MAHATMA GANDHI UNIVERSITY

SCHOOL OF COMPUTER SCIENCES

M. Phil (Master of Philosophy) in Computer Science

Syllabus 2016

MAHATMA GANDHI UNIVERSITY
SCHOOL OF COMPUTER SCIENCES

Programme   :   **M. Phil (Master of Philosophy) in Computer Science**
Specialisation   :   **Computer Science**
FACULTY OF **SCIENCE**
Duration   : **2 Semesters (1 year)**
Minimum Total Credits Required: **36**
Eligibility for Admission **: Post Graduation (*M.Sc/MCA/MS/M.Tech/ ME*) in Computer Science / Computer Application with not less than 55% marks.**

M. Phil Computer Science 2016: Semester wise List of Courses

Semester I

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
SKS PD I C1611	Research Methodology	3	2	3	4
SKS PD I C1612	Advanced Computing Techniques	3	2	3	4
SKS PD I E1613	Elective	3	2	3	4
SKS PD I C1614	Main Project-Phase I	-	-	8	4

Semester II

Course Code	Course Title	Hours/Week			Credits
SKS PD II C1621	Main Project-Phase II	One Semester			16
SKS PD II C1622	Comprehensive Viva-voce	-	-	-	4

Total Credits   : 36

M.Phil scholars shall perform individual research in any one area of Computer Science under the direct supervision of a faculty member and submit a dissertation at the end of second semester. The research should be able to make original scientific contribution which has both practical significance and a sound theoretical grounding.

The elective course in semester I shall form the basis of the Main Project in semester I and II and the list of electives offered for a batch shall be finalized and approved before the commencement of the programme every year.

The evaluation shall be as per CSS regulations.

MAHATMA GANDHI UNIVERSITY
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PROGRAMME: **M.Phil. Computer Science**

<u>Semester I</u>

SKS PD IC 1611Research Methodology

Unit 1 – Science and   Research

Definition – History – Evolution of Scientific Inquiry – Verification versus Falsification – Objectivity : Facts, theory and concepts – Philosophy of Science and Technology, Epistemology of Sciences – Construction of Scientific facts.

Unit 2 - Introduction to   Research Methodology

Meaning and Importance of Research – Types of Research – Selection and Formulation of Research Problem.Research Design – Need – Features – Inductive, Deductive and Development of Models.Developing a Research Plan – Exploration, Description, Diagnosis, Experimentation, Determining Experimental and Sample Designs.

Analysis of Literature Review – Primary and Secondary Sources, Web Sources –Critical Literature Review.Hypothesis – Different Types – Significance – Development of Working Hypothesis.

Research Methods: Scientific Method vs Arbitrary Method, Logical Scientific Methods: Deductive, Inductive, Pattern of Deductive – Inductive Logical Process – Different Types of Inductive Logical Methods.

Unit 3 - Data Collection and Analysis

Sources of Data – Primary, Secondary and Teritary – Types of Data – Categorical, Nominal & Ordinal.Methods of Collecting Data : Observation, Field Investigations, Direct Studies – Reports, Records or Experimental Observations.

Sampling methods – Data Processing and Analysis Strategies- Graphical Representation – Descriptive Analysis – Inferential Analysis- Correlation Analysis – Least Square Method - Data Analysis using Statistical Package – Hypothesis – Testing – Generalization and Interpretation – Modeling.

Unit 4 – Scientific Writing

Structure and Components of Scientific Reports – Types of Report – Technical Reports and Thesis – Significance – Different Steps in the Preparation – Layout, Structure and Language of Typical Reports - Illustrations and Tables – Bibliography, Referencing and Foot Notes – Oral Presentation – Planning – Preparation and Practice – Making Presentation – Use of Visual Aids – Importance of Effective Communication.

Conventions and Strategies of Authentication – Citation Style – Sheet.Preparing Research Papers for Journals, Seminars and Conferences – Design of Paper using Template, Calculations of Impact Factor of a Journal, Citation Index, ISBN & ISSN.

Preparation of Project Proposal - Title, Abstract, Introduction – Rationale, Objectives, Methodology – Time Frame and Work Plan – Budget and Justification - References

Unit 5 – Application ofResults and Ethics and Application of Computer in Research

Environmental Impacts - Ethical Issues – Ethical Committees – Commercialization – Copy Right – Royalty – Intellectual Property Rights and Patent Law – Track Related Aspects of Intellectual Property Rights – Reproduction of Published Material – Plagiarism – Citation and Acknowledgement – Reproducibility and Accountability.

Data Analysis Tool: R-Tool, Documentation Tool: Latex, Use of Internet in Research – Websites, Search Engines, E-journal and E-Library – INFLIBNET.

