CURRICULUM AND SYLLABI FOR

MASTER OF PHILOSOPHY - COMPUTER SCIENCE

(For the students joining in 2015 - 2016 and afterwards)

**Department of Computer Science and Applications
Gandhigram Rural Institute - Deemed University
Gandhigram - 624 302
Dindigul District
Tamil Nadu**

THE GANDHIGRAM RURAL INSTITUTE – DEEMED UNIVERSITY
(Re-Accredited by NAAC with 'A' Grade)

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

Programme   : **M. Phil. - Computer Science (under CBCS)**

Duration   : **2 Semesters**

No. of Seats : **24**

Eligibility   : **A Pass in M.C.A./ M.Sc. (Computer Science) / M. Sc. (Information Technology) or Equivalent Degree**

Scheme of Examinations

S. No.	Sem.	Course Code	Course Title	Max. Marks			No. of Credits
				CFA	ESE	Total	
1	I	15MCSM0101	Research Methodology	50	50	100	4
2	I	15MCSM0102	Advanced Computing Techniques for Research	50	50	100	4
3	I	15MCSM01SX	Specialization Course	50	50	100	4
4	II	15MCSM0201	Dissertation & Viva-Voce	75	$75+50^{*}$	200	12
						Total	24

* **Dissertation will be evaluated by the External Examiner for 75 Marks. Viva – Voce to be conducted jointly by the Guide and External Examiner.**

15MCSM0101 Research Methodology

Objectives:

- To familiarise the student with the dimensions and methods of research.
- To orient the student to make an informed choice from the large number of alternative methods and experimental designs available.
- To enable the student to demonstrate knowledge of recent research in the area and exhibit technical writing and presentation skills

Outcomes:

- Have a good understanding of the nature of research and scientific writing
- Demonstrate the application of statistical decision making techniques
- Understand and apply graph algorithms
- Understand the fundamental principles of Fourier Transforms
- Empowered with the knowledge on Soft Computing Techniques

Unit I: Research Methodology

Introduction to Scientific Research, Meaning, Objectives and Significance of Research Motivation in Research, Types of Research Approaches, Quantitative Research Methods, Research Methods versus Methodology, Research Process, Criteria of Good Research, Research Problems, Necessity of Defining the Problem, Technique involved in Defining the Problem, Design and Development Research Methods, Meaning of Research Design, Need for Research Design, Features of A Good Design, Different Research Designs, Basic Principles of Experimental Designs, Ethics in Research, Building Expertise in the areas of interest, Generating the base content in the Selected Area, Literature Survey for Research Work, Arriving at Directions of Research, Formulation of Research Title, Development of Criteria Based Research Proposal.

Unit II : Report Writing

Technical writing using LaTeX: Scientific Writing : Significance of Report Writing, Structure and Components of Research Report, Types of Report: Research Papers, Thesis, Research Project Reports, Precautions for Writing Research Reports, Pictures and Graphs, Citation Styles, Oral Presentation, Exposure to LaTeX, Installation, MikTeX, TeXnicCenter, Creating Reports and Articles, Text Environment, Math Environment, Figures, Tables, BibTeX - Reference Manager, Camera Ready Preparation.

Unit III: Statistical Decision Making

Introduction – Bayes's Theorem – Multiple Features – Conditionally Independent Features – Decision Boundaries –Unequal Costs of Error – Estimation of Error Rates – The Leaving – One –Out Technique – Characteristic Curves – Estimating the Composition of populations – Problems – Clustering: Introduction – Hierarchical Clustering –Partitional Clustering - Problems.

Unit IV: Graph Theory

Basics: Subgraphs – Isomorphism – Automorphism Group – Matrices – Associated with Bipartite Graphs**:** Characterization – Trees – Cu edges and cut – vertices – Spanning Trees – Minimum Spanning Trees – DFS, BFS Algorithms. Connectivity: k- Connected Graphs – Characterization of 2- Connected Graphs.

Unit V: Fourier Transforms

Integral Transforms - Fourier Integral Theorem – Fourier Sine and Cosine Integrals – Complex form of Fourier Integrals – Fourier Transforms – Complex Fourier Transforms and its Inversion Formula - Fourier Sine and Cosine Transforms – Properties and problems – Transforms of Simple Functions – Convolution Theorem – Parseval's Identity.

