	**-**	**2**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**

SYLLABUS

No.	Content	Hours	Cos
I	Introduction: Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, Types of learning, Supervised, Unsupervised, Reinforcement learning, knowledge representation and acquisition Learning Process: Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.	**10**	**CO1**
II	Single Layer Perceptrons: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception –convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment. Multilayer Perceptrons: Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection, Back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, accelerated convergence, supervised learning.	**12**	**CO2**
III	Radial-Basis Function Networks: Cover's theorem on the separability of patterns, separability and interpolation, Posed surface reconstruction, Solution of regularization equation: Greens function, Use of Greens function in regularization networks, Regularization networks and generalized RBF. Support Vector Machines: Optimal hyperplane for linearly separable patterns, Optimal hyperplane for nonseparable patterns, How to build a support vector machine for pattern recognition, Support vector machines for nonlinear regression.	**12**	**CO3**
IV	Principal Components Analysis: Some intuitive principles of self organization, Principal components analysis, Hebbian-based principal components analysis, Dimensionality reduction using PCA. Self-Organizing Maps: Basic feature mapping models, Self-organizing map, Learning vector quantization, Hierarchical vector quantization.	**10**	**CO4**
	Total Hours	**44**	

Essential Readings

1. S. Haykin, "Neural networks and Learning Machines", Pearson Education, 3rd Edition, 2013.

Supplementary Readings

1. B.Vegnanarayana, "Artificial neural networks", Prentice Halll of India, 1998.
2. Li Min Fu, "Neural networks in Computer intelligence", McGraw Hill Education, 1st Edition, 2003.
3. James A. Freeman and David M. Skapura, "Neural Networks: Algorithms, Applications, and Programming Techniques", Addison-Wesley, 1991.