Program

Master of Philosophy
Computer Science

(Revised with effect from 2016-2017 AY onwards)

Faculty of Sciences
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Programme Outcomes

PO1: Develop scholars into mature researchers, able to make original scientific contributions that have both practical significance and a rigorous, elegant theoretical grounding that underpins the various areas of Computer Science and IT.

PO2: To impart sound knowledge in Computer Science and interdisciplinary areas with Science, Technology and Management related to Information Systems and their applications in relevant fields with the latest technologies. Build a pool of technically and scientifically qualified manpower to build a strong scientific community.

PO3: Motivate and orient youngsters to do research with proper baseline.

PO4: Develop professionals and teachers with strong analytical and synthesizing capability with innovative and creative thinking that can instill to student community to develop a strong Scientific community.
Programme Specific Outcomes

**PSO1.** Identify, analyze, and synthesize scholarly literature relating to the field of computer science

**PSO2.** Write about and orally communicate technical material about computer science and computer systems

**PSO3.** Understand how technological advances impact society and the social, legal, ethical and cultural ramifications of computer technology and their usage.
Evaluation Scheme and Grading System

1.3 All M.Phil. students must complete 12 credits of course work which includes 4 credits on Research Methodology; 8 credits in the domain of research; a one-credit course on Amrita Values Programme, followed by a Thesis and Viva-voce, carrying 17 credits.

The courses (excluding Thesis and Viva-voce) shall be graded as follows;

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>10.00</td>
<td>Outstanding</td>
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<tr>
<td>A+</td>
<td>09.50</td>
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<td>A</td>
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<td>FA</td>
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<tr>
<td>I</td>
<td></td>
<td>Incomplete (awarded only for Lab. courses / Internship, etc)</td>
</tr>
<tr>
<td>W</td>
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2.3.5 Thesis Submission and Evaluation

After the thesis synopsis is approved, the M.Phil. scholar can submit thesis within two weeks from the date of Synopsis submission.

The thesis adviser shall nominate four experts to evaluate the thesis. The Head of the institution can choose anyone from the given list. The Thesis Advisor and Co-Advisor are also invited to provide a formal evaluation of the thesis. All examiners will be given three weeks to provide their evaluation. Each examiner can give one of three recommendations: (i) Accept, (ii) Accept with Modifications, or (iii) Reject. If neither of the external examiners recommends a Reject, the candidate is permitted to proceed to the Viva Voce. If both external examiners recommend a Reject, the thesis is rejected and the candidate is required to leave the M.Phil. Programme. If only one of the examiners recommends a Reject, the thesis is sent to a third external examiner whose evaluation decides whether or not the
candidate is permitted to proceed with the Viva Voce. Prior to the Viva Voce, the candidate must submit a revised Thesis taking into account the comments and suggestions made by all examiners.

2.3.6 Viva Voce

The M.Phil. Thesis Committee consists of the M.Phil. Committee and at least one of the external experts who evaluated the thesis. The Convener of the M.Phil. Committee serves as the Convener of this Committee. If none of the external examiners can be present, the Head of the Institution can nominate a substitute examiner.

The Convener forwards the consolidated recommendation to the PGP Chair who forwards the same to the PGP Dean. The PGP Dean forwards the final recommendation to the Vice-Chancellor for his approval. After the Vice-Chancellor’s approval, the PGP Dean issues the Provisional Certificate.
Curriculum Structure

M.Phil. in Computer Science (2 Semesters - 1 year)

Curriculum and Credit Distribution

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Semester I</td>
<td></td>
</tr>
<tr>
<td>15CSA701</td>
<td>Research Methodology</td>
<td>4</td>
</tr>
<tr>
<td>15CSA702</td>
<td>Advanced Computing Techniques</td>
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<tr>
<td>15AVP501</td>
<td>Amrita Values Programme</td>
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<tr>
<td></td>
<td>Semester II</td>
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<td></td>
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</table>

List of Electives

<table>
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<th>Title</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>15CSA731</td>
<td>Cloud Computing Techniques</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA732</td>
<td>Data Analytics</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA733</td>
<td>Mobile and Wireless Technologies</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA734</td>
<td>Science Communication Techniques</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA735</td>
<td>Soft Computing Techniques</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA736</td>
<td>System and Network Security</td>
<td>3 0 2 4</td>
</tr>
<tr>
<td>15CSA737</td>
<td>Visual Communication</td>
<td>3 0 2 4</td>
</tr>
</tbody>
</table>
Course Objectives, Course Outcomes, Syllabus

SEMESTER I

Research Methodology 3-1-0-4

Course Description: The research methodology module is intended to assist students in planning and carrying out research projects. The students are exposed to the principles, procedures and techniques of implementing a research project. The course starts with an introduction to research and carries through the various methodologies involved. It continues with finding out the literature using computer technology and ends with knowing the tools used for data analysis in various systematical way, and writing the report, paper using LaTeX s/w.

