Swami Ramanand Teerth Marathwada University, Nanded

School of Computational Sciences

M. Phil. in Computer Science

W.e.f. (2019-2020)

Paper	Title	Contact Hrs/Week	Credits
Compulsory			
MPHILLCS-101	Research Methodology	04	4
MPHILLCS -102	Mathematical Foundations of Computer Sciences	04	4
Elective –I (any one) MPHILLCS -103	A-Advances in Computer Vision	04	4
	B- Advanced Computer Networks		
	C- Mobile Computing		
	D- Cloud Computing		
	E- Data center virtualization		
Elective –II (any one) MPHILLCS-104	A- Managing Big Data	04	4
	B- Cyber security		
	C- Soft Computing		
	D -Sensor Networks Infrastructure		
	E-Bioinformatics and Application		
MPHILLCS -105	Dissertation	08	6
MPHILLCS -106	Viva-Voce	01	2
MPHILLCS -107	Seminar	01	1
	Total		25

Director
School of Computational Sciences
S.R.T.M. University, Nanded (M.S.)

MPHILLCS-101
Research Methodology

Course Objectives: The primary objective of this course is to develop a research orientation among the scholars and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing them to the basic concepts used in research and to scientific social research methods and their approach. It includes discussions on sampling techniques, research designs and techniques of analysis. Some other objectives of the course are:
 • To develop understanding of the basic framework of research process.
 • To develop an understanding of various research designs and techniques.
 • To identify various sources of information for literature review and data collection.
 • To develop an understanding of the ethical dimensions of conducting applied research.
 • Appreciate the components of scholarly writing and evaluate its quality.

Course Outcomes: Upon completing this course, each student will be able to:
 1. Demonstrate knowledge of research processes (reading, evaluating, and developing);
2. Perform literature reviews using print and online databases;
3. Employ formats for citations of print and electronic materials;
4. Identify, explain, compare, and prepare the key elements of a research proposal/report;
5. Define and develop a possible research interest area using specific research designs;
6. Compare and contrast quantitative and qualitative research paradigms, and explain the use of each in research;
 7. Describe, compare, and contrast descriptive and inferential statistics, and provide examples of their use in research;
8. Describe sampling methods, measurement scales and instruments, and appropriate uses of each;
9. Explain the rationale for research ethics, and the importance of and local processes for University Research Board for review; and
10. Demonstrate how educational research contributes to the objectives of your doctoral program and to your specific career aspirations in higher education.

UNIT -1 Research Methodology

Research- Definition, Importance and Meaning of Research, Characteristics of Research, Types of research, Research Approaches, significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of good research, research problem and selection, techniques involved in defining a problem.

UNIT -2 Research Design

Research Design- Meaning, research design need, features of a good design, important concept relating to research design, different research design, basic principles of experimental designs. Sampling meaning, sample design, criteria of selecting a sampling procedure, characteristics of a good sample design, different types of sample design, Hypotheses-meaning , Basic concept concerning testing of hypotheses, procedure for hypothesis testing, measure of a hypothesis test,

UNIT -3 Measurement and Scaling Techniques

Measurement in research, Measurement scale, source of error in measurement, test of sound measurement, techniques of developing measurement tools, scaling, scale classification bases, important scaling techniques, scale construction techniques, different methods of data collections- interview, questionnaires, through schedules
.
UNIT -4 Processing and Analysis of Data

Processing Operations, Problem in processing, types of analysis, measure of central tendency, measure of dispersion, measure of asymmetry, measure of relationship, simple regression analysis, multiple correlation and regression, partial correlation, Chi-square as a test for

comparing variance, Chi-square as a non-parametric test, ANOVA, basic principle of ANOVA, ANOVA techniques,

UNIT -5 Interpretations and Report Writing
Research Reports- Types of reports, contents, Format & Styles of reporting, steps in drafting reports, Editing the final draft, Evaluating the final draft. Analysis and Interpretation of Data and Report Writing, References and Bibliography.

