1. OBJECTIVES OF THE PROGRAM

This M.Phil programme in Computer Science, aims at exposing the students to the area of Machine Intelligence and its applications in other research areas of Computer Science and to introduce the research methodology in Computer Science.

The major Objectives are:

- To provide an understanding of principles and methods in research activities.
- To identify critical and relevant research problems in Computer Science.
- To select the appropriate methods/techniques to solve an identified problem.
- To model, implement and analyze the methodology developed for the solution.
- To provide a comprehensive understanding of techniques and algorithms in the areas of Machine Intelligence.
- To introduce another research area of Computer Science from among Information Security, Information Theory and Coding, Medical Image Processing, and Big Data Analytics.
- To provide an exposure to identify, analyze and criticize relevant research literature
- To understand the best practices and methods in scientific writing and publishing
- To motivate and inspire the students to pursue their doctoral programmes.

2. Programme Structure

The M.Phil will be a (12 month) regular full-time programme. Students are integrated into the research culture of the Department. Students are guided by the respective guides and motivate them to undergo further research.

The degree is awarded following the successful completion of a period of research which includes the submission of a thesis, and its subsequent oral examination, together with a series of Departmental reports and seminars. The thesis is expected to display a comprehensive particular knowledge of some part or aspect of the field of study, and to make some original contribution to knowledge or understanding.

Admission Eligibility Criteria

A Masters Degree with 60% aggregate marks (OR CGPA of above 6.5 on a 10point scale or equivalent) in Computer Science/Computer Applications/Information Technology or an equivalent degree recognised by the University.

Admission process will be as per the rules and regulations of the University.

Number of Seats

Depending on the number of eligible Faculty with a Faculty: Student ratio 1:2

Duration

One year with two Semesters

Evaluation

The examinations for the three theory papers will be conducted at the end of Semester I and the evaluation of the Dissertation and the Viva-Voce will be conducted at the end of Semester II.

Theory Papers

All the theory papers should have Continuous Assessment (CA) for 40 marks and End Semester Assessment (ESA) for 60 marks.
A maximum of 40 marks can be awarded for CA as per the criteria given below.
Attendance - 5
Mid Semester Examination – 15
Assignment – 10
Seminar/Lab assignments/viva – 10

*Dissertation*

In the case of Dissertation, 120 marks will be awarded by the respective supervising teacher on the basis of following criteria.


The remaining 180 marks will be awarded through the assessment done by the panel of teachers in the department on the basis of following criteria.

Presentation of work - 90, Publications – 30, Report – 60

Viva –Voce examination (for 100 marks) will be conducted by a panel of examiners in which there will be one or more external examiners and one or more teachers from the Department including the respective guide.

*Grading of results*

Based on the overall performance in the examinations, grades will be assigned as per the following scheme.
Grade A - 60% and above
Grade B - 50% and above but below 60%
Failure - Below 50%

5. **Scheme and Syllabus**

There shall be three theory papers out of which papers I and II shall be common papers to all the candidates and paper III shall be an elective paper in the specific area in which dissertation is done.

**Scheme of the programme**

<table>
<thead>
<tr>
<th>Semester –I</th>
<th>Evaluation</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>CA</td>
</tr>
<tr>
<td>COS711 Research Methodology</td>
<td>40</td>
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<tr>
<td>COS712 Machine Intelligence</td>
<td>40</td>
</tr>
<tr>
<td>COS70xx Elective</td>
<td>40</td>
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<td>Semester Total</td>
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<table>
<thead>
<tr>
<th>Semester –II</th>
<th>Evaluation of Dissertation - 300</th>
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</thead>
<tbody>
<tr>
<td>COS713 Dissertation &amp; Viva Voce</td>
<td>Viva Voce - 100</td>
</tr>
<tr>
<td>Semester Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>400</td>
</tr>
</tbody>
</table>

| Total                      | 700                               |
List of Electives:

1. COS701 BigData Analytics
2. COS702 Information Security
3. COS703 Information Theory and Coding
4. COS704 Medical Image Processing

DETAILED SYLLABUS

COS711 Research Methodology

Module - I


Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Module - II


Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection – Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation.

