P.hD. COMPUTER SCIENCE AND ENGINEERING

SYLLABI 2022-2023

Department of Computer Science and Engineering

FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)

(Accredited with A+ Grade by NAAC in Second Cycle)

Pollachi Main Road, Eachanari Post

Coimbatore-641021.

FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
RESEARCH PROGRAM – PhD in Computer Science and Engineering
(2022–2023 Batch and onwards)

Course Code	Name of the Course	Instruction Hours / Week	Credits	Maximum Marks (100)
22RCSE101	Research Methodology and pedagogy	4	4	100
22RCSE201	Research Publication Ethics	4	4	100
22RCSE301	Advanced digital image processing	4	4	4
22RCSE302	Cryptography and Network Security			
22RCSE303	Data Warehousing and Data Mining			
22RCSE304	Network Routing Algorithms			
22RCSE305	Internet of Things			
22RCSE306	Machine Learning			
22RCSE307	Virtual Reality			
22RCSE308	Ad hoc Networks			
22RCSE309	Big Data			
22RCSE310	Distributed Computing			
22RCSE311	Grid Computing			
22RCSE312	Cloud Computing			
Program Total		12	12	300

22RCSE101 **RESEARCH METHODOLOGY AND PEDAGOGY** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**
Exam: 3 Hours

UNIT I-INTRODUCTION TO RESEARCH

Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps. Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

UNIT II-EXPERIMENTAL DESIGN

Laboratory and the Field Experiment – Internal and External Validity – Factors affecting Internal validity. Measurement of variables – Scales –Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale-Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non- probability sampling method – convenience sampling, judgment sampling, quota sampling.

UNIT III-TESTING METHODS

Hypotheses testing – Testing of hypotheses concerning means (one mean anddifference between two means -one tailed and two tailed tests), Concerning variance – onetailed Chi-square test-Nonparametric tests- One sample tests – one sample sign test, Kolmogorov-Smirnovtest, run test for randomness, Two sample tests – Two sample sign test, Mann-Whitney U test,K-sample test – Kruskal Wallis test (H-Test)

UNIT IV-MULTIVARIATE STATISTICAL TECHNIQUES

Data Analysis – Factor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical (SPSS) Software Package in Research.

UNIT V-PEDAGOGICAL METHODS IN HIGHER LEARNING

Objectives and roll of higher education- important characteristics of an effective lecture- Quality teaching and learning- Lecture preparation- Characteristics of instructional design- Methods of teaching and learning: Large group –Technique- Lecture, Seminar, Symposium, Team Teaching, Project, small group technique-Simulation, role playing demonstration, Brain storming, Case studies and assignment, methods of evaluation-self-evaluation, student evaluation, diagnostics testing and remedial teaching –question banking-electronic media in education:-'e' learning researches-web based learning.

SUGESSTED READINGS

1. Donald R. Cooper and Ramela S. Schindler, (2000), Business Research Methods, Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. Uma Sekaran, (2000), Research Methods for Business, John Wiley and Sons Inc., New York.

3. C.R.Kothari, (2001),Research Methodology, WishvaPrakashan, New Delhi.

4. Donald H.McBurney, (2002), Research Methods, Thomson Asia Pvt. Ltd. Singapore.

5. G.W.Ticehurst and A.J.Veal, (1999), Business Research Methods, Longma.

6. Ranjit Kumar, (2199), Research Methodology, Sage Publications, London, New Delhi.

7. Raymond-Alain Thie'tart, et.al., (1999), Doing Management Research, Sage Publications, London.

8. Panneerselvam, R., (2004), Research Methodology, Prentice-Hall of India, New Delhi.

22RCSE201 **RESEARCH PUBLICATION ETHICS** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**
Exam: 3 Hours

Unit I: Philosophy and Ethics

Introduction to Philosophy: Definition, nature and scope, concept, branches- Ethics: Definition, moral Philosophy,nature of moral judgments and reactions.

