A student who is admitted to M.Phil. Degree program in Amrita University shall undertake course work of minimum of 13 credits, consisting of two courses of four credits and one course of one credit in the first semester and four credits elective paper chosen from the pool of electives offered in the second semester. In order to facilitate a proper evaluation of the student’s progress in terms of research and academic input, the scholar shall present a paper in a seminar in the second semester. To augment the learning gained and the progress made in research, the scholar shall present at least one research paper in a UGC sponsored International seminar or International conference. As a culmination of the program the scholar shall publish a paper in an international journal of repute.

**CURRICULUM**

**Credit distribution**

<table>
<thead>
<tr>
<th>Division</th>
<th>Title</th>
<th>L-T-P</th>
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<tr>
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<td>Research Methodology</td>
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**ELECTIVES (Any One)**

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<td>Data Analytics</td>
<td>3-0-2</td>
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<td>Mobile and Wireless Technologies</td>
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<td>Science Communication Techniques</td>
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<td></td>
<td>Soft Computing Techniques</td>
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<td></td>
<td>System and Network Security</td>
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<tr>
<td></td>
<td>Visual Communication</td>
<td>3-0-2</td>
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</table>
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 Learning Outcome
Define research and describe the research process and research methods; Understand and apply basic research methods including research design, data analysis, and interpretation.

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

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.
18CSA702 ADVANCED COMPUTING TECHNIQUES 3 – 1 – 0 – 4

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

Course Learning Outcome
Creating awareness of the new research arenas and open problems.

Unit 1
Advanced Operating Systems: Virtual memory management, Synchronization and communication, Distributed Operating System.

Unit 2

Unit 3

Unit 4

Unit 5
Subjected to change based on recent trends.

Text Books:

Recommended Reading

SEMESTER II

ELECTIVES

18CSA731 CLOUD COMPUTING TECHNIQUES 3-0-2-4

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:

18CSA732 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.

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
18CSA733    MOBILE AND WIRELESS TECHNOLOGIES  3-0-2-4

Objectives: The purpose of this course is to provide an introduction to modern digital mobile and wireless communication systems.

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

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

18CSA734    SCIENCE COMMUNICATIONTECHNIQUES  3-0-2-4

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.

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

18CSA735 SOFTWARE COMPUTING TECHNIQUES 3-0-2-4

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:**


**18CSA736 SYSTEM AND NETWORK SECURITY 3-0-2-4**

**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.

**Unit 1**

**Unit 2**

**Unit 3**

**Unit 4**

**Unit 5**

**TEXTBOOK:**


**18CSA737 VISUAL COMMUNICATION 3-0-2-4**

**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**