Course Outcomes

| CO1 | Define research and describe the research process and research methods |
| CO2 | Understand and apply basic research methods including research design, data analysis, and interpretation. |
| CO3 | Student will be able to perform literature review effectively |
| CO4 | Learn various tools and methods to perform quantitative data analysis |
| CO5 | Students will be able to use LaTeX and Berner to write research publications |

Unit 1
Introduction - meaning of research - objectives of research - motivation in research - types of research - research approaches - significance of research - research methods versus methodology - research and scientific method - importance of knowing how research is done - research processes - criteria of good research - defining research problem - selecting the problem - necessity of defining the problem - techniques involved in defining a problem - research design - meaning of research design - need for research design - features of good design - different research designs - basic principles of experimental design.

Unit 2
Resources for research - research skills – time management - role of supervisor and scholar - interaction with subject experts. Thesis Writing: The preliminary pages and the introduction - the literature review - methodology - the data analysis - the conclusions - the references (IEEE format).

Unit 3

Unit 4
Tools in Research: Introduction of analytical tools – Introduction to data analysis – least squares fitting of linear data and non-linear data - exponential type data - logarithmic type data - power function data and polynomials of different orders - plotting and fitting of linear, Non-linear, Gaussian, Polynomial, and

Unit 5
LaTeX and Beamer: Writing scientific report - structure and components of research report - revision and refining’ - writing project proposal - paper writing for international journals, submitting to editors - conference presentation – preparation of effective slides, pictures, graphs - citation styles.

Text Books

Reference Books

Evaluation Pattern: 1.3

ADVANCED COMPUTING TECHNIQUES 3 – 1 – 0 – 4

Course Description
This paper gives insights into the fundamental and emerging technologies in Computer Science.

Course Outcomes

| CO1 | Learn the concepts of advanced operating system |
| CO2 | Understand the concepts, use and management of modern database systems |
| CO3 | Give knowledge about various security threats and prevention methods |
| CO4 | Provides understanding on machine learning techniques |
| CO5 | Gives insight to emerging technologies, new research areas and open problems |
Unit 1
**Advanced Operating Systems:** Virtual memory management, Synchronization and communication, Distributed Operating System.

Unit 2
**Advanced Database Systems:** Overview of emerging database applications and challenges- Mobile Data Management, Geographic Information System, Biological and Genomic Databases, Spatial Databases, Multimedia Databases, Distributed Databases.

Unit 3

Unit 4

Unit 5

* Subjected to change based on recent trends.

**Text Books:**

**Recommended Reading**

**Evaluation Pattern:** 1.3
Course Objectives
The module aims to develop an understanding of the processes and skills required to undertake a supervised research project at masters level of study, and to write this up as your dissertation. The dissertation is the assessment for this module.

The module objectives are

- develop research skills commensurate with the accomplishment of a masters degree
- develop skills in independent inquiry
- produce a coherent and logically argued piece of writing that demonstrates competence in research and the ability to operate independently
- address issues of research design, methodology, ethics and theoretical arguments, and apply these to your own research

Course Outcomes

| CO1 | Identify/define problems and Generate questions and/or hypotheses |
| CO2 | Review and summarize the literature and apply appropriate research methods |
| CO3 | Collect data systematically and conduct research responsibly and ethically |
| CO4 | Evaluate, interpret, and analyze a body of empirical data and evidence and discuss findings in the broader context of the field |
| CO5 | Develop and sustain an evidence-based argument and produce publishable results |

Evaluation Pattern: 2.3.5

Course Objectives
This course is aimed at evaluating the knowledge level of students in various courses.

Course Outcomes

| CO1 | Have a systematic understanding of their field of knowledge, which includes a critical awareness of current problems and/or new insights at the forefront of that field |
| CO2 | Continue to advance their knowledge and understanding, and to develop new skills to a high level |
| CO3 | Improve the verbal defence skills of the scholar |
| CO4 | Determines standards and merits of the thesis |
| CO5 | Proves the originality, credibility and authenticity of the research thesis |

Evaluation Pattern: 2.3.6
ELECTIVES

SCIENCE COMMUNICATION TECHNIQUES

Course Objective
This course is for those who want to train as professional science communicators. Academic components provide a broad overview of the professional science communication landscape. The course includes print journalism, new media work, broadcast television or radio production and presentation.