Unit II: Scientific conduct

Ethics with respect to science and research – Intellectual honesty and research integrity – scientific misconduct: Falsification – Fabrication and plagiarism (FFP) – Redundant Publications: duplicate and overlapping publications – salami slicing – Selective reporting and misrepresentation of date.

Unit III: Publication Ethics

Publication Ethics: Definition, introduction and importance – Best practices / standards setting initiatives and guidelines: COPE , WAME, etc,-Conflicts of interest -Publication Misconduct: definition, concept, problems that lead to unethical behavior and vice versa, type-Violation of publication ethics,
Authorship and contributor ship – Identification of publication misconduct, complaints and appeals-Predatory publishers and journals

Unit IV: Publication Misconduct

Group Discussions: Subject specific ethical issues, FFP, authorship- Conflicts of interest-Complaints and appeals: examples and Fraud from India and abroad.

Software tools: Use of plagiarism software like Tumitin, Urkund and other open source software tools

Unit V: Database and Research Metrics

Database : Indexing database-Citation database: Web of Science, Scopus, etc

Research Metrics: Impact Factor of journal as per journal citation Report, SNP, SJR,IPP, Cite score-Metrics:h-index, 110 index, altmetrics.

Unit VI: Development of e-conduct & IPR

Integrated Library Management System (ILMS) : e-journals-e-books- e- shodsindu- shodhganga-Database –e-content Development –Learning Management system(LMS) –e-PG-Pathshala-CEC(UG) SWAYAM-MOOCs-NPTEL-NMEICT.

IPR: Patent-Copyrights-Trademark-Geographical Indication.

PRACTICE

Open ACCESS Publishing

Open access publications and initiatives –SHERPA/ROMEO online resource to check polisher copyright & self-archiving policies-Software tool to identify predatory publications developed by SPPU –journal finder/Journal suggestion tools viz, JANE Elsevier Journal Finder, Springer Journal Suggester, etc.

SUGESSTED READINGS

1. Best Practice Guidelines on Publishing Ethics: A Publisher's Perspective, Second Edition, 2014 John Wiley & Sons, Ltd.
2. Wager E. The Committee on Publication Ethics (COPE): Objectives and achievements 1997-2012. Presse Med. 2012
3. Carlson RV, Boyd KM, Webb DJ. The revision of the Declaration of Helsinki: Past, present and future. Br J Clin Pharmacol. 2004
4. KambadurMuralidhar, Amit Ghosh,& Ashok Kumar Singhvi "ETHICS in Science Education,Research and Governance",
5. Indian National Science Academy, New Delhi 2019
6. Publishing Ethics: Academic Research, Cambridge University Press ,Version 2.0, May 2019.

22RCSE301   **ADVANCED DIGITAL IMAGE PROCESSING**   **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External: **100** Total: **100**
                                                     Exam: 3 Hours

UNIT I-FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

UNIT II-SEGMENTATION

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

UNIT III-FEATURE EXTRACTION

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model-based features, Gabor filter, wavelet features.

UNIT IV-REGISTRATION AND IMAGE FUSION

Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching Template matching. Transformation functions-Similarity transformationand Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusiondiscrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V-3D IMAGE VISUALIZATION

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images

SUGESSTED READINGS

1. John C.Russ, (2011), "The Image Processing Handbook", CRC Press.
2. Mark Nixon, Alberto Aguado, (2012), "Feature Extraction and Image Processing", Academic Press, 3rd edition.
3. ArdeshirGoshtasby, (2005)," 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications",John Wiley and Sons.
4. Rafael C. Gonzalez, Richard E. Woods,(2007), Digital Image Processing', Pearson,Education, Inc., 3rd Edition.
5. Anil K. Jain, (2002), Fundamentals of Digital Image Processing', Pearson Education,Inc.,
6. Rick S.Blum, Zheng Liu,(2006), " Multisensor image fusion and its Applications",Taylor& Francis.