UNIT -6 Introductions to Matlab
Getting used to the environment, Algorithms, Pseudo-code, Tracing a program/algorithm step-by-step, Debugging with breakpoints and print statements, Divide and conquer, Variables, Data Types, Conditional program flow (if), Iteration / Looping (while), Solve a problem for one case, then iterate, Functions, Abstraction and Encapsulation, Planning a large program, working with stubs

Reference Books:
1. C.R. Kothari , "Research Methodology: Methods and Techniques", second edition New Age International Publications.
2. H.K. Kapil, "Research Methodology", TataMcGrawhill publications.
3. B.C. Tandon, "Research Methodology in Social Science",5.
4. Anderso J.berry H.D. & Poole M. Wiley, "Thesis and Assignment writing",Eastern Limited, New Delhi.

MPHILLCS-102
Mathematical Foundations of Computer Sciences

Course Objectives

Cultivate clear thinking and creative problem solving. Thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies. The course also covers fundamental portion of theory of computations and languages.

Course Outcomes

At the end of the course student will be able to Understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving. It enhances ability to understand use of functions, graphs and their use in programming applications. Apply discrete structures into computing problems, formal specification, artificial intelligence, cryptography, Data Analysis. Theory of language like context free grammar and NP complete problem analysis is comprehended by student.

UNIT- 1 Mathematical Logic
 Propositions, Logical Connectives and compound Propositions, Truth Tables, Logical Equivalence, Algebra Of Propositions, Conditional Propositions, Converse, Contra positive and Inverse, Biconditional Statements, Negation Of Compound Statements, Tautologies, Contradictions and Contingency, Methods Of Proof, Predicate Calculus

UNIT -2 Boolean Algebra and Logic Circuits

Boolean Algebra, Unique Features, Basic Operations, Boolean Functions, De-Morgan's Theorem, Logic Gates, Sum Of Products and Product Of Sums Forms, Normal Form, Expression of Boolean Function as a Canonical Form, Simplification of Boolean Expression, Boolean Expression From Logic and switching Network, Implementation Of Logic Expressions With Logic gates and switching Circuits, Functionally Complete Sets, Karnaugh Map Method For Simplification Of Boolean Expression

UNIT -3 Relations And Functions

Relations On Sets, Types Of Relations, Properties Of Relations, Representation Of Relation
Relational Database, Functions Classification Of Functions
Types Of Functions, Composition Of Functions, Some Special Functions

UNIT-4 Finite Automata

Deterministic finite automata, Nondeterministic finite automata, Finite automata and regular expressions, languages that are and are not regular, state minimization, algorithmic aspect of finite automata

UNIT-5 Context free Languages

Context-free grammars, parse tree, pushdown automata, languages that are and are not context free, algorithms for context free grammars, Determinism and parsing.

UNIT-6 NP-Completeness

Polynomial time reduction, Cook's Theorem, More NP-completeness problems, coping with NP-completeness.

Reference Books
1. Harry R. Lewis and Christos H. Papadimitriou, " Elements of the Theory of computation", second edition , Pearson education.
2. Swapan Kumar Sarkar, "Text Book of Discrete mathematics",S Chand and company.
3. George J. Klir, Tina A, " Fuzzy sets uncertainty and Information", Prentice Hall of India.

MPHIL CS -103
Elective –I A-   Advances in Computer Vision

Course Objectives:
In this course, students will learn to methods of biometrics, devices of biometrics, and use for computer security, design and build a secure system using biometrics and computer vision.
Course Outcomes:

Successful completion of this course will prepare the student to do any of the following:

• Perform Research & Development on biometrics methods and systems.
• Evaluate and design security systems incorporating biometrics

• Understand the technology of biometrics for public policy matters involving security and privacy.

UNIT-1 Introduction

Input-output channels: Vision, Hearing, Touch, Movement Human memory: Sensory memory, Short-term memory, Long-term memory Thinking: reasoning and problem solving, Skill acquisition, Errors and mental models . Motivations for Using Biometric Systems, Human Identity and Biometrics, Levels of Identification, Biometrics for Identity Management

UNIT-2 Fundamentals of Biometrics
Biometric Technologies Work—In General, Overview of Applications, Errors and Error Rates, Failure to Acquire, Personal Biometric Criteria, Biometric System-Level Criteria, Key Elements of Biometric Systems, Biometric Performance Metrics, Template Storage Considerations, Terms and Definitions Related to Biometrics.

