

Swami Ramanand Teerth Marathwada University, Nanded

School of Computational Sciences

M. Phil. in Computer Science

W.e.f. (2013-2014)



Paper	Title	Credit	Credits
Compulsory			
COMP-101	Research Methodology	100	4
COMP -102	Mathematical Foundations of Computer Sciences	100	4
Elective -I (any one) COMP -103	A- Advances in Computer Vision	100	4
	B- Advanced Computer Networks		
	C- Mobile Computing		
	D- Cloud Computing		
	E- Bioinformatics and applications		
Elective -II (any one) COMP -104	A- Data Mining and applications	100	4
	B- Machine Learning		
	C- Simulation and Modeling		
	D- Wireless and Mobile Communications		
COMP -105	Dissertation	150	6
COMP -106	Viva-Voe	50	2
COMP -107	Seminar	25	1
	Total	625	25

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

COMP-101

Research Methodology

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 Interpretation 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.

COMP-102
Mathematical Foundations of computer Sciences

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.

COMP -103
Elective –I A- Advances in Computer Vision

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

COMP-103
Elective-I B- Advanced Computer Networks

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 servers.

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, ports, 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.
1. Forouzan, TCP-IP, Protocol Suit, TMH.
2. Comer, Internetworking with TCP-IP Vol. 3.
3. W. Richard Stevens, UNIX Network Programming.
4. Stallings, SNMP, Pearson.
5. Hunt Craig, TCP-IP Network Administration.
6. Loshin, Harwurt, TCP-IP Cleanly Explained.

COMP -103

Elective-I C- MOBILE COMPUTING

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.

COMP -103
Elective-I D-Cloud Computing

UNIT-1 First Drive

Grid computing, Grid-The way to cloud, Emerging through cloud, Benefits, Buisness and IT Perspective, Cloud Virtualization, Cloud Services Requirement, Cloud and Dynamic Infrastructure, Cloud computing Characteristics, Cloud computing Barriers.

UNIT-2 Cloud Models

Cloud Characteristics: On-demand service, Ubiquitous Network Access, Location Independent Resource Pooling, rapid elasticity.

Measured Services: Cost factor, Benefits,

Cloud Models: Public clouds, Private Clouds, Hybrid clouds, Community clouds, Cloud Models Impact.

UNIT-3 Security in a Public cloud

Multi-tenancy, Srvce Assessment, Shared risk, Staff Security Screening, Distributed Data Cnetres, Physical Security, Policies, Coding, Data Leakages, Public vs Private cloud, Cloud infrastructure self services.

UNIT-4 Cloud as a Service

Platform as a service, Software as a service, Infrastructure as a service, Principle technologies, cloud strategy, platform integration and deployment component services.

UNIT-5 Cloud Solutions

Cloud application planning, Cloud Business and Operational Support Services, Cloud eco system, Identifying BPM Opportunities, cloud technical strategy, cloud stack: Cloud stack requirement analysis, cloud infrastructure security.

UNIT-6 Cloud Offering

Information storage, Retrieval, Archive and Protection, Cloud Business Analytic Competencies, testing under cloud, Information security, Virtual Desktop Infrastructure.

Reference Books:

1. Dr. Kumar Saurabh, "Cloud Computing: Inside into- Era Infrastructure, Wiley India Pvt. Ltd.

COMP -103
Elective-I E - Bioinformatics 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, Wiley 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.

COMP -104
Elective –II A-Data Mining and Applications

UNIT –1 Data Warehousing

Data Warehousing: Introduction, Definition, Architecture, Warehouse Schema, Warehouse server, OLAP operations, Multidimensional Data Model, Meta data, OLAP engine, Data warehouse backend process.

UNIT –2 Data Mining

Data Mining definition , KDD Vs Data Mining, DBMS Vs DM, DM Techniques, issues and Challenges in DM, DM Application areas, DM Application and case studies.

UNIT –3 Association Rules

Introduction to Association rule, Methods to discover association rule, a priori algorithm, Partition algorithm, Pincer-search algorithm, Dynamic Itemset Counting Algorithm, FP-tree Growth Algorithm, Incremental Algorithm, Border Algorithm, Generalized Association rule, association rules with Item Constraints.

UNIT-4 Clustering Techniques

Introduction, Clustering Paradigms, Partitioning Algorithms, K means & K Mediod algorithms, CLARA, CLARANS, Hierarchical clustering, DBSCAN, BIRCH, Categorical Clustering algorithms, STIRR, ROCK, CACTUS.

UNIT-5 Decision Trees

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

UNIT-6 Other Techniques

Introduction to Neural Network, Learning in NN, Unsupervised Learning, Data Mining using NN: A Case Study, Genetic Algorithm, Rough Sets, support Vector Machines

Reference Books:

1. Arun k Pujari , —Data Mining Techniques, University press , edition 2001.
2. Jaiwei Han, Micheline Kamber ,—Data Mining : Concepts and Techniques —
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar,—Introduction to Data Mining, 2007.
4. T.Sushmita mitra, Tir ku Acharaya , —Data Mining Multimedia , Softcomputing &
5. Bioinformatics, Wiley Interscience publications , 2004.
6. Michal J A Berry , Gordon Linoff , —Mastering Data Mining, John Wiley & Sons ,2000.
7. Alex Berson , Stephen J.Smith , —Data Warehousing , Data Mining & OLAP —, Tata McGrawhill
8. C S R Prabhu, —Data Warehousing concepts , techniques and applications —, Prentice Hall of India, 2nd edition , 2002

COMP -104
Elective –II B-Machine Learning

UNIT -1 Pattern Recognition

What is Pattern recognition; Applications and Examples, Paradigms of Pattern Recognition, Representation of Patterns and classes, Feature Extraction; Different methodologies of feature selection, classification vs clustering, study of different classifiers.