Reference Books

1. Research Methodology – Methods and Techniques, 2/e, Kothari C. R., WishwaPrakashjan, 1999.
2. LaTeX: A Document Preparation System, 2/e, Leslie Lamport, 1994.
3. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnson Laugh, Steve Jost, PHI – 1997
4. Graph Theory: J.A. Bondy and U.S.R. Murty, Springer 2008.
5. Transforms and Partial Differential Equations, Dr. A. Singaravelu, Meenakshi Agency, 2009.
6. Thesis and Assignment writing, Berny H. Durston, M. Poole, Wiley Eastern Ltd., 1970.
7. Research Methodology – A Hand Book, Misra R.P., Concept Publishing Company, 1988.
8. Fourier series and Integrals, H. Dym, H.P. McKean, Academic Press, 1972
9. Graph Thoery, R. Diestet, Springer. 2000.

LECTURE SCHEDULE

UNIT	Topics Covered	Hours
	Research Methodology	**13**
UNIT I	Introduction to Scientific Research, Meaning, Objectives and Significance of Research Motivation in Research, Types of Research Approaches, Quantitative Research Methods, Research Methods versus Methodology, Research Process, Criteria of Good Research	3
	Research Problems, Necessity of Defining the Problem, Technique involved in Defining the Problem, Design and Development Research Methods	3
	Meaning of Research Design, Need for Research Design, Features of A Good Design, Different Research Designs, Basic Principles of Experimental Designs, Ethics in Research	3
	Building Expertise in the areas of interest, Generating the base content in the Selected Area, Literature Survey for Research Work, Arriving at Directions of Research, Formulation of Research Title, Development of Criteria Based Research Proposal.	4
	Report Writing	**10**
UNIT II	Technical writing using LaTeX: Scientific Writing : Significance of Report Writing, Structure and Components of Research Report	5
	Types of Report: Research Papers, Thesis, Research Project Reports, Precautions for Writing Research Reports, Pictures and Graphs, Citation Styles, Oral Presentation, Exposure to LaTeX, Installation, MikTeX, TeXnicCenter, Creating Reports and Articles, Text Environment, Math Environment, Figures, Tables, BibTeX - Reference Manager, Camera Ready Preparation.	5
	Statistical Decision Making	**13**
UNIT III	Introduction – Bayes's Theorem – Multiple Features – Conditionally Independent Features – Decision Boundaries –Unequal Costs of Error – Estimation of Error Rates – The Leaving – One –Out Technique – Characteristic Curves – Estimating the Composition of populations – Problems –	7
	Clustering: Introduction – Hierarchical Clustering –Partitional Clustering - Problems.	6
	Graph Theory	**14**
UNIT IV	Basics: Subgraphs – Isomorphism – Automorphism Group – Matrices – Associated with Bipartite Graphs**:** Characterization	7
	Trees – Cu edges and cut – vertices – Spanning Trees – Minimum Spanning Trees – DFS, BFS Algorithms.	7

	Connectivity: k- Connected Graphs – Characterization of 2-Connected Graphs.	
UNIT V	**Fourier Transforms**	**14**
	Integral Transforms - Fourier Integral Theorem – Fourier Sine and Cosine Integrals	4
	Complex form of Fourier Integrals – Fourier Transforms – Complex Fourier Transforms and its Inversion Formula	5
	Fourier Sine and Cosine Transforms – Properties and problems – Transforms of Simple Functions – Convolution Theorem – Parseval's Identity.	5
	Total Contact Hours	**64**

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15MCSM0102 Advanced Computing Techniques for Research

Objectives:
- To familiarise the students with the recent research techniques in computing

Outcomes:
- Have an overview on basics of computing
- Explain the key concepts of Genetic Algorithms
- Understand the architecture of Neuro-Fuzzy Inference systems
- Describe the fundamental concepts of number theory

Unit I Introduction to Computing

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics.

Unit II Genetic Algorithms

Introduction to Genetic Algorithms (GA) – Applications of GA - Building block hypothesis- Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning.