Course Outcomes

<table>
<thead>
<tr>
<th>CO1</th>
<th>Understand the history of science communication</th>
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</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Give the students the need and importance of science communication, and various sources of scientific communications</td>
</tr>
<tr>
<td>CO3</td>
<td>Able to design an develop effective science communication using moden tools</td>
</tr>
<tr>
<td>CO4</td>
<td>Learn various science tecasting technologies</td>
</tr>
<tr>
<td>CO5</td>
<td>Students will be able to modern medias, social media and blogs for science broadcasting</td>
</tr>
</tbody>
</table>

Unit 1
Science Communication- an introduction- Professional scientific communication - History of science and technology communication theory, laws and ethics

Unit 2
Need for science communication - Importance and use of science communication, Sources of scientific information – books, scientific reports, scientific journals, magazines, feature syndicates, leaflets, tabloids, wall magazines, speeches, seminars, press releases, databases, encyclopedias on science, etc - Comparative study of science sections and supplements carried in Indian / foreign newspapers and science magazines.

Unit 3

Unit 4

Unit 5
Science Broadcasting- New Media and Science Communication- Internet- Blogs- Alternative Media and Science Communication

Text
- Anthony Wilson, “Handbook of Science Communication”, IOP
- Kahlor, LeeAnn, Communicating Science, Routledge Publishers
References

- Dubas O and Martel L, “Media Impact. A Research Study on Science Communication

Evaluation Pattern: 1.3

DATA ANALYTICS 3-0-2-4

Prerequisites

This course requires that you are familiar with high-school level linear algebra, and calculus. Knowledge of probability theory, statistics, and programming is desirable.

Course Objectives

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Course Outcomes

<table>
<thead>
<tr>
<th>CO1</th>
<th>Understanding various types of data and preprocessing techniques</th>
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</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Basic understanding of descriptive and inferential statistics</td>
</tr>
<tr>
<td>CO3</td>
<td>Comprehend the concepts of supervised and unsupervised learning techniques</td>
</tr>
<tr>
<td>CO4</td>
<td>Learn the fundamental concepts of various supervised learning methodologies</td>
</tr>
<tr>
<td>CO5</td>
<td>Understanding the concepts of Unsupervised Learning and Challenges for Big Data Analytics</td>
</tr>
</tbody>
</table>

Unit 1

Introduction to data analytics (DA), data preparation, data cleaning. Data types and measures of similarity, Data Preprocessing and numerosity reduction, Data Governance

Unit 2

Descriptive Statistics, Probability Distributions, Inferential Statistics through hypothesis tests, Permutation & Randomization Test, Regression, ANOVA (Analysis of Variance)

Unit 4
Supervised Learning with Regression and Classification techniques -1: Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines.

Supervised Learning with Regression and Classification techniques -2: Ensemble Methods: Random Forest, Neural Networks, Deep learning

Unit 5
Unsupervised Learning and Challenges for Big Data Analytics : Clustering, Associative Rule Mining, Challenges for big data analytics.

Prescriptive analytics: Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning. (R, Weka or any tool)

References

Evaluation Pattern: 1.3

VISUAL COMMUNICATION 3-0-2-4

Course Objectives
This course acquaints underestudies with correspondence in an imaginative and creative viewpoint through visual symbolism and media. Students will learn the concepts, theories, aesthetics and skills of visual communication, covering visual persuasion, graphic design and so on.

Course Outcomes

| CO1 | Learn the importance of effective communication and the factors affecting communication |
| CO2 | Understand the process of communication in various levels |
| CO3 | Learn the fundamental design elements, its need, role, process and methodologies |
| CO4 | Learn to apply principles of visual and sensory perceptions |
| CO5 | Able to use various tools used for graphic design through various process to effectively deliver an idea |

Unit 1
Necessity and importance of Human and Visual Communication, Communication as expression, skill and process, Understanding Communication: SMRC-Model

Unit 2
Communication as a process- Message, Meaning, Connotation, Denotation Culture/Codes etc ., Levels of communication: Technical, Semantic, and Pragmatic. The semiotic landscape: language and visual communication, narrative representation

Unit 3

Unit 4
Principles of Visual and other Sensory Perceptions - Color psychology and theory (some aspects) Definition, Optical / Visual Illusions Etc Various stages of design process- problem identification, search for solution refinement, analysis, decision making, and implementation.

