M.Phil. Computer Science

Programme-Specific Objectives

- To provide a strong foundation in the Mathematics and Science of computing that is relevant for pursuing research in Computer Science.

- To power research in interesting, contemporary and high-impact research areas.

- To motivate research scholars towards inter-disciplinary research so that their research output may have a larger set of beneficiaries.

Course Objectives and Outcomes

Semester I / Year I

MPhlCS1a: Research Methodology

OBJECTIVES:

1. To understand the basic concepts in research methodology.
2. To learn the different research design principles and methods.
3. To understand the concepts of measurement and scaling techniques in research.
4. To understand data collection and processing methods.
5. To create a research report.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Explain the importance, characteristics and types of research.
2. Understand how to select and define a research problem.
3. Explain the features of a good research design and the different methods involved in creating a good design.
4. Understand the concept of sampling and explain various types of sampling.
5. Explain the basic concepts of measurement and different measurement tools.
6. Explain the different methods involved in data collection and processing.
7. Describe the various ways by which analysed data is communicated/displayed.
8. Learn how to create a research report.

MPhlCS2: Theoretical Foundations for Computer Science

OBJECTIVES:
1. To simplify Boolean functions using Karnaugh Map.
2. To learn to design combinational circuits and sequential circuits.
3. To learn tree and graph data structures and sorting algorithms.
4. To learn various algorithmic design strategies and write algorithms for specific problems using one of the given design strategies.
5. To learn the different normal forms for normalizing a database and write basic SQL queries.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Simplify Boolean expressions using Karnaugh map.
2. Design combinational circuits.
3. Explain the basic types and circuitry of flip-flops.
4. Explain the design of asynchronous and synchronous counters.

5. Given a binary tree, traverse the tree using the traversal algorithms learnt.
6. Given a graph, traverse the graph using the traversal algorithms learnt.
7. Given a graph, generate the minimum cost spanning tree using the algorithms learnt.
8. Explain specific sorting algorithms.
9. Understand the algorithmic design strategies of Divide-and-Conquer, Greedy, back tracking, Dynamic Programming, branch and bound and know how these strategies are applied to solve the given specific problems.
10. Understand different normal forms and normalize simple databases.
11. Write simple SQL queries.

Elective 1 – MPhlCSPT: Pattern Recognition

OBJECTIVES:
1. To understand the concept of features and classifiers in pattern recognition.
2. To learn linear and non-linear classifiers.
3. To learn feature selection and generation techniques.
4. To learn the concept of clustering and different clustering algorithms.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain the concepts of feature, feature vector and classifiers.
2. Understand the different types of learning.
3. Understand Bayes decision theory and explain Bayes classifier.
4. Explain the concepts and algorithms of linear and non-linear classifiers.
5. Explain the concepts and algorithms used for context dependent classification.
6. Explain the concepts and methods used for feature selection and feature generation.
7. Understand learning methods with the given case-study.
8. Understand the concept of clustering and its types.
9. Explain sequential and Hierarchical clustering algorithms.
10. Explain how clustering done based on function optimization and graph theory.

Elective 2 - MPhlCSIP: Digital Image Processing

OBJECTIVES:

1. To gain knowledge of the various characteristics and aspects of digital images.
2. To learn to apply spatial and frequency filters for intensity and image enhancements.
3. To learn the methods of image compression and restoration.
4. To learn the basics of colour image processing.

OUTCOMES:

Upon completion of the course, the student will be able to
1. Understand the fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Explain the basics of colour image processing.
3. Understand simple image enhancement techniques in spatial and frequency domains.
4. Understand the concept of filters.
5. Explain image compression and restoration techniques.

Elective 3 – MPhlCSLP: Natural Language Processing

OBJECTIVES:

1. To learn the basic concepts of natural language processing and the associated mathematical concepts.
2. To learn the concept of parsing of context-free grammars with respect to English.
3. To learn lexical, syntactic and semantic processing concepts for English language processing.

4. To understand the complexities and methods of word sense disambiguation.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand language models and algorithms.
2. Understand the use of automata in English language parsing.
3. Learn the various classes of words and parts of speech in English and to understand the method of tagging PoS.
4. Learn to represent English as a context-free grammar.
5. Understand how to parse sentences in the lexical, morphological, syntactic and semantic levels.
6. Understand the challenges and solutions in word sense disambiguation.
7. Understand the techniques used for machine translation.