UNIT -2 Introduction to Artificial Neural Network

Biological Neuron and Artificial Neuron Model, McCulloch-Pits Neuron Model, Perceptron Classification, Linearly Separability, XOR Problem, Overview of Neural Network, Architecture, Learning Rules, Supervised Learning, Unsupervised Learning, Perceptron Learning, Reinforcement Learning, Delta Learning Rule.

UNIT -3 Multilayer Neural Network

Generalized Delta Learning, Back propagations training algorithm and derivation of weight, Variant in Back propagations, Radial Basis Function (RBF), Application of BP and RBF N/W Counter Propagation, Kohonen Self Organizing feature Maps, Hopfield network

UNIT -4 Fuzzy Logic

Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Fuzzy Sets Vs Crisp Sets, Additional Properties Fuzzy complements, Fuzzy Union, Fuzzy Intersections, Crisp & Fuzzy Relation, Binary Fuzzy Relation, Binary Relation on single set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relation, properties of alpha cuts, Presentation of fuzzy sets, Extension principle for fuzzy sets Fuzzy Compatibility Relation.

UNIT -5 Fuzzy system & Neuro fuzzy system

Fuzzy Neurons , Fuzzy Neural networks, Applications of Fuzzy Neural networks

UNIT -6 Introduction to Biometrics

Introduction of biometric traits and its aim, Image processing/pattern recognition/statistics, Error types. Biometric system, authentication, physiological and behavioral properties, properties of biometric system, Application areas. Fingerprint recognition, Enhancement, Thinning, minutiae, CN number, matching, Ear and Iris recognition, normalization, matching and decision

Reference Books:

1. Fuzzy Sets and Fuzzy Logic Theory and Application By- George J. Klir, Bo Yuan
2. Fuzzy Sets Uncertainty and Information By- George J. Klir, Tina A. Floger
3. Introduction to the Theory of Neural Competition By- John hertz, Krogh and Richard Addision Wesely
4. Artificial Neural Systems By Jack M. Zurada West Publishing Company, 1992.
5. Fuzzy Logic with Engineering Applications“, By Timothy J. Ross, „McGraw Hill, 1997.
6. Neural Networks A CLASS ROOM APPROACH By Satish Kumar, Tata McGraw –Hill

Publishing.

7. Pattern Classification, second edition, by "Richard O.Duda, Peter E. Hent & David G. Strok.
8. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.

COMP -104
Elective –II C-Modeling and Simulation

UNIT-1.

Introduction to Systems modeling concepts, continuous and discrete formalisms

UNIT-2.

Framework for Simulation and Modeling, modeling formalisms and their simulators, discrete time, continuous time, discrete event, process based.

UNIT-3.

Hybrid systems and their simulators, Review of basic probability, probability distributions, estimation, testing of hypotheses

UNIT-4.

Selecting input probability distributions, models of arrival processes

UNIT-5.

Random number generators, their evaluation, generating random variates from various distributions.

UNIT-6.

Output analysis, transient behavior, steady state behavior of stochastic systems, computing alternative systems, variance reduction techniques, Verification and Validation

References Books:

1. Discrete Event System Simulation, 3rd ed., J. Banks, J. Carson, B. Nelson, D. Nicol, Prentice Hall Pub., 2001
2. Simulation Modeling and Analysis, 3rd ed., A. Law, W. Kelton, McGraw Hill Pub., 2000
3. Simulation with Arena, 2nd ed., W. Kelton, R. Sadowski, D. Sadowski, McGraw Hill Pub., 2002
4. Theory of modeling and Simulation, 2nd ed., B. Zeigler, H. Praehofer, T. Kim, Academic Press, 2000

COMP -104

Elective-II D-Wireless Mobile Communication

Unit -1: Introduction to Wireless Mobile Communication

A Short history of wireless communication, a market for mobile communication, Some research topics, A simplified reference model, Wireless Transmission, Frequencies for Radio transmission: Signal antennas, signal propagation, Multiplicity, modulation, spread spectrum, cellular systems.

Unit- 2: Medium Access Control

Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA Telecommunication Systems: GSM, DECT, TETRA, UMTS.

Unit-3: Satellite Systems

Basics, Routing, Localization, Handover, And Broadcast System: Cyclic repetition of data, digital audio broadcasting digital video broadcasting.

Unit -4: Wireless LAN

Infrared vs. radio transmission, ad-hoc networks, IEEE802.11, Bluetooth, Wireless ATM, Motivation for WATM, WATM services reference model, functions, radio access layer, handover, location management, addressing, mobile quality of service, access point control protocol.

Unit -5: Mobile Network Layer

Mobile IP, Dynamic host configuration protocol, Ad-hoc Networks, Mobile Transport Layer: Traditional TCP, Indirect TCP, Mobile TCP.

Unit- 6 :Support Layer for Mobility

File system, WWW, WAP

Reference Books:

1. Jochen Schiller, Mobile Communication, Pearson Education Asia.
2. Mallick, Mobile and wireless design essentials, Wiley computer pub.
3. Andy Dornan, the Essential Guide of Wireless communications Applications, Pearson Education Asia
4. Weisman, the Essential guide to RF and wireless, Pearson Education Asia Lee, Mobile Cellular Telecommunications, MGH.

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Unit -1: Introduction to Wireless Mobile Communication

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