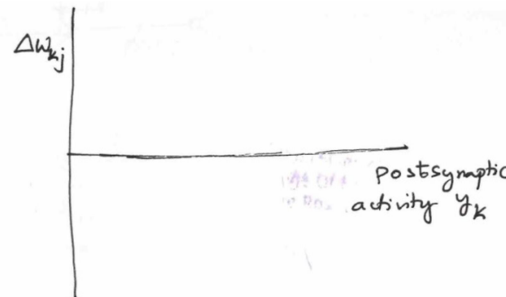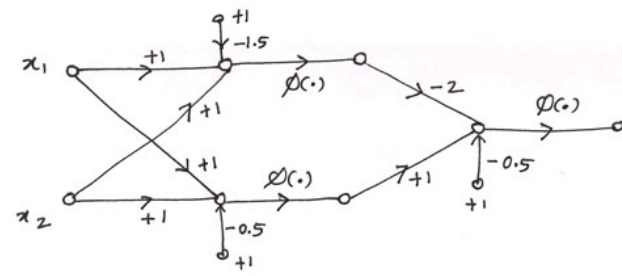USN

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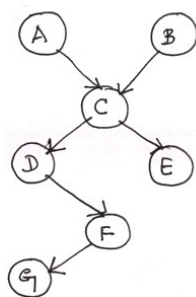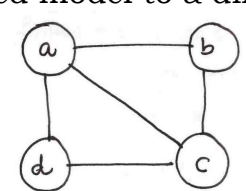## Computer Science and Engineering
ARTIFICIAL NEURAL NETWORKS (ELECTIVE)

Time: 03 Hours   *Maximum Marks: 100*

Instructions to candidates:
  1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
  2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	The function which is used to limit the amplitude of the output of a neuron is called as _____.	01
	1.2	Give the definition of sigmoid function	01
	1.3	According to the delta rule, the adjustment $\Delta\omega_{kj}(n)$ applied to the synaptic weight w_{kj} at time step n is defined by _____.	01
	1.4	Complete the following partial illustration of Hebb's hypothesis and the covariance hypothesis.	02
	1.5	Give any one application which can be solved using supervised learning.	01
	1.6	In a learning model, if the system observes a temporal sequence of stimuli received from the environment, which results in generation of the heuristic reinforcement signal is called as _____.	01
	1.7	Given the memory matrix $M = \sum_{h=1}^{q} w(k)$. Give the definition of $w(k)$	01
	1.8	Give the significance of wiener filter	01
	1.9	With respect to weights updation, differentiate sequential mode and batch mode of training in back-propagation method.	01
	1.10	Write the purpose of the following signal flow graph.	01

1.11	Give an illustration for the given original set of data points, the effects of mean removal decorrelation and covariance equalization.	01
1.12	Given the significance of implementing sparse interactions by making use of smaller kernels in CNN.	01
1.13	Max pooling introduces invariance illustrate.	02
1.14	Define "explaining away" effects, and give an example.	02
1.15	Give the following Bayes network. Answer the following using d-separation a) Are D and E conditionally independent, given A & B? b) Are A and B conditionally independent, given C?	02
1.16	Convert the given undirected model to a directed model.	01

PART-B

2	a	Explain a nonlinear model of a neuron, with required block diagram basic elements, required mathematical equations and types of activation functions.	08
	b	Answer the following with respect to learning models: i) Competitive learning versus Hebb's learning over outputs neuron activation. ii) Learning rule of competitive learning and Hebb's learning.	08
3	a	Write the block diagram of learning with a teacher and discuss	04
	b	Explain any two types of learning tasks that makes use of the neural networks.	06
	c	With respect to memory answer the following: i) Characteristics of associative memory ii) Derivation of memory matrix M iii) Memory recall process.	06

OR

4	a	Derive the equation for $w(n+1)$ in Newton's method and least-mean-square algorithm	06

	b	Discuss the following with respect to *LMS* algorithm:
		  i) Learning curves significance
		  ii) Learning rate annealing schedules.
			06

	c	Write signal-flow graph of the perceptron, and algorithm for weights adaption in elementary perceptron.	04
5	a	Write signal-flow graph detailing the output neuron '*j*' in Multilayer perceptron, and derive the equation for $\Delta w_{ji}(n)$ and $\delta_j(n)$	08

	b	Discuss the following two methods used to improve the performance of back propagation algorithm
		  i) Maximizing information content
		  ii) Activation function.
			08

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OR

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6	a	Write signal-flow graph highlighting the details of output neuron '*k*' connected to hidden neuron '*j*', and derive the back propagation formula.	08
	b	By considering any one application areas, demonstrate the use of multilayer perceptron models to solve a problem under consideration.	08
7	a	Define convolution operation, discuss briefly those three important ideas that *CNN* leverages to improve a *ML* system.	08
	b	Write the block diagram depicting a typical convolutional neural networks layer, and discuss the working of pooling.	04
	c	By considering image –processing domain, propose a problem statement and briefly a process to solve using *CNN*.	04
8	a	Discuss the process used to create undirected models or Markov networks. Illustrate the same with suitable example.	06

	b	Explain the following:
		  i) Separation and *D*-separation
		  ii) Converting directed models to undirected.
			06

	c	"Directed models are space-efficient compared to undirected models" comment.	04