

(Time: $2\frac{1}{2}$ hours)

[Total Marks: 60]

- N. B.: (1) All questions are compulsory.
(2) Make suitable assumptions wherever necessary and state the assumptions made.
(3) Answers to the same question must be written together.
(4) Numbers to the right indicate marks.
(5) Draw neat labeled diagrams wherever necessary.
(6) Use of Non-programmable calculator is allowed.

1. Attempt any two of the following: 12
 - a. Write a short note on scalars, vectors, matrices and tensors.
 - b. Write a short note on gradient based optimization.
 - c. State and explain poor conditioning in numerical computation.
 - d. Write a short note on Eigen decomposition in linear algebra.

2. Attempt any two of the following: 12
 - a. Write a short not on dataset augmentation.
 - b. State and explain AdaGrad algorithm for adaptive learning rates.
 - c. Write a short note on hidden units. Also explain logistic sigmoid and hyperbolic tangent.
 - d. Write a short note on stochastic gradient descent.

3. Attempt any two of the following: 12
 - a. Write a short note on convolutional networks and convolution operation.
 - b. What are leaky units? Explain the strategies for multiple time scale.
 - c. What is a deep recurrent network?
 - d. Write a short note on neural language model.

4. Attempt any two of the following: 12
 - a. Write a short note on denoising autoencoders.
 - b. Write a short note on independent component analysis.
 - c. State and explain the list of generic regularization strategies for representation learning.
 - d. Write a short note of transfer learning and domain adaptation.

5. Attempt any two of the following: 12
 - a. Write a short note on convolutional Boltzmann machines.
 - b. Explain the concept of deep belief networks (DBNs).
 - c. State and explain learned approximate inference.
 - d. Write short note on MAP inference and sparse coding.