References

1. Garg.B.L.,Karadia, R., Agarwal,F. and Agarwal, U.K., An introduction to Research Methodology, RBSA Publishers, 2002.

2. Kothari, C.R, Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi, .2008.

3. Sinha, S.C. and Dhiman, A.K., Research Methodology, Ess Publications, 2 volumes, 2002.

4. Trochim, W.M.K., Research Methods: The Concise Knowledge Base, Atomic Dog Publishing. 270 p., 2005.

5. Day RA (1992) How to Write and Publish a Scientific Paper. Cambridge University Press. London

6. Hempel,C. Philosophy of Natural Science Englewood Cliffs, N.J: Prentice Hall, 1966.

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11. Kozak A, Kozak R.A., Staudhammer C.L., and Watts S.B. Introductory probability and Statistics; Applications for forestry and Natural sciences.CAB International, UK.408p., 2008.

12. Downine N.M, Basic Statistical Methods, New York:¨Harper and Health Row Publishers,…….

13. Frank, Harry, Statistics - Concepts and Applications. Cambridge, Althoen, Steven Cambridge University.

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15. Wadehra, B.L.. Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, Universal Law Publishing,2000.

16. Chandera A. and SexenaT.PStyle Manual, New Delhi, Metropolitan Book Comp. Ltd., 2000.

17. SPSS – Operating Manual and Handbook – Latest Version, Sinha P.K Computer Fundamentals, BPB Publications, New Delhi, .1992.

SKS PD IC 1612 Advanced Computing Techniques

UNIT I

Pattern Recognition: Pattern Recognition Systems; Data Pre-Processing Techniques; Feature Generation, Selection and Dimensionality Reduction; Classification, Prediction and Clustering; Accuracy Measures and Metrics.

UNIT II

Digital Image Processing: Problems and Applications, Image representation and modeling, Image Transforms, Image Enhancement, Image Analysis and computer vision.

UNIT III

Security Services and Mechanisms: Cryptography, Cryptographic Protocols and Standards; Network Security; Web and OS Security; Database Security.

UNIT IV

Data Mining: Classification, Prediction and Clustering through Frequent Item set Mining and Association Mining, Mining using Spatial Data, Multimedia Data, Text Data and Web Data.

UNIT V

Computing Paradigms – Parallel and Distributed Processing, Grid and Cloud Computing, Web-Based Application, Security objectives,Threats to cloud Infrastructure.

References

1. Sergios Theodoridis, Aggelos Pikrakis, Konstantinos Koutroumbas, Dionisis Cavouras, Introduction to Pattern Recognition: A MATLAB Approach, Academic Press, First Edition, 2010.
2. Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, Academic Press, Fourth Edition, 2009.
3. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, Wiley India, Second Edition, 2006.
4. V. Susheela Devi, M. NarasimhaMurty, Pattern Recognition: An Introduction, University Press, Hyderabad, 2011.
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6. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education Inc, Third Edition, 2008.
7. A.K. Jain, Fundamentals of Digital Image Processing, PHI.
8. Richard A. Robb, Biomedical Imaging Visualizations and Analysis John Wiley & Sons, Nov. 1999.
9. Matt Bishop , Computer Security: Art and Science, Addison- Wesley, 2003.
10. William Stallings, Cryptography and Network Security : Principles and Practices, Sixth Edition, Prentice Hall, 2014
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19. Jiawei Han and Micheline Kamber, Data Mining-Concepts and Techniques, Elsevier , Third Edition, 2012.
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22. Ronald L. Krutz, Russell Dean Vines, Cloud Security – A comprehensive Guide to Secure Cloud Computing, Wiley – India, 2010.
23. Ian Foster, Carl Kesselman(Editor), The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Second edition (November 2003)..
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SKS PD I E1613 (A) DIGITAL IMAGE PROCESSING

Unit 1

Introduction: Overview, Fundamental steps in digital image processing, Components of image processing system, Basic relationship between pixels, Introduction to mathematical tools used in image processing.

Colour image processing: Fundamentals, Colour image models, Pseudo colour image processing, Colour transforms, Smoothing and sharpening, Noise in colour image.

Unit 2

Feature Extraction: Low-level feature extraction (including edge and line detection): Overview, First order edge detection operators, Second order edge detection operators, Other edge detection operators, Morphological edge detection, Watershed segmentation, Pattern fitting approach, Edge linking and edge following, Edge element extraction by thresholding, Comparison of edge detection operators, Phase congruency, Localized feature extraction-Detecting image curvature (corner extraction) & Modern approaches: region/patch analysis, Describing image motion, line detection.

Feature extraction by shape matching: Overview, Thresholding and subtraction, Template matching, Hough transform, Generalized Hough transform, Other extensions to the Hough transform.

Unit 3

 Segmentation and Object Recognition: Segmentation: Introduction, Region extraction, Pixel based approaches, Thresholding, Region based approaches, Segmentation using morphological watersheds.

Object Recognition: Patterns and pattern classes, Recognition based on decision theoretic methods, Structural methods

Unit 4

Image Enhancement: Introduction, Point operations, Histogram modelling, Spatial operations, Transform operations, Multispectral image enhancement, False colour and pseudo-colour, Colour image enhancement.

Unit 5

Image Compression: Introduction and overview, Some basic compression methods: Pixel coding, Huffman coding, Run length coding, Lempel-Ziv-Welch coding, Gray level run length coding, Block truncation coding, Vector quantization, Model based and fractal based compression, Transform coding, Hybrid and wavelet methods, Predictive techniques, Interframe coding.

References

1. Rafael C. Gonzalez, Rechard E. Woods, 'Digital Image Processing', Pearson Education, Second Edition, 2000.
2. A.K. Jain, 'Fundamentals of Digital Image Processing', Pearson Education, 2003.
3. B. Chanda, D. Dutta Majumder, 'Digital Image Processing and Analysis', PHI, Second Edition, 2011.
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12. Andreas, Koschan, 'Digital Colour Image Processing', Wiley Interscience, 2008.

SKS PD IE 1613(B) Machine Learning

Unit I
Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier
Machine Learning Fundamentals: Binary Classification, Regression, Generalization, Regularization

Unit II
Feed forward Neural Networks: Overall Structure of a Neural Network, Expressing the Neural Network in Vector Form, Evaluating the Output of the Neural Network, Training the Neural Network

Deriving Cost functions using Maximum Likelihood – Binary Cross Entropy, Cross Entropy, Squared Error, Summary of Loss Functions

Types of Units/ Activation Functions/Layers – Linear Unit, Sigmoid Unit, Softmax Layer, Rectified Linear Unit (ReLU), Hyperbolic Tangent

Unit III
Introduction to Deep Learning: Convolutional Neural Networks, Convolution Operation, Pooling Operation, Convolution-Detector-Pooling Building Block, Convolution Variants, Intuition Behind Convolutional Neural Networks

Unit IV
Recurrent Neural Networks: RNN Basics, Training RNNs, Bidirectional RNNs, Gradient Explosion and Vanishing, Gradient Clipping, Long Short Term Memory

Unit V
Stochastic Gradient Descent: Optimization Problems, Method of Steepest Descent, Batch, Stochastic (Single and Mini-batch) Descent – Batch, Stochastic Single Example, Stochastic Mini-batch, Batch vs. Stochastic, Challenges with Stochastic Gradient Descent: Local Minima, Saddle Points, Selecting the Learning Rate, Slow Progress in Narrow Valleys

Algotihmic Variations on SGD: Momentum, Nesterov Accelerated Gradient (NAS), Annealing and Learning Rate Schedules, Adagrad, RMSProp, Adadelta, Adam, REsilint Backpropagation, Equilibrated SGD, Parallel and Distributed SGD

References

1. Nikhil Ketkar, Deep Learning with Python: A Hands-on Introduction, Apress.
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13. U Dinesh Kumar, Manaranjan Pradhan, "Machine Learning using Python", Wiley.

SKS PD IE 1613(C) DATA MINING

Unit I

Introduction to Data Mining: Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Data Warehouse and OLAP Technology: Basic Concepts of Data Warehouse, Multitired Data Warehouse Architecture, Data Warehouse Modeling, Data Cube, a Multidimensional Data Model, Schemas for Multidimensional Data Models, Typical OLAP Operations.

Unit II

Data Objects and Attribute Types, Basic Statistical Description of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

Data Preprocessing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Unit III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods, Pattern Evaluation Methods.

Advanced Pattern Mining: Pattern Mining in Multilevel, Multidimensional space, Constraint-Based Frequent pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Appropriate Patterns, Pattern Exploration and Application.

Unit IV

Classification: Basic Concepts and Methods, Model Evaluation and Selection, Techniques to Improve Classification Accuracy.
Advanced Classification Techniques: Bayesian Belief Networks, Support Vector Machines, Soft Computing Approaches, Classification using Frequent Patterns.

Cluster Analysis: Basic Concepts and Methods, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based methods, Evaluation of Clustering.
Advanced Cluster Analysis: Probabilistic Model-Based Clustering, Clustering High-Dimensional data, Clustering graph and Network data, Clustering with Constraints.

Unit V

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications.

References

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Elsevier,3rd Edition, 2012

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4. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.2005.
5. Data Warehousing in the Real World – Sam Anahory & Dennis Murray. Pearson Edn Asia, 2004.
6. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley Student Edition
7. The Data Warehouse Life cycle Tool kit– Ralph Kimball Wiley Student Edition