22RCSE302 **CRYPTOGRAPHY AND NETWORK SECURITY** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I -INTRODUCTION

Attacks - Services - Mechanisms - Conventional Encryption - Classical And

Modern Techniques – Encryption Algorithms - Confidentiality.

UNIT II- PUBLIC KEY ENCRYPTION

RSA - Elliptic Curve Cryptography - Number Theory Concepts

UNIT III- MESSAGE AUTHENTICATION

Hash Functions - Digest Functions - Digital Signatures - Authentication Protocols.

UNIT IV-NETWORK SECURITY PRACTICE

Authentication, Applications - Electronic Mail Security - IP Security - Web Security.

UNIT V-SYSTEM SECURITY

Intruders – Viruses – Worms – Firewalls Design Principles – Trusted Systems.

SUGESSTED READINGS

1. Stallings, (2012), Cryptography & Network Security - Principles & Practice, Prentice Hall, 6th Edition

2. Bruce, Schneier, (2016), Applied Cryptography, 2nd Edition, Toha Wiley & Sons,

3. Man, Young Rhee, (2003), "Internet Security", Wiley,

4. Pfleeger&Pfleeger, (2006), "Security in Computing", Pearson Education, 4th Edition,

22RCSE303 DATA WAREHOUSING AND DATA MINING **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I - INTRODUCTION

Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data Mining Process-Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems - Overview Of Data Mining Techniques.

UNIT II- DATA PREPROCESSING AND ASSOCIATION RULES

Data Preprocessing-Data Cleaning, Integration, Transformation, Reduction, Discretization Concept Hierarchies-Concept Description: Data Generalization And Summarization Based Characterization-Mining Association Rules In Large Databases.

UNIT III- PREDICTIVE MODELING

Classification And Prediction: Issues Regarding Classification And Prediction- Classification By Decision Tree Induction-Bayesian Classification-Other Classification Methods-Prediction-Clusters Analysis: Types Of Data In Cluster Analysis- Categorization Of Major Clustering Methods: Partitioning Methods –Hierarchical Methods

UNIT IV- DATA WAREHOUSING

Data Warehousing Components -Multi Dimensional Data Model- Data Warehouse Architecture-Data Warehouse Implementation- -Mapping The Data Warehouse To Multiprocessor Architecture-OLAP.-Need- Categorization Of OLAP Tools.

UNIT V- APPLICATIONS

Applications of Data Mining-Social Impacts Of Data Mining-Tools-An Introduction To DB Miner-Case Studies-Mining WWW-Mining Text Database-Mining Spatial Databases.

SUGESSTED READINGS

1. Jiawei Han, Micheline Kamber,(2011), "Data Mining: Concepts and Techniques",Morgan Kaufmann Publishers,
2. Alex Berson,Stephen J. Smith, (2004), "Data Warehousing, Data Mining,& OLAP", Tata Mcgraw-Hill,
3. Usama M.Fayyad, Gregory Piatetsky - Shapiro, Padhrai Smyth And Ramasamy, (2016).
4. Uthurusamy,(2016), "Advances In Knowledge Discovery And Data Mining", The M.I.T Press,
5. Ralph Kimball, (2018), "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc.,
6. Sean Kelly,(2017), "Data Warehousing In Action", John Wiley & Sons Inc.,

22RCSE304   **NETWORK ROUTING ALGORITHMS**   **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External: **100** Total: **100**

                                                                       Exam: 3 Hours

UNIT I-INTRODUCTION

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II-INTERNET ROUTING

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III-ROUTING IN OPTICAL WDM NETWORKS

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting-Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV-MOBILE - IP NETWORKS

Macro-mobility Protocols, Micro-mobility protocol:Tunnel based: Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V-MOBILE AD –HOC NETWORKS

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

SUGESSTED READINGS

1. William Stallings, (2009), "High speed networks and Internets Performance and Quality of Service", 2nd Edition, Pearson Education Asia. Reprint India.
2. M. Steen Strub,(2019), ' Routing in Communication network, Prentice –Hall International, Newyork.
3. S. Keshav,(2019), 'An engineering approach to computer networking' Addison Wesley.
4. William Stallings,(2019), 'High speed Networks TCP/IP and ATM Design Principles, Prentice-Hall, New York.
5. C.E Perkins, (2011), 'Ad Hoc Networking', Addison – Wesley.
6. Ian F. Akyildiz, Jiang Xie and ShantidevMohanty,(Aug.2004, pp 16-27) " A Survey of mobilityManagement in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications.