Unit 5
Basics of Graphic Design - Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual thinking, associative techniques, materials, tools (precision instruments etc.) design execution, and presentation.

References


Evaluation Pattern: 1.3

Course Objectives

Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

Course Outcomes

| CO1 | Basic understanding of AI techniques and soft computing techniques |
| CO2 | Comprehend the concepts of feed forward neural networks |
| CO3 | Implementation of Associative memories by using neural networks |
To have an understanding of the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems

To learn the basic concepts of Evolutionary Computation

Unit 1
Artificial Intelligence – a Brief Review – Pitfalls of Traditional AI – Need for Computational Intelligence – Importance of Tolerance of Imprecision and Uncertainty - Constituent Techniques – Overview of Artificial Neural Networks - Fuzzy Logic - Evolutionary Computation.

Unit 2
Neural Network: Biological and Artificial Neuron, Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron - Multilayer Perceptron – Backpropagation Learning. –

Unit 3
Neural Networks as Associative Memories - Hopfield Networks, Bidirectional Associative Memory. Topologically Organized Neural Networks – Competitive Learning, Kohonen Maps,

Unit 4

Unit 5
Evolutionary Computation - Overview of other Bio-inspired Algorithms - Swarm Intelligence Algorithms

Text books/ References:

Evaluation Pattern: 1.3

CLOUD COMPUTING TECHNIQUES

Course Objectives
Students will learn
● To use Cloud Services.
● To implement Virtualization

Course Outcomes

CO1 Define Cloud Computing and memorize the different Cloud service and deployment models
CO2 Describe importance of virtualization along with their technologies

CO3 Use and Examine different cloud computing services

CO4 Learn platform as a service using Eucalyptus

CO5 Understand service level agreement to manage data stored on cloud

Unit 1
Cloud Computing - Introduction, characteristics, Benefits, challenges and risks, Web 2.0

Unit 2

Unit 3
Cloud Computing Architecture- Service Models – Deployment Models- Infrastructure as a Service

Unit 4
Resource Virtualization-Server-Storage-Network-Platform as a Service- Cloud Platform and Management- Software as a Service- Case Study on Eucalyptus. Service Management in Cloud Computing

Unit 5

Text Books / References:


Evaluation Pattern: 1.3

MOBILE AND WIRELESS TECHNOLOGIES 3-0-2-4

Course Objectives: The purpose of this course is to introduce modern digital mobile and wireless
communication systems.

Course Outcomes

<table>
<thead>
<tr>
<th>CO1</th>
<th>Introduces the students with various 3G and 4G technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>Understand 802.11 wireless architecture</td>
</tr>
<tr>
<td>CO3</td>
<td>Give knowledge about various multi access control protocols</td>
</tr>
<tr>
<td>CO4</td>
<td>Learn to use bluetooth and its working.</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the role of TCP for various wireless applications</td>
</tr>
</tbody>
</table>

Unit 1
GSM –Mobile services , system architecture , Radio interface , protocols, Localization and calling , Handover, security- 27--31 GPRS , HSCDC

Unit 2
Wireless LAN: IEEE 802.11, system architecture- IEEE-802.11

Unit 3
protocol architecture, physical layers, medium access control layers, MAC management 802.11b, 802.11a, Hiper LAN

Unit 4
Bluetooth, Adhoc network, sensor network-Mobile IP, DHCP

Unit 5

Textbook:
1. Mobile Communications by Jochen Schiller, Pearson Education 2nd Edition
2. Wireless communications & Networks by William stallings.

Evaluation Pattern: 1.3

SYSTEM AND NETWORK SECURITY 3-0-2-4

Course Objectives: System and Network Security a study of the security principles and practices of computer and network systems. The students will be able to understand what the foundational theory is behind computer security, what the common threats are, and how to deal with attackers.
Course Outcomes

| CO1 | Student will be able to identify various threats and how to protect from those threats using encryption techniques |
| CO2 | Will be able to use authentication techniques according to the requirements and needs of the user |
| CO3 | Learn various flaws in programming and how to prevent those program flaws |
| CO4 | Study protection provided by operating system how to use it |
| CO5 | Understand security threats in a network, how to prevent it and privacy and ethical issues |

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

TEXTBOOK:

Evaluation Pattern: 1.3