Module - III


Application of results and ethics - Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

Text Books:


Reference:


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**COS712 Machine Intelligence**

**Module - I**

*Introduction to knowledge engineering and Machine intelligence* – knowledge, challenges in knowledge computing, intelligent systems, scope and applications of machine intelligence;

*Machine Learning* – Introduction, Input, Feedback and types of learning methods;

*Supervised Learning* - Rule induction & Decision trees, classifiers and its Evaluation-Accuracy, precision and recall, F1-value, ROC curve, Scoring and ranking; Support Vector Machines and Kernels;

**Module - II**

*Unsupervised Learning* - Principal components analysis, *Self-organizing maps*;

*Reinforcement Learning* –Introduction and applications, Q learning, Monte Carlo Methods for evaluation;

*Artificial Neural Networks* – Introduction, Neuron model, Single layer, Multi layer feed forward network, Learning algorithm, Back propagation network.

**Module - III**

*Fuzzy Logic* - Fuzzy sets, Membership function – interference in fuzzy logic, Introduction to neuro fuzzy systems.

*Genetic Algorithms* - binary and real representation schemes, selection methods, crossover and mutation operators for binary and real coding.

Introduction to Swarm Intelligence and Ant-colony optimization techniques

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**Text Books:**

- N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press.

**Reference:**


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**Electives**

**COS701 BigData Analytics**

**Module - I**

Introduction: Fundamentals of data mining, Data Mining Functionalities, Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture. Methods for Data Cube Computation, Associations and Correlations: Efficient and Scalable Frequent Item set Mining Methods, Mining Various
Kinds of Association Rules, Introduction to Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification Based on Concepts from Association Rule Mining.

Module - II

*Introduction to BigData* – Challenges of Conventional Systems, Evolution of Analytic Scalability, Analytic Processes and Tools;

*Stream Data* – Stream Data Model and Architecture, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Real time Analytics Platform (RTAP) Applications, Case study on Stock Market Predictions.

*Frequent Itemsets and Clustering* – Mining Frequent Itemsets, Market Based Model, Apriori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithm, Counting Frequent Itemsets in a Stream, Clustering High Dimensional Data, CLIQUE and PROCLUS, Clustering for Streams and Parallelism.

Module - III

*Frameworks* – MapReduce, Hadoop, Hive, MapR, NoSQL Databases, Hadoop Distributed File Systems, Approaches to modeling in Analytics, Intelligence from unstructured information, Text analytics, Industry challenges and application of Analytics

Text Books:

- Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques”, Morgan Kaufmann, 2nd Ed., 2005.

Reference:

- C. Bishop, Pattern Recognition and Machine Learning, Springer 2007

COS702 Information Security

Module - I


Module - II


Module - III


Text Books:


Reference:


COS703 Information Theory and Coding

Module - I:

Introduction: Compression Techniques, Modeling and Coding, Mathematical Preliminaries for Lossless compression: Information Theory, Models, Coding: Uniquely decodable codes, Prefix codes, Kraft-McMillan Inequality, Huffman Coding: Minimum Variance Huffman Codes, Length of Huffman Codes, Adaptive Huffman Coding, Golomb codes, Rice codes, Tunstall codes, Applications of Huffman Coding. Arithmetic Coding: Coding a sequence, Generating a binary code, Comparison of Huffman and arithmetic coding, Applications.

Module - II:


Module - III:


Text Books:

Reference:


COS706 Medical Image Processing

Module - I


Module II

Medical Image Processing: Introduction to medical imaging, challenges; Medical Image Formation Principles: X-Ray and Computed Tomography(CT) imaging, Basic principles of CT, 2D Image reconstruction-Fourier space and filtered back projection methods, Iterative reconstruction, 3D reconstruction basics; Imaging Modalities, mathematical principles, applications.

Medical Image Storage: Archiving and Communication Systems and Formats Picture archiving and communication system (PACS), Formats - DICOM, Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Visualization: Fundamentals of visualization, different generations of visualization techniques, surface and volume rendering/visualization.

Module III

Medical Image Segmentation: Histogram-based methods, Region growing, watersheds, Multispectral Techniques, Segmentation by Fuzzy clustering methods and issues, Active Contour models, Segmentation with Neural Networks, Segmentation with deformable models; Medical Image Registration: Introduction, Intensity-based methods, Joint histograms, Information theory measures, cost functions, clinical applications of Image registration; Medical Image Search and Retrieval: Current technology in medical image search, content-based image retrieval, new trends; Applications: Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems.

Text Books:


References:

UNIVERSITY OF KERALA

M. PHIL PROGRAMME IN COMPUTER SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

UNIVERSITY OF KERALA

SCHEME AND SYLLABUS

Department of Computer Sciences
University of Kerala Kariavattom
Thiruvananthapuram
2016