UNIT-3 Types of Biometric Technologies
Dynamic Signature Analysis, Facial Imaging or Recognition, Fingerprint, Hand Geometry, Iris Recognition, Keystroke Analysis/Keystroke Dynamics, Palmprint, Retinal Scan, Skin Spectroscopy/Skin Texture/Skin Contact, Speaker Verification, Vascular Biometrics, Other Biometric Technologies

UNIT-4 The Biometric System Design Process
System Concept Development, Operational Considerations and Constraints, The Requirements Definition, The System Specification, Biometric Access Control, The Architectural Aspects of an Automated Access

UNIT-5 Structure of Biometric Standards
Introduction, Current Work in Biometric Standards, Development, International Standards Organizations, BioAPI Consortium, Common Biometric Exchange Framework Format (CBEFF), Best Practices in Standards Development.

UNIT-6 Testing and Evaluation
Introduction, Understanding Biometric System Performance, Comparison of Types of Testing, Technology Testing, Scenario Testing, Operational Testing

References Books:

1. Biometric Technology Application Manual, Volume One: Biometric Basics
   Compiled and Published by: National Biometric Security Project Updated Summer 2008.
2. Human-Computer Interaction, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale February 13th, 2005
3. Biometric Recognition: Challenges and Opportunities, Joseph N. Pato and Lynette, National Research Council
4. Soft Computing for Recognition Based on Biometrics, Patricia Melin, Janusz Kacprzyk, and Witold Pedrycz (Eds.), ISBN 978-3-642-15110-1 e-ISBN 978-3-642-15111-8 2010 Springer-Verlag Berlin Heidelberg

MPHILLCS -103

Elective-I B- Advanced Computer Networks

Course Objectives: At the end of the course, the students will be able to:

1. Build an understanding of the fundamental concepts of computer networking.

2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.

3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.

 4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes: After completing this course the student must demonstrate the knowledge and ability to:

1. Independently understand basic computer network technology.

2. Understand and explain Data Communications System and its components.

3. Identify the different types of network topologies and protocols.

4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.

5. Identify the different types of network devices and their functions within a network

6. Understand and building the skills of subnetting and routing mechanisms.

7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

UNIT- 1: Review

Review of networking Technologies and Internetworking Concepts and Architectural Model, Application level and Network level Interconnection, Properties of the Internet, Internet Architecture, and Interconnection through IP Routers.

UNIT- 2:ARP and RARP

Internet Addresses, Mapping Internet addresses to Physical addresses, Universal identifiers, three Primary classes of IP addresses, network and Broadcast Addresses, Limited Broadcast, Dotted decimal Notation, weakness in Internet addressing, Loopback addresses, resolution through Direct Mapping, Resolution Through Dynamic Binding, address resolution cache, ARP to other protocols, Reverse address resolution protocol, timing, RARP transaction, Primary and backup RARP severs.

UNIT- 3: Routing

Internet Protocol, Connectionless Datagram Delivery, Routing IP Datagrams, The concepts of unreliable delivery, purpose of the internet protocol, Routing in an internet, direct and indirect delivery, table driven IP routing, Next Hop Routing, default routes, host specific routes, The IP routing Algorithm, handling incoming datagram's, Establishing routing tables.

UNIT- 4:ICMP Protocol

Internet Protocol, Error and Control Message (ICMP), Subnet and Supernet Address, ICMP, Error reporting versus error detection, ICMP message format, Detecting and reporting various network problems through ICMP, Transparent Router, Proxy ARP, subset addressing, implementation of subnets with masks representation, Routing in the presence of subsets, a unified algorithm.

UNIT- 5:User Datagram Protocol (UDP)

Format of UDP message, UDP pseudo header, UDP encapsulation and Protocols layering, UDP checksum computation, UDP multiplexing, De-multiplexing and Ports.

UNIT- 6: Reliable Stream Transport service (TCP)

The Transmission control Protocol, pots, Connections and Endpoint, passive and active opens the TCP segment format, TCP implementation issues.

Reference Books:

  1. Douglas E.Comer, Internetworking with TCP/IP: Principles, Protocols, PHI Pub.
  2. Forouzan, TCP-IP, Protocol Suit, TMH.
  3. Comer, Internetworking with TCP-IP Vol. 3. PHI publications
  4. W. Richard Stevens, UNIX Network Programming. PHPTR
  5. William Stallings, SNMP, Pearson.