Elective 4 – MPhlCSCN: Cryptography and Network Security

OBJECTIVES:

1. To learn the evolution of cryptographic systems.
2. To understand public key encryption standards, algorithms and protocols.
3. To learn the concepts of message authentication and intrusion detection methods.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand the important role of cryptography in network security.
2. Learn various encryption techniques from classical to modern.
3. Understand the important aspects of number theory used in cryptography.
4. Understand the RSA algorithm and connected protocols.
5. Learn the importance of message authentication and understand the secure hash algorithm.
6. Explain the various authentication protocols.
7. Explain the various intrusion detection mechanisms.

Elective 5 – MPhlCSDM: Data Mining and Data Warehousing

OBJECTIVES:

1. To appreciate the types of problems for which Data Mining is used.
2. To learn how data mining is done, the various issues involved in Data Mining, and how to handle them.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand the concept of data discovery in various types of databases, and the need for data mining.
2. Understanding the various methods of data preprocessing.
3. Understand how to perform data reduction and discretization.
4. Learn the rules and algorithms involved in association rule mining.
5. Understand the issues involved and methods used for classification and prediction.
6. To understand the different methods used for clustering.
7. To understand the concepts of web, spatial and temporal data mining.

Elective 6 – MPhlCSNN: Artificial Neural Networks

OBJECTIVES:

1. To learn the fundamental theory and concepts of neural networks for creating computationally intelligent systems.
2. To understand the architecture, learning algorithms and issues of various feed forward and feed backward neural networks.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand the need and basic concepts of neural networks.
2. Describe the various neural computational models.
3. Understand supervised and unsupervised learning methods.
4. Understand how to train a neural nework.
5. Explain the architecture of feed-forward and feed-backward neural networks.
6. Find the output of a neural network using various methods, given the inputs, input weights and learning rule.
7. Describe the different neural network models.
8. Understand the basic concepts of pattern recognition using neural networks.

Elective 7 - MPhlCSPP: Distributed Parallel Processing

OBJECTIVES:

1. To understand the different parallel processor architectures and interconnecting networks.
2. To understand how to design parallel algorithms and languages.
3. To understand the concepts of distributed systems.

OUTCOMES:
Upon completion of the course, the student will be able to

1. Explain the various parallel processor architectures.
2. Explain the different types of interconnection networks.
3. Understand the design of parallel algorithms.
4. Explain the features and constructs of parallel languages.
5. Explain the various concepts and models of distributed systems with specific case study.
6. Understand the design and implementation of distributed file system.

Elective 8 - MPhlCSGI: Geographic Information Systems

OBJECTIVES:

1. To understand the basic principles and techniques of geographic information systems.

OUTCOMES:
Upon completion of the course, the student will be able to

1. Understand the basic concepts and applications of geographic information systems.
2. Explain the important principles of geographic information systems.
3. Understand geographic data modeling.
4. Explain the methods used for analysis of GIS.
5. Understand the policies and management aspects involved with GIS.

Elective 9 - MPhlCSCI: Human Computer Interaction

OBJECTIVES:
1. To gain an understanding of the concepts relating to the design of human-computer interfaces.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Understand how the field of HCI evolved.
2. Learn the software engineering concepts required for interactive system design.
3. Understand the different types of models & laws required for design and evaluation.
4. Learn the various rules and principles, which serve as guidelines for HCI.
5. Explain the empirical research methods and task models used for HCI.
6. Understand dialog design using FSMs, State charts and Petri Nets.
7. Understand the design of HCI using specific case studies.

Semester II / Year II

MPhlCSPR: Project Dissertation

OBJECTIVES:

1. To gain real-time experience in software project development in a production environment.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand how to execute a software project from scratch to delivery and deployment.

2. Understand the various processes involved in the engineering of software through practical implementation.

3. Understand how to develop a software solution for the given large problem.

4. Write a project report that incorporates all the stages of software engineering and processes involved in the project.

MPhlCSPV: Project Viva-Voce

OBJECTIVES:

1. To learn to present project work done.

OUTCOMES:

Upon completion of the course, the student will be able to

1. Understand how to make an effective presentation of the project work.

2. Explain the project work and answer technical questions on the work done.