Unit III Soft Computing

Fuzzy Systems: Fuzzy Set, Fuzzy Arithmetic, Fuzzy Relations, Fuzzy Logic, Fuzzy Systems
Neural Network: Artificial Neural Network, Single Layer Perceptron, Multilayer Perceptron (MLP), Supervised Learning Neural Networks, MLP using Back propagation of error, Radial Basis Function Networks, Unsupervised Learning and Other Neural Networks, Kohonen Network, Competitive Learning Networks, Kohonen Self-Organizing Networks, Learning Vector Quantization, Hebbian Learning, Principal Component Networks, Hopfield Network.

Unit IV Number Theory and Coding Theory

Number Theory: Basic Notations, Solving $ax+by=d$, Confruences, The Chinese Reminder Theorem, Modular Exponentiation, Fremat and Euler, Primitive Roots, Inverting Matrice Mod n, Square Roots Mod n, Legende and Jocabi Symbols, Finite Fields, Continued Fractions.
Coding Theory: Probability Review, Entropy, Huffman Codes, Perfect Secrecy, Error Detecting Codes

Unit V Optimization Algorithms

Particle Swarm Optimization**,** Firefly Algorithms, Cuckoo Search, Bat Algorithms, Flower Pollination Algorithms

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Reference Books

1. Neuro - Fuzzy and Soft Computing, Jang J.S.R, Sun C.T, and Mizutani E., Prentice Hall India, Pearson Education, 2004.
2. Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, S. V. Kartalopoulos, IEEE Press - Prentice Hall India, 2004.
3. Introduction to cryptography with Coding Theory, Wade Trappe, Lawrence C. Washington, 2/e, Prentice Hall, 2006
4. Nature-Inspired Optimization Algorithms, Xin-She Yang, Elsevier, 2014

LECTURE SCHEDULE

UNIT	Topics Covered	Hours
	Introduction to Computing	**12**
UNIT I	Evolution of Computing - Soft Computing Constituents	6
	From Conventional AI to Computational Intelligence - Machine Learning Basics.	6
	Genetic Algorithms	**12**
UNIT II	Introduction to Genetic Algorithms (GA) – Applications of GA	6
	Building block hypothesis- Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning	6
	Soft Computing	**14**
	Fuzzy Systems: Fuzzy Set, Fuzzy Arithmetic, Fuzzy Relations, Fuzzy Logic, Fuzzy Systems	6
UNIT III	Neural Network: Artificial Neural Network, Single Layer Perceptron, Multilayer Perceptron (MLP), Supervised Learning Neural Networks, MLP using Back propagation of error, Radial Basis Function Networks	4
	Unsupervised Learning and Other Neural Networks, Kohonen Network, Competitive Learning Networks, Kohonen Self-Organizing Networks, Learning Vector Quantization, Hebbian Learning, Principal Component Networks, Hopfield Network	4
	Number Theory and Coding Theory	**14**
UNIT IV	Number Theory: Basic Notations, Solving $ax+by=d$, Confruences, The Chinese Reminder Theorem, Modular Exponentiation, Fremat and Euler, Primitive Roots, Inverting Matrice Mod n, Square Roots Mod n, Legende and Jocabi Symbols, Finite Fields, Continued Fractions.	7
	Coding Theory: Probability Review, Entropy, Huffman Codes, Perfect Secrecy, Error Detecting Codes	7
	Optimization Algorithms	**12**
UNIT V	**Particle Swarm Optimization**, **Firefly Algorithms**	6
	Cuckoo Search, Bat Algorithms, Flower Pollination Algorithms	6
	Total Contact Hours	**64**

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15MCSM01SX Specialization Course

      The students must select one Course from the List of Specializations. The syllabus along with two set of question papers and Panel of Examiners will be sent to the Controller of Examinations, GRI by the respective Research Supervisors.

SEMESTER II

15MCSM0201   Dissertation

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List of Specializations *

15MCSM01S1	Advanced Network Security
15MCSM01S2	Big Data Analysis
15MCSM01S3	Bioinformatics
15MCSM01S4	Biometric Image Processing
15MCSM01S5	Digital Image and Video Compression
15MCSM01S6	Digital Image and Video Processing
15MCSM01S7	Image Processing and Pattern Recognition
15MCSM01S8	Information Security
15MCSM01S9	Medical Image Processing
15MCSM01SA	Mobile Ad-Hoc Networks
15MCSM01SB	Parallel Computing for Image Processing
15MCSM01SC	Semantic Web

   *Syllabus will be framed by the respective research supervisors

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