MPHILLCS -103

Elective-I C- MOBILE COMPUTING

Course Objectives: The course is design to meet the objectives of:

1. Define Mobile Computing and look at current trends

2. Distinguish between types of Mobility

3. Examine Theory Research in Mobility

4. Examine Systems Research in Mobility

5. Acquire solid knowledge on mobile networks and mobile computing.

Course outcomes: Upon Completion of the subjects:

1. Apply advanced data communicating methods and networking protocols for wireless and mobile environments

2. Utilize and employ mobile data base application for developing mobile applications including under disconnected and weakly connected environment

3. Select components and networks for particular application

4. Creatively analyze mobile and wireless networks

5. Critically analyses security issues of mobile and wireless computing systems

UNIT - 1 Introduction to Mobile Communications and Computing

Introduction to Mobile Computing, novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

UNIT - 2 (Wireless) Medium Access Control

Motivation for a specialized MAC: Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, CDMA.

UNIT - 3 Mobile Network Layer

Mobile IP: Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).

UNIT - 4 Mobile Transport Layer

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT - 5 Database Issues and Data Dissemination

Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues, Communications asymmetry, classification of new data delivery mechanisms, pushbased mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

UNIT - 6 Mobile Ad hoc Networks

Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

ReferenceBooks :

1. JochenSchiller,"Mobile Communications",Addison-Wesley,second edition, 2004
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
6. MartynMallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.
7. K. Pahlavan and P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall.

MPHILLCS-103
Elective-I D-Cloud Computing

Course objectives:
1. To learn how to use Cloud Services.
2. To implement Virtualization
3. To implement Task Scheduling algorithms.
4. Apply Map-Reduce concept to applications.
5. To build Private Cloud.
6. Broadly educate to know the impact of engineering on legal and societal issues involved.

Course Outcomes:
CO1: Analyze the Cloud computing setup with it's vulnerabilities and applications using different architectures.
CO2: Design different workflows according to requirements and apply map reduce programming model.
CO3:Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
CO4: Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds
CO5:.Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application
CO6: Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing

UNIT-1 Introduction
Introduction, Cloud Infrastructure: Network centric computing and network centric content, Peer-to-peer systems, Cloud Computing: an old idea whose time has come, Cloud Computing delivery models & Services, Ethical issues, Cloud vulnerabilities, Challenges
UNIT-2 Cloud Infrastructure

Cloud Infrastructure: Amazon, Google, Azure & online services, open source private clouds. Storage diversity and vendor lockin, intercloud, Energy use & ecological impact of data centers, service level and compliance level agreement, Responsibility sharing, user experience, Software licensing.

UNIT-3 Cloud Computing: Application Paradigms.:

Challenges, existing and new application opportunities, Architectural styles of cloud applications: single , multi ,hybrid cloud site, redundant, non redundant , 3 tier, multi tier architectures, Workflows coordination of multiple activities, Coordination based on a state machine model -the Zoo Keeper, The Map Reduce programming model, Apache Hadoop, A case study: the GrepTheWeb application, Applications: Healthcare, Energy systems, transportation, manufacturing, Education, Government, mobile communication, application development

UNIT-4 Cloud Resource Virtualization:

Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based web services, Resource bundling, combinatorial auctions, fair queuing, Start time fair queuing, borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling mapreduce applications subject to deadlines, Resource management and application scaling

UNIT-5 Cloud Resource Management and Scheduling:

Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based web services, Resource bundling, combinatorial auctions, fair queuing, Start time fair queuing, borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling mapreduce applications subject to deadlines, Resource management and application scaling

UNIT-6 Cloud Security, Cloud Application Development: Storage systems: Evolution, Storage models, file systems, databases, DFS, General parallel File system, GFS, Hadoop, Locks & Chubby, TPS, NOSQL, Big Table, Mega store. Cloud security: Risks, Security, privacy, Trust. Security of OS, VM, VMM, shared image, management OS, Xoar.

Reference Books:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013, 1st Edition, Print Book ISBN :9780124046276, eBook ISBN :9780124046412 Chapter 1 - Introduction Pages 1-19, Chapter 2 - Parallel and Distributed Systems Pages 21-65, Chapter 3 - Cloud Infrastructure Pages 67-98, Chapter 4 - Cloud Computing: Applications and Paradigms Pages 99-130, Chapter 5 - Cloud Resource Virtualization Pages 131-161, Chapter 6 - Cloud Resource Management and Scheduling Pages 163-203, Chapter 8 - Storage Systems Pages 241-271, Chapter 9 - Cloud Security Pages 273-300,, Chapter 11 - Cloud Application Development Pages 317-359

2. Cloud Computing : A hands on Approach, Arshdeep Bagha - Vijay Bagha Madisetti , 2013, ISBN/EAN13: 1494435144 / 9781494435141, web links: www.cloudcomputingbook.info. Chapter 1-1-19 pages, Chapter 4-64-93 pages, Chapter 5- 94-113 pages, Case studies and examples.

3. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, 1st edition, 2014, Morgan Kaufmann Publishers, Inc., San Francisco. ISBN-13: 978-0124166752, ISBN-10: 012416675X

4. T. Erl, R. Puttini, and Z. Mahmood, Cloud Computing: Concepts, Technology & Architecture • ISBN-10: 0133387526 • ISBN-13: 9780133387520 ©2013 • Prentice Hall • Cloth, 528 pp

5. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.

5. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra and Geoffrey Fox, Morgan Kaufmann, 20111.

6. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010

MPHILLCS-103
Elective-I E- Data Centre Virtualization

Course objectives:
- Understanding and exploring creation of virtual machine and its benefits, Process to move from a physical environment to a virtual one

- Describe types of virtualization used for data centers

- Describe virtualization, virtual machines, hypervisors, and VMware vSphere® components

- Describe the concepts of server, network, storage, and desktop virtualization

- Understand how individuals and businesses benefit from virtualization

Course Outcomes:
Upon successful completion of this course, the students will be able to
- understand creation of virtual machine and Process to move from a physical environment to a virtual one
- Explore different types of virtualization used for data centers
- Get hands-on on hypervisors, and VMware vSphere® components through Hands-on Lab from Vmware
- Able to understand the concepts of server, network, storage, and desktop virtualization
- : Understand how individuals and businesses benefit from virtualization

UNIT-I Virtualization, Layering and virtualization, What is a Virtual Machine?
Before Virtualization and After Virtualization**,** Virtual machine monitors, Virtual machines Performance and security isolation, Full virtualization and paravirtualization,

UNIT-II VMware Virtualization Solutions: vMotion, Storage vMotion, vSphere High Availability (HA), vSphere Distributed Resource Scheduler (DRS), vSphere Storage Distributed Resource Scheduler (Storage DRS), vSphere Fault Tolerance (FT), vSphere Replication, VMware VSAN, VMware NSX **.** A performance comparison of virtual machines, Virtual machine security, The darker side of virtualization, Software fault isolation.

UNIT-III: The Hypervisor: Type 1 Hypervisor, Type 2 Hypervisor, Two Virtualization Scenarios, VMware Workstation, Creating a Virtual Machine, Virtual Machine Files, From the Personal Desktop to Enterprise Virtualization

UNIT-IV The Data Center: Compute Systems, Networks, Storage, RAID, File Level and Block Level Storage, Direct Attached Storage, Network Attached Storage, Storage Area Network, Storage Protocols, Storage Provisioning Building a Data Center

UNIT-V: **The Virtual Data Center (VDC):** vSphere, ESXi, vCenter, vSphere Client, Server Virtualization, Storage Virtualization, Network Virtualization, Types of Virtual Networks, Application and Desktop Virtualization, The Cloud, From a Physical to a Virtual Data Center - Convergence

UNIT-VI: VMware Virtualization Solutions: vMotion, Storage vMotion, vSphere High Availability (HA), vSphere Distributed Resource Scheduler (DRS), vSphere Storage Distributed Resource Scheduler (Storage DRS), vSphere Fault Tolerance (FT), vSphere Replication, VMware VSAN, VMware NSX

TEXT/Reference Books
1. **Virtualization For Dummies 1st Edition, by Bernard Golden .**
2. https://mylearn.vmware.com/mgrreg/index.cfm VMware official text book and link
3. VMware education exclusive e content on Vsphere

MPHILLCS -104
Elective –II   A- Managing Big Data

Course objectives:
1. To Understand big data for business intelligence
2. To Learn business case studies for big data analytics
3. To Understand NoSQL big data management
4. To understand map-reduce analytics using Hadoop and related tools

Course Outcomes:
1. Students are able to learn, analyze and interpret big data and few of its use cases from selected
   business domains, Health Care, Fraud Detection and Advertising
2. Students are able to analyze and apply NoSQL in big data
3. Students are able to apply map-reduce analytics using Hadoop
4. Students are able to analyze and develop applications using Hadoop and its related tools
5. Broadly educate students to know the impact of engineering on legal and societal issues

UNIT –1 Understanding Big Data
What is big data – why big data – Data!, Data Storage and Analysis, convergence of key trends
unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and
big data – risk and big data— big data and healthcare – big data in medicine – advertising and big data –
big data technologies

UNIT –2 Hadoop
Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence
– Crowd sourcing analytics – inter and trans firewall analytics

UNIT –3 NoSQL Data Management:
Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models –
relationships – graph databases – schema less databases – materialized views – distribution models –
sharding — version – Map reduce – partitioning and combining – composing map-reduce calculations

UNIT4 Basics Of Hadoop
: Data format – analysing data with Hadoop – scaling out – Hadoop streaming– Hadoop pipes – design
of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O –
data integrity – compression – serialization – Avro – file-based data structures

UNIT-5 MapReduce Applications
Introduction to decision tree, Tree Construction Principle, Best Split, Splitting Indices, Splitting
Criteria, Decision tree construction algorithm, CART, ID3, C4.5, CHAID.

UNIT-6 Hadoop Related Tools:
Introduction to Neural Network, Learning in NN, Unsupervised Learning, Data Mining using
NN: A Case Study, Genetic Algorithm, Rough Sets, support Vector Machnies

Reference Books:
1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot
Persistence", Copyright © 2013 Pearson Education, Inc. 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.

4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

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MPHILLCS -104
Elective –II B-Cyber Security

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Course objectives:
1. To provide an understanding Computer forensics fundamentals
2. To analyze various computer forensics technologies
3. To provide computer forensics systems
4. To identify methods for data recovery.
5. To apply the methods for preservation of digital evidence.

Course Outcomes:
1. Understand the definition of computer forensics fundamentals.
2. Describe the types of computer forensics technology.
3. Analyze various computer forensics systems.
4. Illustrate the methods for data recovery, evidence collection and data seizure.
5. Summarize duplication and preservation of digital evidence.

UNIT -1 Computer Forensics Fundamentals

Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement,
Computer Forensics Assistance to Human Resources/Employment Proceedings,
Computer Forensics Services, Benefits of Professional Forensics Methodology

UNIT -2 Types of Computer Forensics Technology

**Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer
Forensic Technology, Types of Business Computer Forensic Technology, Specialized
Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware.**

UNIT -3 Encryption Methods and Vulnerabilities ,Protecting Data from Being
Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding
Pitfalls with Firewalls ,Biometric Security Systems.

UNIT -4 Types of Computer Forensics Systems

Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area
Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure
Systems, Wireless Network Security Systems.
Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy
Systems, Identity Management Security Systems ,Identity Theft , Biometric Security Systems,
Homeland Security Systems .

UNIT -5 Data Recovery

Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data
Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data
Evidence Collection and Data Seizure
Why Collect Evidence?, Collection Options ,Obstacles ,Types of Evidence ,The Rules of
Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of
Collection, Artefacts.

UNIT -6 Duplication and Preservation of Digital Evidence

Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image
Verification and Authentication Special Needs of Evidential Authentication, Practical
Considerations.

Reference Books:
1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition,
    Charles,River Media, 2005 ISBN-13: 978-1584503897

2. ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners,2nd Edition, Springer's, 2010ISBN 978-3-642-04101-3
3. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009ISBN-13: 978-0984271504
4.Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series:Computer Forensics), 2010ISBN-13: 978-1435483521

MPHILLCS -104

Elective –II C- Soft Computing

Course objectives:
1. To learn the key aspects of Soft computing
2. To know about the components and building block hypothesis of Genetic algorithm.
3. To gain insight onto Neuro Fuzzy modeling and control.
4. To gain knowledge in machine learning through Support vector machines

COURSE OUTCOMES:
1: Understanding the basics of soft computing, ANN and Terminologies
2: Apply ANN techniques on Adaptive linear neuron and Multiple adaptive linear neurons,
3: Understanding the classical sets and fuzzy sets
4: Applying the Fuzzy decision making on Fuzzy sets
5: Understand and apply the reinforcement learning and Sarsa Algorithm on soft computing applications

UNIT-1.
 Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.