22RCSE305 **INTERNET OF THINGS** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I-INTRODUCTION

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT II-IOT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT III-WEB OF THINGS

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture

UNIT IV-INTEGRATED

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT V-APPLICATIONS

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments – Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid-Electrical Vehicle Charging

SUGESSTED READINGS

1. The Internet of Things in the Cloud: A Middleware Perspective - HonboZhou(2012), CRC Press.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) (2011) – Springer.
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, (2010), Cambridge University Press.
4. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley (2012).
5. Olivier Hersent, David Boswarthick, Omar Elloumi , (2012), "The Internet of Things – Key applications and Protocols", Wiley.

22RCSE306 **MACHINE LEARNING** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External: **100** Total: **100**
                                                                        Exam: 3 Hours

UNIT I-INTRODUCTION TO MACHINE LEARNING

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II- MACHINE LEARNING LINEAR MODELS

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi layer Perceptron in Practice – Examples of using the MLP – Overview– Radial Basis Functions and splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III- TREE AND PROBABILISTIC MODELS

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

UNIT IV- DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V- MACHINE LEARNING GRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

SUGESSTED READINGS

1. EthemAlpaydin, (2014) —Introduction to Machine Learning 3e (Adaptive Computation and MachineLearningSeries),ThirdEdition,MITPress,
2. Jason Bell, (2014)—Machine learning – Hands on for Developers and Technical Professionals, FirstEdition,Wiley,
3. Peter Flach, (2012) —Machine Learning: The Art and Science of Algorithms that Make Sense of Data,FirstEdition,CambridgeUniversityPress,.
4. Stephen Marsland, (2014) —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,
5. Tom M Mitchell, (2013) —Machine Learning, First Edition, McGraw Hill Education,
6. Christopher Bishop,(2007) "Pattern Recognition and Machine Learning" Springer,
7. Kevin P. Murphy,(2012), "Machine Learning: A Probabilistic Perspective", MIT Press,
8. Trevor Hastie, Robert Tibshirani, Jerome Friedman,(2011), "The Elements of Statistical Learning" Springer, Second Edition,
9. https://www.coursera.org/learn/machine-learning

22RCSE307 **VIRTUAL REALITY** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I -INTRODUCTION

Introduction-Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of the Wireless Channel - IEEE 802.11a,b Standard – Origin Of Ad hoc: Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios – Ad hoc Wireless Networks -What Is an Ad Hoc Network? Heterogeneity in Mobile Devices - Wireless Sensor Networks - Traffic Profiles - Types of Ad hoc Mobile Communications - Types of Mobile Host Movements - Challenges Facing Ad Hoc Mobile Networks-Ad hoc wireless Internet

UNIT II- AD HOC ROUTING PROTOCOLS

Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols -Table-Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) - Wireless Routing Protocol (WRP) - Cluster Switch Gateway Routing (CSGR) - Source-Initiated On-Demand Approaches - Ad Hoc On- Demand Distance Vector Routing (AODV) - Dynamic Source Routing (DSR) - Temporally Ordered Routing Algorithm (TORA) - Signal Stability Routing (SSR) - Location-Aided Routing (LAR) - Power-Aware Routing (PAR) - Zone Routing Protocol (ZRP)

UNIT III- MULTICASTROUTING IN AD HOC NETWORKS

Introduction - Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - An Architecture Reference Model for Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols- Mesh-Based Multicast Routing Protocols - Summary of Tree-and Mesh-Based Protocols - Energy-Efficient Multicasting - Multicasting with Quality of Service Guarantees - Application-Dependent Multicast Routing - Comparisons of Multicast Routing Protocols