 UNIT-2.
Perceptual Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).

 UNIT-3.
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.

UNIT-4.
 Fuzzy decision making and applications.

UNIT-5.
Reinforcement Learning, Examples , Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, Early History of Reinforcement Learning,

 UNIT-6.
Temporal-Difference
Learning, Reinforcement Learning, Examples , Temporal-Difference Learning , TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0) , Sarsa: On-policy TD Control, Q-learning: O_policy TD Control, Expected Sarsa, Maximization Bias and Double Learning Games, After states, and Other Special Cases .

References Books:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India,) ISBN 13: 9788126527410, 2011 (Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, and Chapter 13.

2. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, 2017, 2nd edition, The MIT Press, Cambridge, Massachusett, London, England (chapter 1, and 6)
3. Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012, ISBN 0-13-261066-3

MPHILLCS -104

Elective-II D- Sensor Networks Infrastructure

Course objectives:
1. Understand of Wireless Sensor Networks and its applications.
2. Understanding of Basic Wireless Sensor Technology.
3. Discuss Wireless Transmission Technology and Protocols.
4. Operating Systems for Wireless Sensor Networks.
Course Outcomes:

The students should be able to:
1. Explain the wireless sensor networks and its applications
2. Explain Basic technologies for WSN.
3. Different types of Protocols for WSN.
4. Understand different types of Operating system for WSN.

Unit -1: Introduction to Wireless Sensor Networks

Introduction and Overview of Wireless Sensor Networks: Introduction, Basic
Overview of the Technology, Applications of Wireless Sensor Networks:
Introduction, Background, Range of Applications, Examples of WSN
Applications.
Unit- 2: Basic Wireless Sensor Technology:

 Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies,

Unit-3: MAC protocols

Available Wireless Technologies: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study.

Unit -4: Routing

Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges

Unit -5: Network Layer design

Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks,

Unit- 6: OS Support for Sensor networks

Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems, 1 TinyOS, 276 2 Mate, 277 3 MagnetOS, 278 4 MANTIS, 278 5 OSPM, 279 6 EYES OS, 279 7 SenOS, 280 8 EMERALDS, 280 9 PicOS,

Reference Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati "WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications" John Wiley & Sons, Inc. Publications.
2. Holge Karl and Andreas Willing " Protocols and Architectures for Wireless Sensor Networks" 2011 John Wiley & Sons, Inc. Publications.
3.Matthijs Kooijman Building Wireless Sensor Networks Using Arduino (Community Experience Distilled).
4. Edgar H. Callaway Jr Wireless Sensor Networks: Architectures and Protocols (Internet and Communications)

COMP -104
Elective-II E - Bioinfomatics And Application

Unit -1: Introduction to Bioinformatics: Present, Future and Prospective

Chronological history of Bioinformatics, Founder of Bioinformatics, Other renowned contributors, Various Definitions for Bioinformatics, Bioinformatics infrastructure in India, Bioinformatics business in India and world, Advantages for India to grasp the bioinformatics market, Bioinformatics Scope and Applications

Unit -2: Bioinformatics and Internet

Internet and Bioinformatics, Fundamentals of Internet, Exchanging Information through File Transfer Protocol (FTP), World Wide Web and http, Hypertext Markup Language (HTML), Web browsers, Evolution of search engine concept, Search-based application, Google: Unlimited and Universal Source of Knowledge, Scirus: A specialised search engine for science

Unit -3: Information Molecule and Information Flow

Cell – the Basic Unit of Life, Cell components and organelles, DNA properties, DNA replication, transcription and translation, Central dogma of molecular biology, Protein, Structure of protein, Proteomics

Unit -4: Introduction to Databases

General Introduction, Requirement of Database, What is Database?, Types of Biological Databases, Major biological databases and consortium, National Center for Biotechnology Information (NCBI), European Molecular Biology Laboratory (EMBL), DNA Data Bank of Japan (DDBJ), International Collaboration Framework of Nucleotide Sequence Database Construction (INSDC), The Protein Data Bank (PDB), SWISS-PROT database, Translation of EMBL nucleotide sequence database (TrEMBL), UniProt database, Major data retrieval systems, NCBI Entrez, GenBank, PubMed, Sequence Retrieval System (SRS)

Reference Books

1   DNA Sequencing: From Experimental Methods to Bioinformatics, Luke Alphey, BIOS scientific publisher,1997.
2   Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, OUP Oxford, 2008.
3   Bioinformatics: The Machine Learning Approach, P.Baldi and S. Brunak, 2nd Edition,

    A Bradford book, 2001.

4   DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling
    Pierre Baldi, G. Wesley Hatfield, Cambridge University Press, 2002.

5   Bioinformatics for Geneticists , Michael Barnes, Ian C Gray, Willy publisher, 2007.

6   Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 2nd Edition,

    Andreas D. Baxevanis and B. F. Francis Ouellette.

7   Bioinformatics Computing ,Bryan P. Bergeron, prentice Hall India Learning private.

Evaluation Pattern:

All theory papers will carry 50 marks as internal and 50 marks as external. Internal marks will consist of two tests (20 marks each) and one seminar / tutorial of 10 marks. The internal marks will be given by respective college/campus Schools. The external exam for 50 marks will be conducted by the University. The candidate has to secure min. 50% marks in internal exam and external exam separately. Otherwise he/she will be declared failed.

Important note: Each theory paper, dissertation, *Viva-Voce* and seminar will form separate heads of passing. A candidate will have to obtain minimum 50% marks in each head of passing for getting M.Phil. Degree.

Passing Rules for M. Phil. courses:

Sr.	Marks	Grade	Grade point
1	100-90	A+	10
2	89-90	A	9
3	79-70	B+	08
4	69-60	B	07
5	59-50	C+	06
6	Less than 49 and FR	FR	0 (Fail)

The assessment of the seminar (MPHILLCS-107) will be made by the Head of the Department in the concerned subject, Research Guide and any two research guides in the campus Schools/College Department. The candidate will have to deliver minimum two seminars each carrying 12.5 marks. Among these two seminars, one seminar should be on the Dissertation.

If the candidate has secured minimum passing grade points in all the Heads of Passing and presented at least one research paper at Regional/State/National Level Conference/ Seminar/ Symposia, then the student shall be allowed to present pre-M.Phil. Dissertation seminar and to submit the Dissertation. *Viva-Voce* (MPHILLCS-106) on Dissertation will be arranged later on. This *Viva-Voce* will be delivered by the candidate only after receiving the satisfactory report and assessment (marks) of the dissertation by the referee(s).

In case of Dissertation, the marks and grades awarded by the external referee shall be considered as final. If external referee has suggested modifications in the Dissertation, the candidate shall resubmit the Dissertation after suitable modifications within a period of two months from the declaration of the first result. In case of rejection of Dissertation, the candidate will have to resubmit the Dissertation within a period of six months and a fresh referee panel may be appointed for evaluation of the resubmitted Dissertation. Only one resubmission of the dissertation shall be allowed in the academic session. If the evaluation report/mark is not satisfactory, then the candidate has to reappear for *Viva-Voce*. In case of course work, a student who does not get the minimum passing grade point

he/she has to reappear the examination in that course and only two chances will be given for re-examination.

Duration of the Course:

The M.Phil course is a full-time course spread over for one and half academic year. First six months are devoted for contact hours/class room lectures and remaining part of one year is devoted for library work, documentation, laboratory work and preparation of dissertation etc. The Dissertation of the candidates will be accepted only after completion of the following requirements of the course.

   i.   Satisfactory attendance 75%

  ii.   Passing all the theory papers.

  iii.   Presenting at least one research paper at Regional / State / National level Conference / Seminar / Symposium.

A candidate is required to submit four copies of his/her dissertation to the university. A candidate must complete the entire course within a period of one and a half years from the date of registration.

Question paper Pattern

Paper Title
M.Phil. (Computer Science)CGPA pattern
Examination summer/ winter 2014

Question 1. Compulsory   10 Marks

Question 2. A   10 Marks
OR
Question 2. B

Question 4.   A   10 Marks
OR
Question 4.   B

Question 5.   Write short note on (any two)   10 Marks
  a.
  b.
  c.
  d.
  e.

Director
School of Computational Sciences
S.R.T.M. University, Nanded (M.S.)

M.phil - 19-20