UNIT IV- TRANSPORT LAYER, SECURITY PROTOCOLS

Introduction - Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks - Classification of Transport Layer Solutions - TCP Over Ad Hoc Wireless Networks - Other Transport Layer Protocols for Ad Hoc Wireless Networks - Security in Ad Hoc Wireless Networks - Network Security Requirements - Issues and Challenges in Security Provisioning - Network Security Attacks - Key Management - Secure Routing in Ad Hoc Wireless Networks

UNIT V-QoS AND ENERGY MANAGEMENT

Introduction - Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions - QoS

Frameworks for Ad Hoc Wireless Networks Energy Management in Ad Hoc Wireless Networks – Introduction - Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes

SUGESSTED READINGS

1. Siva Ram Murthy C. and B.S. Manoj (2004), "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR,

2. Toh C.K., (2001), Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR

3. Charles E. Perkins,(2000), Ad Hoc Networking, Addison Wesley,

4**.** Mobile Ad Hoc Networking **,** Stefano Basagni , Marco Conti ,(26 August 2010) Wiley India Private Limited ,

5**.** Mobile Ad Hoc Networks: Current Status and Future Trends Hardcover**,** Jonathan Loo , Jaime Lloret Mauri , (16 December 2011), CRC Press,.

22RCSE308 **ADHOC NETWORKS** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**
Exam: 3 Hours

UNIT I -INTRODUCTION

Introduction-Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of the Wireless Channel - IEEE 802.11a,b Standard – Origin Of Ad hoc: Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios – Ad hoc Wireless Networks -What Is an Ad Hoc Network? Heterogeneity in Mobile Devices - Wireless Sensor Networks - Traffic Profiles - Types of Ad hoc Mobile Communications - Types of Mobile Host Movements - Challenges Facing Ad Hoc Mobile Networks-Ad hoc wireless Internet

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UNIT V-QoS AND ENERGY MANAGEMENT

Introduction - Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions - QoS

Frameworks for Ad Hoc Wireless Networks Energy Management in Ad Hoc Wireless Networks – Introduction - Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes

SUGESSTED READINGS

1. Siva Ram Murthy C. and B.S. Manoj (2004), "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR,

2. Toh C.K., (2001), Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR

3. Charles E. Perkins,(2000), Ad Hoc Networking, Addison Wesley,

4**.** Mobile Ad Hoc Networking **,** Stefano Basagni , Marco Conti ,(26 August 2010) Wiley India Private Limited ,

5**.** Mobile Ad Hoc Networks: Current Status and Future Trends Hardcover**,** Jonathan Loo , Jaime Lloret Mauri , (16 December 2011), CRC Press,.

22RCSE309 **BIG DATA** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**
Exam: 3 Hours

UNIT I - UNDERSTANDING BIG DATA

What is big data – why big data – convergence of key trends – unstructured data – industryexamples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

UNIT II - NOSQL DATA MANAGEMENT

Introduction to NoSQL – aggregate data models – aggregates – key-value and document datamodels – relationships – graph databases – schemaless databases – materialized views
– distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map- reduce – partitioning and combining – composing map-reduce calculations

UNIT III - BASICS OF HADOOP

Data format – analyzing 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 IV - MAPREDUCE APPLICATIONS

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

UNIT V   HADOOP RELATED TOOLS

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

SUGESSTED READINGS

1.Michael Minelli, Michelle Chambers, and Ambiga Dhiraj,(2013), "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.

2. P. J. Sadalage and M. Fowler, (2012), "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional,

3.Tom White,(2012), "Hadoop: The Definitive Guide", Third Edition, O'Reilley,

4.Eric Sammer, (2012) , "Hadoop Operations", O'Reilley,

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

6.Lars George,(2011), "HBase: The Definitive Guide", O'Reilley,

7. Eben Hewitt,(2010), "Cassandra: The Definitive Guide", O'Reilley,

8.Alan Gates,(2011), "Programming Pig", O'Reilley,

22RCSE310 **DISTRIBUTED COMPUTING** **4H–4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I - INTRODUCTION

Characterization of Distributed Systems - Examples - Resource Sharing and the Web -Challenges - System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles - Internet Protocols - CaseStudies.

UNIT II- PROCESSES AND DISTRIBUTED OBJECTS

Interprocess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Case Study - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications - Java RMI - Case Study.

UNIT III- OPERATING SYSTEM ISSUES – I

The OS Layer - Protection - Processes and Threads - Communication and Invocation – OS Architecture - Security - Overview - Cryptographic Algorithms - Digital Signatures - Cryptography Pragmatics - Case Studies - Distributed File Systems - File Service Architecture - Sun Network File System - The Andrew File System

UNIT IV- OPERATING SYSTEM ISSUES – II

Name Services -Domain Name System - Directory and Discovery Services – Global Name Service - X.500 Directory Service - Clocks, Events and Process States - Synchronizing Physical Clocks - Logical Time And Logical Clocks - Global States - Distributed Debugging - Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

UNIT V- DISTRIBUTED TRANSACTION PROCESSING

Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions – Atomic Commit Protocols - Concurrency Control in Distributed Transactions – Distributed Deadlocks - Transaction Recovery - Overview of Replication And Distributed Multimedia Systems

SUGESSTED READINGS

1. George Coulouris, Jean Dollimore and Tim Kindberg, (2011), Distributed Systems Concepts and Design, Pearson Education, 5th Edition,

2. SapeMullender,(1993), Distributed Systems, Addison Wesley, 2nd Edition,

3. Albert Fleishman, (1994), Distributes Systems- Software Design and Implementation, Springer-Verlag,

4. Liu M.L.,(2004), Distributed Computing Principles and Applications, Pearson Education,

5. Andrew S Tanenbaum ,Maartenvan Steen, (2006), Distibuted Systems –Principles and Pardigms,Pearson Education,

6. MugeshSinghal,Niranjan G Shivaratri, (2008), Advanced Concepts in Operating Systems,Tata McGraw Hill Edition, 21st reprint,

22RCSE311	GRID COMPUTING	4H–4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External: **100** Total: **100**

Exam: 3 Hours

UNIT I - GRID COMPUTING

Introduction - Definition - Scope of grid computing

UNIT II- GRID COMPUTING INITIATIVES

Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing Road map.

UNIT III- GRID COMPUTING APPLICATIONS

Merging the Grid sources – Architecture with the Web Devices Architecture.

UNIT IV- TECHNOLOGIES

OGSA – Sample use cases – OGSA platform components – OGSI – OGSA Basic Services.

UNIT V- GRID COMPUTING TOOL KITS

Globus Toolkit – Architecture, Programming model, High level services – OGSI .Net middleware Solutions.

SUGESSTED READINGS

1. Joshy Joseph & Craig Fellenstein, (2016), "Grid Computing", PHI, PTR

2. Ahmar Abbas, (2013), "Grid Computing: A Practical Guide to technology and Applications", Charles River media

22RCSE312 CLOUD COMPUTING 4H-4C

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: External: **100** Total: **100**
Exam: 3 Hours

UNIT I -UNDERSTANDING CLOUD COMPUTING
Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II- DEVELOPING CLOUD SERVICES
Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service –Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools Amazon Ec2 – Google App Engine – IBM Clouds

UNIT III- CLOUD COMPUTING FOR EVERYONE

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV- USING CLOUD SERVICES
Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

UNIT V- OTHER WAYS TO COLLABORATE ONLINE

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services –Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

SUGESSTED READINGS

1. Antonopoulos, (2012), Cloud Computing: Principles, Systems and Applications, Springer IndiaPrivate Limited
2. Dimitris N. Chorafas, (2 August 2014), Cloud Computing Strategies Hardcover, CRC Press,
3. Michael Miller, (August 2016), Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing,.
4. Haley Beard,(July 2018), Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited,