Ph.D., COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus

Regular (2023 – 2024)

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)
(Accredited with A+ Grade by NAAC in the Second Cycle)
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DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

Ph. D Computer Science

(2023 – 2024 Batch and onwards)

Course code	Name of the course	Instruction hours / week			Credit(s)	Maximum Marks	Page No
		L	T	P		ESE (100)	
23RCS101	Research Methodology and Pedagogy	4	-	-	4	100	1
23RCS201	Research Publication Ethics	4	-	-	4	100	3
23RCS301	Cryptography and Network Security	4	-	-	4	100	5
23RCS302	Advanced Networking	4	-	-	4	100	7
23RCS303	Data Mining and Analytics	4	-	-	4	100	9
23RCS304	Digital Image Processing	4	-	-	4	100	12
23RCS305	Soft Computing	4	-	-	4	100	14
23RCS306	Web Data Analytics	4	-	-	4	100	16
23RCS307	Software Engineering	4	-	-	4	100	18
23RCS308	Cyber Security	4	-	-	4	100	20
23RCS309	Machine Learning	4	-	-	4	100	22
23RCS310	Cloud Computing	4	-	-	4	100	24
23RCS311	Internet of Things	4	-	-	4	100	26
23RCS312	Artificial Intelligence	4	-	-	4	100	28

23RCS101   Paper – I Research Methodology and Pedagogy   4H-4C

Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
                                                        End Semester Exam: 3 Hours

Course Objectives
- To construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology
- To understand the methods of data collection
- To make the students understand the techniques in report writing
- To understand the use of statistical analysis
- To enable the students to understand the evaluation of research.

Course Outcomes (COs)
1. Read, interpret, and critically evaluate social research.
2. Identify, explain, and apply the basic concepts of research, such as variables, operationalization, sampling, reliability, and validity.
3. Recognize the ethical issues involved in research, and practice ethical research standards. 4. Identify and explain the difference between quantitative, qualitative, and mixed methods research and what types of research questions can be answered with each method.
4. Use theory and previous research to create research questions and hypotheses and to identify and analyze the appropriate method and variables needed for research questions.
5. Use a variety of research methods through hands-on experience.

Unit I - RESEARCH METHODOLOGY
Research Methodology: Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research Approaches – Significance of Research – Research methods versus methodology. Research and Scientific Method – Importance of knowing how Research is done – Research process – Criteria for good Research – Problems encountered by Researchers in India. Journal Reading Techniques - Defining the Research problem – What is the Research Problem – Selecting the Problem – Necessity of Defining the problem – Technique involved in Defining the Problem – An illustration – Conclusion.

Unit II - METHODS OF DATA COLLECTION
Collection of primary data – Collection of data through questionnaires – Schedules – Differentiation between questionnaires and schedules – Other methods of data collection – Collection of secondary data – Selection of appropriate method for data collection– Guidelines for constructing questionnaire/Schedule–Guidelines for successful Interviewing – Difference between survey and experiment – Data Collection using Journals

Unit III - RESEARCH DESIGN
Need for Research Design – Features of good design – Important concepts relating to Research Design – Different Research Design – Basic principles of Experimental Designs –

Conclusion – Developing a Research Plan. Significance of Report Writing – Different steps in writing Report – Layout of the Research Report – Types of Reports – Oral presentation – Mechanics of writing a Research Report – Precautions for writing a Research Reports – Conclusions.

Unit IV - STATISTICAL ANALYSIS
Central tend in correlation, auto correlation and regression analysis, curve fitting - probability models-distribution. Testing of hypothesis- Analysis variance, testing means for small and large sequence. Simulation-render generation techniques and distribution monte carlo model. Data Analysis: Mathematical and statistical analysis using software tools.

Unit V - PEDAGOGICAL METHODS IN HIGHER EDUCATION
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, Tam Teaching, Project, Small group Technique- Simulation, role playing Demonstration, Brain storing, case discussion and assignment, Methods of evaluation- Self evaluation, student evaluation. Diagnostic testing remedial teaching Question banking-Electronic media in education –'e' learning researches web based learning.

SUGGESTED READINGS
1.   Deepak Chawla , Neena Sondhi. (2018). Research Methodology: Concepts and Cases. 2nd Edition. Vikas Publishing House Private Ltd, New Delhi.
2.   C.R. Kothari. (2017). Research Methodology – Methods and Techniques. 2nd Edition. New Age International (P) Limited. New Delhi.
3.   Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams . (2017). The Craft of Research. 3rd Edition, University of Chicago Press.
4.   C Eileen M. Trauth. (2017). Qualitative Research in IS: Issues & Trends. IDEA Group Publishing. USA/London (ISBN: 1-930708-06-08)
5.   Vedanayagam, E.G. (1989). Teaching technology for college teachers. Sterling Publishers(P) Ltd., New Delhi.
6.   Kumar K.L. (1997) Educational Technologies, New age International. New Delhi.
7.   Winkler, Anthony C. & Jo Roy Mc Cuen. (1985). Writing a research Paper: A Handbook, 2nd edition, Harcourt,NY.

WEBSITES
1.   www.dcs.gla.ac.uk/~johnson/teaching/research_skills/research.html
2.   http://www.csc.liv.ac.uk/~ullrich/COMP516
3.   http://www.idi.ntnu.no/~thomasos/paper/interpretive.pdf

23RCS201   **Paper – II Research Publication Ethics**   **4H-4C**
Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**
                                                      End Semester Exam: 3 Hours

Course Objectives
- To understand the ethical codes to be followed by the researcher
- To maintain scientific integrity in the research
- To promote knowledge and truth in the research
- To understand trust, respect, and objectivity in a collaborative work

Course Outcomes (COs)
1. Be aware about the publication ethics and publication misconducts
2. Understand the philosophy of science and ethics and research integrity
3. Develop hands-on skills to identify research misconduct and predatory publications.
4. Differentiate indexing and citation databases, open access publication and research metrics
5. Use plagiarism tools

Unit I - Philosophy and Ethics
Introduction to Philosophy: Definition, nature and scope, concept, branches – Ethics: Definition, moral philosophy, nature of moral judgments and reaction.

Unit II - Scientific Conduct
Ethics with respect to science and research – Intellectual honesty and research integrity – scientific misconduct: Falsification – Fabrication – Fabrication and Plagiarism (FFP) – Redundant publications: duplicate and overlapping publication-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 contributing 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.

Unit V - Development of E-content & IPR
Database: indexing database- citation database: web of science, Scopus, etc. Research Metrics: impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score – Metrics: h-index, g index, g index, I 10 Index, altmetrics.

Unit VI - Development of E-Content & IPR

Integrated Library Management System (ILMS): e-journals – e-books – e-shodhsindu – 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.

23RCS301 Paper – III: Special Paper I – Cryptography and Network Security 4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
End Semester Exam: 3 Hours

Course Objectives
- To provide scholars with a theoretical knowledge to understand the fundamental principles of access control models and techniques and,
- To know about various encryption techniques.
- To understand the concept of Public key cryptography.
- To study about message authentication and hash functions
- To impart knowledge on Network security

Course Outcomes (COs)
1. Classify the symmetric encryption techniques
2. Illustrate various Public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Summarize the intrusion detection.
5. Understand basic concepts of system level security
6. Summarize the intrusion detection and its solutions to overcome the attacks.

Unit I – INTRODUCTION TO CRYPTOGRAPHY
Services. Mechanisms and Attacks – The OSI Security Architecture – A Model for Network Security – Classical Encryption Techniques –   Symmetric Cipher Model – Substitution Techniques – Transporation Techniques – Rotor Machines – Steganography.

Unit II – SIMPLIFIED DES
Block Cipher Principles – The Data Encryption Standard – The Strength of DES – Differential and Linear Cryptanalysis – Block Cipher Design Principles – Block Cipher Modes of Operation.

Unit III – PUBLIC KEY CRYPTOSYSTEM
RSA Algorithm – Key Management – Diffie–Hell man Key exchange – Introduction to Elliptic Curve Cryptography. Message Authentication and Hash functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions – Security of Hash functions and MAC.

Unit IV – DIGITAL SIGNATURES AND AUTHENTICATION PROTOCOLS&WEB SECURITY
Digital Signature Standard – Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E–mail Security – PGP – S / MIME – IP Security-Secure Socket Layer – Secure Electronic Transaction. System Security – Intruders and Viruses – Firewalls– Password Security.

Unit V – BLOCK CHAIN TECHNOLOGY

Block chain currency: Technology stack – Key Concepts in Bitcoin- How a cryptocurrency works – Block chain contracts- Financial services – crowd funding – Bitcoin prediction markets -Extensibility of block chain concepts – Fundamental Economic principles -Digital Identity verification – block chain neutrality – Digital divide of Bitcoin -Advanced concepts of Block chain – Limitations – Cryptocurrency Basics.

SUGGESTED READINGS

1.   Deepti Mittal, Ajay Raj. (2018). Cryptography and Network Security. 1st Edition, Laxmi Publication Private Ltd, Delhi.
2.   K.HarBaskar . (2017). Cryptography and Network Security – A Practical Approach. 1st Edition, Laxmi Publication Private Ltd, Delhi.
3.   William Stallings. (2016). Cryptography and Network Security. 4th Edition, Pearson Education, Delhi.
4.   Behrouz A. Forouzan. (2016). Cryptography and Network Security. Special Indian Edition, Tata McGraw Hill, Delhi.
5.   Melanie Swan (2015). Block chain Blue print for a new economy.4th Edition, O'Reilly media. Inc.
6.   Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg. (2016). Network Security. 1st Edition, Tata McGraw Hill, Delhi.
7.   Ankit Fadia. (1998). Network Security. 1st Edition, McMillan Publications, Delhi.
8.   Bruce Schneir.(1998). Applied Cryptography. 1st Edition. CRC Press, New Delhi.
9.   William Stallings.(1998).Cryptography and Network Security. 3rd Edition, Pearson Education, New Delhi.

WEB SITES

1.   http://domino.research.ibm.com/comm/research_projects.nsf/pages/security.index.html
2.   http://whitepapers.techrepublic.com.com
3.   http://www.rsa.com
4.   http://www.nsa.gov/home_html.cfm

23RCS302   Paper – III: Special Paper II - Advanced sssNetworking   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
                                                     End Semester Exam: 3 Hours

Course Objectives
- To study and compare various Network architectures and fundamental protocols.
- To learn various transmission media.
- To understand the topologies of networks, layered architecture (OSI and TCP/IP) and protocol suites.
- To understand the routing techniques
- To study and compare the Adhoc network principles

Course Outcomes (COs)
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.
5. Employ fundamental computer theory to basic programming techniques.
6. Gain the skills and project-based experience needed for entry into web design and development careers.

Unit I – INTRODUCTION
Internet Protocol review, Router Basics – forwarding versus routing – ISPs – Evolution of the Internet Architecture – IP Addressing and Allocation Techniques – NAPs – Autonomous Systems.

Unit II - ROUTING PROTOCOL FOUNDATIONS
Distance vector and link state – Dijkstra's algorithm – IGPs and EGPs – RIP – OSPF – ISIS. Introduction to BGP – EBGP and IBGP

Unit III - INTERDOMAIN ROUTING AND BGP
Border Gateway Protocol details – messages and state machines – route aggregation. Policy and BGP – BGP decision process – Access lists, prefix lists, AS paths, Community – Route maps – Attributes – AS Path, local preference, MED, Community, ATOMIC_AGGREGATE, Aggregator, Origin, NEXT_HOP, AS–SET – Route filtering. Architecture and BGP – Redundancy, symmetry, load balancing – Confederations, route reflectors.

Unit IV - AD–HOC/MOBILE ROUTING
Peer to Peer Overlay Networks – Mesh Networks – Sensor Networks – MANET

Unit V- NETWORK SERVICE QUALITY AND RESOURCE RESERVATION
Queues and Delays – Queuing and Scheduling – A Reservation Protocol – Differentiated Services Network simulator tools NS2

SUGGESTED READINGS
1. Andrew S. Tannenbaum. (2018). Computer Networks. 5th Edition. Pearson Education.
2. Forouzan, B. A. (2017). Data Communications and Networking .4th edition. THM, New Delhi.
3. Bassam Halabi. Internet Routing Architectures. (2016). Cisco Press, New Riders Publishing, ISBN 1-56205-652-2
4. Christian Huitema. (2016). Routing in the Internet. 2nd Edition, Prentice Hall.
5. W. Richard Stevens.(2005). TCP/IP Illustrated, Volume 1: The Protocols. Addison Wesley.
6. Pete Loshin. (2004). IPv6Theory, Protocol, and Practice. 2nd Edition, The Morgan Kaufmann Series.
7. J. Stewart. (1999). BGP4: Inter Domain Routing in the Internet. Addison Wesley.

WEB SITES
1. http://www.academ.com/nanog/feb1997/BGPTutorial
2. http://www.ietf.org/html.charters/manet-charter.html
3. http://tools.ietf.org/html/rfc2475
4. http://www.ietf.org/rfc/rfc2205.txt

23RCS303   Paper – III: Special Paper III – Data Mining and Analytics   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                     End Semester Exam: 3 Hours

Course Objectives
- To provide grounding in basic and advanced methods to big data technology and Understand the Big Data Platform
- To Understand MapReduce features, cluster analysis and tools.
- To provide exposure to Graph databases Neo4J, Connecting your data and Dashboard
- To understand the Big Data Platform and its Use cases
- To make the students to learn the Map Reduce Jobs and apply analytics on Structured, Unstructured Data.

Course Outcomes (COs)
1. Apply Hadoop ecosystem components.
2. Analyze MapReduce Types
3. Apply Data Model and Connect your data and Dashboard
4. Participate data science and big data analytics projects
5. Understand the fundamentals of Hadoop system and analyze data with Hadoop
6. Understand MapReduce function and its types and apply MapReduce function to various datasets

Unit I - INTRODUCTION: FUNDAMENTALS OF DATA MINING
Data Mining Functionalities - Classification of Data Mining systems - Major issues in Data Mining - Data Warehouse and OLAP Technology for Data Mining Data Warehouse - Multidimensional Data Model - Data Warehouse Architecture - Data Warehouse Implementation - Further Development of Data Cube Technology - From Data Warehousing to Data Mining. **Data Preprocessing:** Needs Preprocessing the Data - Data Cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation - Online Data Storage. Preparing Data for Mining: Variable Measures.

Unit II - DATA MINING PRIMITIVES AND MINING ASSOCIATION RULES
Languages, and System Architectures: Data Mining Primitives - Data Mining Query Languages - Designing Graphical User Interfaces Based on a Data Mining Query Language Architectures of Data Mining Systems. **Concepts Description:** Characterization and Comparison: Data Generalization and Summarization - Based Characterization - Analytical Characterization: Analysis of Attribute Relevance - Mining Class Comparisons: Discriminating between Different Classes - Mining Descriptive Statistical Measures in Large Databases. Association Rule Mining - Mining Single -Dimensional Boolean Association Rules from Transactional Databases - Mining Multilevel Association Rules from Transaction Databases - Mining Multidimensional Association Rules from Relational Databases and Data Warehouses - From Association Mining to Correlation Analysis – Constraint - Based Association Mining. **Classification and Prediction:** Issues Regarding Classification and

Prediction - Classification by Decision Tree Induction - Bayesian Classification - Other Classification Methods – Prediction - Classifier Accuracy.

Unit III - CLUSTER ANALYSIS AND APPLICATIONS

Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods – Density -Based Methods - Grid-Based Methods - Model-Based Clustering Methods - Outlier Analysis. Machine Learning: Basic Concepts in machine learning - Supervised and Unsupervised Learning. Mining Spatial Databases - Mining Multimedia Databases - Mining Time-Series and Sequence Data - Mining Text Databases - Mining the World Wide Web - Visual Data Mining

Unit IV – DATA ANALYTICS AND TOOLS

Introduction to big data: Introduction – Big Data- Characteristics of Big Data – Big data management architecture- Examining Big Data Types – Big Data Technology Components - Big data analytics – Big data analytics examples - Web Data Overview – Web Data in Action. **Hadoop:** Introduction – History of Hadoop - Hadoop Ecosystem- Analyzing data with Hadoop, Hadoop Distributed File System- Design - HDFS concepts - Hadoop filesystem –Data flow –Hadoop I / O - Data integrity – Serialization - Setting up a Hadoop cluster - Cluster specification -cluster setup and installation – YARN. **MapReduce:** Introduction – Understanding MapReduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures – Shuffle and sort - MapReduce types and formats - features –counters - sorting - MapReduce Applications – Configuring and setting the environment - Unit test with MR unit- local test.

Unit V – SPARK AND NO SQL

Spark: – Installing spark – Spark applications, Jobs, Stages and Tasks –Resilient Distributed databases- Anatomy of a Spark Job Run – Spark on YARN- SCALA: Introduction- Classes and objects- Basic types and operators- built-in control structures- functions and closures- inheritance. **NoSQL Databases:** Introduction to NoSQL- MongoDB: Introduction – Data types –- Creating, Updating and deleing documents -Querying – Introduction to indexing – Capped collections. HBase: Concepts - HBase Vs RDBMS - Creating records- Accessing data – Updating and deleting data –Modifying data- exporting and importing data.

SUGGESTED READINGS

1. Han, Kamber & Pei. (2018). Data Mining: Concepts and Techniques. 3rd Edition. University Press.
2. Zaki & Meira. (2017). Data Mining and Analysis Fundamental Concepts and Algorithms. Prentice Hall of India, New Delhi.
3. Agarwal. (2015). Data Mining: The Textbook. Prentice Hall of India, New Delhi
4. Boris lublinsky, Kevin t. Smith, Alexey, Yakubovich (2015). Professional Hadoop Solutions,Wiley Bill Franks (2012). Taming the Big Data Tidal wave, John Wiley & Sons
5. 10. Tom White (2012). Hadoop: The Definitive Guide, Third Edition, O'Reilly Media

6. Michael J. A.Berry, Gordon S.Linoff. (2007). Data mining Techniques, Second Edition.
7. K.P.Soman, Shyam Diwakar, V.Ajay. (2006). Insight into Data Mining Theory and Practice, Prentice Hall of India.
8. Jiawei Han & Micheline Kamber. (2001). Data Mining – Concepts and Techniques, Harcourt, India.

WEB SITES
1. http://www.the-data-mine.com/bin/view/Misc/ApplicationsOfDataMining
2. http://www.biomedcentral.com/info/about/datamining
3. http://www-users.cs.umn.edu/~han/kdd/kdd-info.html
4. http://www.dmreview.com/article_sub.cfm?articleId=1046025
5. http://www.datamining.databasecorner.com/?
6. http://www.web-datamining.net/tools/
7. http://databases.about.com/od/datamining/a/datamining.htm
8. http://www.dwreview.com/DW_Overview.html
9. www.kdnuggets.com
10. http://www.improvedoutcomes.com/docs/WebSiteDocs/Clustering/Clustering_Overview.
11. http://dms.irb.hr/tutorial/tut_dtrees.php
12. http://www.aaai.org/AITopics/pmwiki/pmwiki.php/AITopics/MachineLearning
13. http://robotics.stanford.edu/~nilsson/mlbook.html

23RCS304   Paper – III: Special Paper IV - Digital Image Processing   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
                                                                          End Semester Exam: 3 Hours

Course Objectives
- To make the students learn the fundamental theories and techniques of digital image processing
- To cover the fundamental concepts of visual perception
- To know the basic techniques of image manipulation segmentation and coding and a preliminary understanding of Computer Vision
- To know the relationships between pixels
- To understand the techniques in compression and pattern recognition.

Course Outcomes (COs)
1. Perform image manipulations and analysis in many different fields.
2. Apply knowledge of computing mathematics science and engineering to solve problems in multidisciplinary research.
3. Apply knowledge to threshold an image
4. Implement the image compression using the lossy techniques.
5. Analyze pattern recognition.
6. Apply knowledge to process Histogram

Unit I – INTRODUCTION
Digital image processing – Origins of digital image processing- Examples of fields that use digital image processing - Fundamental steps in digital image processing - Components of an image processing system - Representing digital image.

Unit II - BASIC RELATIONSHIPS BETWEEN PIXELS
Basic gray level transformations - Histogram processing - Basic spatial filtering - Smoothing special filtering - Image Degradation/Restoration process - Noise Models.

Unit III - IMAGE SEGMENTATION: THRESHOLDING
Edge Based Segmentation – Region Based Segmentation – Matching. Image Compression: Error Criterion - Lossy Compression - Lossless Compression.

Unit IV - SHAPE REPRESENTATION AND DESCRIPTION
Region Identification - Contour Based Representation And Description – Region Based Shape Representation And Description

Unit V - INTRODUCTION TO INFORMATION CODING
Introduction to image compression techniques Image Recognition: Introduction – Statistical Pattern Recognition - Neural Net- Syntactic Pattern Recognition - Graph Matching - Clustering

SUGGESTED READINGS

1. Rafael C. Gonzalez, Richard E. Woods. (2016). Digital Image Processing, 3rd Edition, Pearson Education, Delhi.

2. Castleman. (2014). Digital Image Processing, 1st Edition, Pearson Education Limited, Delhi.

3. T. Veera Kumaran, S. Jayakumar.(2014).Digital Image Processing, 3rd Edition, McGraw Higher Ed, Delhi.

4. Milan Sonka and Vaclav Hlavac and Roger Boyle. (2014). Image Processing, Analysis and Machine Vision. 2nd Edition. Vikas Publishing House, New Delhi.

5. Nick Efford. (2013). Digital Image Processing – A Practical introduction using JAVA. 2nd Edition, Pearson Education Limited, Delhi.

6. Chanda. B and Dutta Majumder .D. (2013). Digital Image Processing and Analysis. 2nd Edition, Prentice Hall of India, New Delhi

WEB SITES

1. www.icaen.uiowa.edu/~dip/lecture/lecture.html
2. www.ece.ucsb.edu/~manj/ecei81bso4/reviue(gw2002).pdf
3. www.wikipedia.org/wiki/image_processing
4. http://unjobs.org/authors/rafael-c.-gonzalez/image processing

23RCS305   Paper – III: Special Paper V – Soft Computing   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                                  End Semester Exam: 3 Hours

Course Objectives
- To build intelligent and wiser machines.
- To derive the answer and not simply arrive to the answer in the fields of soft computing
- To increase purity of thinking machine intelligence freedom to work dimensions complexity and fuzziness handling capability.
- To understand the working of resonance theory in networks and usage of fuzzy logic.
- To understand the NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Course Outcomes (COs)
1. Universalize into domains where direct experience is absent
2. Can perform mapping from inputs to the outputs faster than inherently serial analytical representations
3. Can build intelligent and wiser machines
4. Implement the usage of networks in resonance
5. Analyze and implement the fuzzy algorithms
6. To provide students with the knowledge on designing procedures for natural language resource annotation and the use of related tools for text analysis and hands-on experience of using such tools.

Unit I - **FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS**
Biological prototype, Artificial neuron, Single layer artificial, neural networks, multilayer artificial neural networks, training of artificial neural networks.

Unit II - PERCEPTIONS
Perceptron Representation, perceptron learning, perceptron Training algorithm. Back propagation: Introduction to back propagations and Back propagation training algorithm, counter propagation networks.

Unit III - **KOHONEN SELF-ORGANIZING NETWORKS AND HOPFILED NETWORKS**
Kohonen Self-Organizing Networks: Introduction, the Kohonen algorithm, weight training, Grossberg layer, Training the Grossberg Layer. **Hop filed Networks**: Introduction, The Hop filed model, hop filed network algorithm, Boltzmann's machine applications of Hop filed Networks, Associative Memories, Bi- directional Associative Memories. optimization using Hopfield Network. Adaptive Resonance Theory: Architecture of Adaptive Resonance Theory, Algorithm, Applicability of Artificial neural Networks to pattern Recognition and Image Processing, Dimensionality of neural Networks for pattern Recognition- Case Studies

Unit IV - FUZZY ARITHMETIC

Fuzzy numbers, linguistic variables, arithmetic operations on intervals, fuzzy numbers, and lattice of fuzzy numbers, Possibility theory**:** fuzzy measures, evidence theory, fuzzy sets and possibility theory, possibility Vs probability theory, Fuzzy logic: Multivalued logics, propositions, quantifiers, linguistic hedges, inferences. Uncertainty based information, Fuzzy systems: fuzzy controllers, fuzzy systems and neural networks, fuzzy neural networks, fuzzy automata, dynamic systems- Applications

Unit V - NATURAL LANGUAGE PROCESSING (NLP)

Overview And Language Modeling - Word Level and Syntactic Analysis- Semantic Analysis and Discourse Processing - Natural Language Generation and Machine Translation- Information Retrieval and Lexical Resources.

SUGGESTED READINGS

1. Flasiński, Mariusz. (2016). Introduction to Artificial Intelligence. Tata McGraw Hill,
2. Delhi. Chandra.S.S.V. (2015). Artificial Intelligence and Machine Learning. Kindle Edition.
3. Dr.R.P.Das. (2015). Neural Networks and Fuzzy Logic. 1st Edition, Tata McGraw Hill, Delhi
4. Dr.R.P.Das. (2014). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill, Delhi.
5. S.N. Sivanandam, S. Sumathi and S. Deepa. (2014). Introduction to Neural Networks using MAT LAB 6.0, 1st Edition, Tata McGraw Hill, Delhi
6. Simon Haykin. (2013). Neural Networks. 3rd Edition, New Delhi: Pearson Education.
7. Alexander and Helen Mart William Jackson. (2013).An introduction to Neural Computing. New Delhi: McGraw Hill.
8. Robert J Schaluoss. (2010). Artificial Neural Networks. 3rd Edition, New Delhi: McGraw Hill.
9. Kishan Mehrotra, Chiluvuri K. Mohan and Sanjay Rana. (2011). Elements of Artificial Neural Networks. 2nd Edition, Mumbai: Penaram International.
10. Tanveer Siddiqui, U.S. Tiwary. (2010)―Natural Language Processing and Information Retrieval‖, Oxford University Press.
11. Daniel Jurafsky and James H Martin, (2010) S.Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, 2nd Edition, Prentice Hall.

WEB SITES

1. www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html
2. http://www.statsoft.com/textbook/stneunet.html
3. http://www.fuzzy-logic.com

23RCS306   Paper – III: Special Paper VI: Web Data Analytics   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                                      End Semester Exam: 3 Hours

Course Objectives
- To understand the various applications of XML in the areas of information representation, Presentation Oriented Publishing, Message Oriented Computing, and Application Configuration. Web Services Protocols
- To use JSP and Java technologies to support the development of modern applications targeted to the evolving spectrum of distributed and decentralized enterprise platforms.
- To Expose the scholars to the advanced CGI enabled capabilities of the Java 2 development environment for Enterprise Applications.
- To gain knowledge in social media mining and know about social media communities.
- To gain knowledge about sentiment analysis and its applications

Course Outcomes (COs)
1. Understand the course structure and objectives
2. Understand what XML is all about
3. Relate to the history of Javascript including some background on Markup Languages (SGML, etc.)
4. Relate to JSP Presentation Oriented Publishing (POP) applications.
5. Understand about social media communities and community algorithms
6. Demonstrate about sentiment classification

UNIT I – INTRODUCTION
Introduction: Web Analytics 2.0 - Click stream- multiple outcome analysis-experimentation and testing- voice of customer – competitive intelligence- the tactical shift -Optimal strategy for choosing web analytics. **Click stream Analysis:** Metrics-Eight critical web metrics-web metrics demystified –strategically aligned tactics for impactful web –Web analytics report- Foundational analytical strategies- click stream analysis made actionable-challenges

UNIT II – MEASURING SUCCESS
Measuring Success: Actionable Outcome KPIs- Moving beyond conversion rates- Micro and macro conversion-Measuring success for a non –ecommerce website- Leveraging qualitative data: Surveys Web enabled emerging user research options

UNIT III – A/B TESTING AND EMERGING ANALYTICS
A/B Testing: Multivariate testing - Actionable testing ideas-Controlled experiments - Competitive intelligence analysis-CI data source, types, secrets- website traffic analysis- Search and keyword analysis- audience identification and segmentation analysis. **Emerging analytics:** Social. mobile, video: Measuring social web - the data challenge- analyzing mobile customer experiences-measuring the success of blogs- quantifying the impact of Twitter – Analyzing the performance of videos.

UNIT IV – SOCIAL MEDIA MINING

Social Media Mining-Network Models- Social media Communities – Member based Detection – Node degree, reachability and similarity–Group Based detection methods - Spectral Clustering: Balanced Community algorithm Community Evolution. Recommendation Vs Search: Recommendation Challenges – Recommender algorithms – Content Based Methods- Collaborative Filtering – Memory Based – Model Based – Social Media Recommendation – User friendship – Recommendation Evaluation – Precision – Recall –Behavioral– User Behavior – User – Community behavior – User Entity behavior – Behavioral Analytics – Methodology

UNIT V – SENTIMENT ANALYSIS

The Problem of Sentiment Analysis- Document Sentiment Classification-Sentence Subjectivity and Sentiment Classification: Subjectivity Classification – Sentence Sentiment Classification- Aspect-based Sentiment Analysis- Extraction- Sentiment Lexicon Generation- Opinion Summarization- Analysis of Comparative Opinions- Opinion Search and Retrieval- Opinion Spam Detection- Sentiment Analysis Applications.

SUGGESTED READINGS

1. David Flanagan. (2018). Javascript: The Definitive Guide 7th Edition. O'Reilly Media.
2. Dave Mercer. (2017). ASP.NET – Beginner's Guide (2nd ed.). New Delhi: MCGraw Hill
3. Thau. (2017). The Book of JavaScript: A Practical Guide to Interactive WebPages.
4. Jeffrey C. Jackson. (2017). Web Technologies, Pearson Education, 2nd Edition.
5. Paul Wilton. (2016). Beginning JavaScript. 3rd Edition. Wiley Dreamtech India(P) ltd, New Delhi.
6. Thomas A Powell. (2015). The Complete SUGGESTED READINGSHTML, 2nd Edition, Tata McGraw Hill Publishing, New Delhi.
7. Rohit Khurana. (2015). Java Script, APH Publishing Corporation. New Delhi.
8. Ivan BayRoss. (2014). HTML, DHTML, Java Script, Perl CGI, BPB Publications, 2nd Edition.
9. Social Media Mining (2014): An Introduction – Reza Zafarani , MohhammadAbiElasi – Published by Cambridge press.
10. Sybex. (2012). XML Complete, BPB Publications, 3rd Edition.
11. Deitel Nieto. (2012). World Wide Web. 3rd Edition, Pearson Education, New Delhi.

WEB SITES

1. http://www.w3schools.com/js/default.asp
2. http://www.w3schools.com/xml/default.asp
3. www.amazon.com/web-server-technology
4. http://www.brics.dk/ixwt

23RCS307   Paper – III: Special Paper VII: Software Engineering   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
                                                                    End Semester Exam: 3 Hours

Course Objectives
- To Understand detailed concepts related to software engineering life cycle
- To Gain knowledge about the concepts of software designing and testing
- To Acquire knowledge about an overview of object-oriented analysis and design, modeling language.
- To acquire knowledge in software testing techniques.
- To make student understand the software quality insurance

Course Outcomes (COs)
1. Analyze and identify a suitable software development life cycle model for an application
2. Develop software requirements specification and cost estimation for an application
3. Differentiate the design models and testing techniques for implementing a software
4. Apply the object orientation concepts in software development
5. Apply the concept of object-oriented methodologies in software development
6. Apply the concept of unified modeling language in software development

Unit I – THE EVOLVING ROLE OF SOFTWARE
Software - software crisis - software process model. Component based development: - The formal methods model – fourth generation techniques. Software Project Planning – Project Planning Objectives - Software Scope – Resources. System planning and initial investigation, bases for planning – Investigation.

Unit II – ANALYSIS CONCEPTS AND PRINCIPLES
Requirement analysis principles – The Information domain – modeling – partitioning – Essential and implementation views. Software prototyping methods and tools. Specification: Specification principles – representation – software requirements specification.

Unit III – DESIGN CONCEPTS AND PRINCIPLES
The Design process: design and software quality – The Evolution of Software Design. Design principles: Design concepts – effective modular design – the design model – design documentation – Software Architecture.

Unit IV – SOFTWARE TESTING TECHNIQUES
Testing Techniques/Tools selection process – Selecting Techniques/tools – Structural System Testing techniques- Functional System Testing Techniques – Unit Testing Technique – Functional Testing and Analysis – Functional Testing – Test factor/Test Technique Matrix-The Cost of Computer Testing – Life Cycle Testing concept – Verification and validation in the software. Assess Project Management Development Estimate and Status - Develop Test Plan - Requirements Phase Testing -Design Phase Testing -Program Phase Testing.

Unit V – **SOFTWARE QUALITY ASSURANCE**
 Case studies: WinRunner – QTP (Quick Test Professional)

SUGGESTED READINGS
1. Pressman, R.S. (2019). Software Engineering: A Practitioner's Approach. 7th edition. McGraw-Hill, New Delhi.
2. Aggarwal, K.K., & Singh, Y. (2018). Software Engineering. 3rd edition. New Age International Publishers.
3. Sommerville, I. (2017). Software Engineering. 8th edition. Addison Wesley. New Delhi.
4. Bell, D. (2015). Software Engineering for Students. 4th edition. Addison- Wesley, New Delhi.
5. Richard Fairley. (2014). Software Engineering Concepts. 8th Edition. Tata McGraw Hill   Publishing Company, New Delhi
6. Mall, R. (2014). Fundamentals of Software Engineering. 2nd edition. Prentice-Hall of India, New Delhi.
7. Elias M. Awad.(2013). System Analysis and Design. 2nd Edition. BPB Publication, New Delhi.

WEB SITES
1. www.opensourcetesting.org
2. www.onestoptesting.com
3. www.cs.queensu.ca
4. www.ece.cmu.edu

23RCS308   Paper – III: Special Paper VIII: Cyber Security   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
End Semester Exam: 3 Hours

Course Objectives
- To provides an overview of Information Security and Assurance.
- To provide an exposure to the spectrum of security activities methods methodologies and procedures with emphasis on practical aspects of Information Security.
- To provide the understanding in Cyber crime.
- To provide awareness of security in mobile devices.
- To understand the use of tools.

Course Outcomes (COs)
1. State the basic concepts in information security
2. Explain concepts related to applied cryptography
3. Explain common vulnerabilities in computer programs including buffer overflow, Vulnerabilities, time-of-check to time-of-use flaws incomplete mediation.
4. To implement the security in mobile devices.
5. To understand the tools to reduce the cyber crime.
6. To understand techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.

Unit I – INTRODUCTION TO CYBERCRIME
Definition and Information Security-who are cybercriminals? - Classification of cybercrimes. Cybercrime: The legal perspectives- cybercrimes: An Indian Perspective - cybercrime and the Indian ITA2000: Hacking and the Indian law(s) - A Global Perspective on cybercrimes: cybercrime and the Extended Enterprise - cybercrime Era: Survival Mantra for the Netizens - Concluding Remarks and Way Forward to Further Chapters.

Unit II – CYBER OFFENSES
How Criminals Plan Them: Introduction: categories of Cybercrime -How criminals Plan the Attacks: Reconnaissance Passive Attacks Active Attacks Scanning and Scrutinizing Gathered Information Attack (Gaining and Maintaining the system Access) -social Engineering: Classification of Social Engineering – Cyber talking: Types of stalkers Cases Reported on Cyber stalking How stalking Works? real-life incident of Cyber stalking -Cybercafe and Cybercrimes - Botnets: The Fuel for cybercrime: Botnet - Attack Vector-Cloud Computing: Why cloud computing? Types of Services Cybercrime and Cloud Computing.

Unit III – CYBERCRIME
Mobile and wireless Devices-Introduction - Proliferation of Mobile and Wireless Devices - Trends in Mobility-Credit Card Frauds in Mobile and Wireless Computing Era: Types and Techniques of Credit Card Frauds - Security challenges Posed by Mobile Devices - Registry Settings for Mobile Devices - Authentication Service security: cryptographic security LDAP

Security RAS Security Media Player Control Security Networking API Security - Attacks on Mobile/Cell Phones: Mobile Phone Theft Mobile Viruses Mishing Vishing Smishing Hacking Bluetooth.

Unit IV – MOBILE DEVICES

Security Implication for Organizations – Managing Diversity and Proliferation of Hand-Held Devices Unconventional/ Stealth Storage Devices Threats through Lost and Stolen Devices Protecting Data on lost devices Educating the Laptop Users - Organizational Measures for Handling Mobile devices - Related Security Issues: Encrypting Organization Databases Including Mobile Devices in Security Strategy -Organizational Security Policies and Measures in mobile Computing Era: Importance of Security polices relating to mobile Computing Devices Operating Guidelines for Implementing Mobile Devices Security Polices Organizational Policies for the Use of Mobile Hand - Held Devices - Laptops: Physical Security Countermeasures.

Unit V – TOOLS AND METHODS USED IN CYBERCRIME

Introduction - Proxy Servers and Anonymizers - Phishing: How Phishing Works? - Password Cracking: Online Attacks Offline Attacks Strong Weak and Random Passwords Random passwords - Keyloggers and Spywares: Software Keyloggers Hardware Keyloggers Anti Keylogger Spywares - Virus and Worms: Types of Virus - Trojan Horses and Backdoors: backdoor How to protect from Trojan Horses and Backdoors - Steganography: Steganalysis - DoS and DDoS Attacks: DoS Attacks Classification of DoS Attacks Types or Levels of DoS Attacks Tools Used to Launch DoS Attacks DDoS Attacks How to Protect from DoS/DDoS Attacks – SQL Injection: Steps for SQL Injection Attacks How to Prevent SQL Injection Attacks - Buffer Overflow: Types of Buffer Overflow How to Minimize Buffer Overflow - Attacks on Wireless Networks: Traditional Techniques of Attacks on Wireless Networks Theft of Internet Hours and Wi-fi-based Frauds and Misuses How to Secure the Wireless Networks.

SUGGESTED READINGS

1.   Nina Godbole & SUNIT Belapure. (2013). CYBER SECURITY. Wiley India Pvt. Ltd. New Delhi
2.   Charles ,P. Pfleeger ,& Shari, L. Pfleeger. (2003).
3.   Dieter Gollmann . (2006). Computer Security. 2nd edition. John Wiley & Sons.
4.   Godbole, N. (2009). Information Systems Security: Metrics Frameworks and Best Practices. Wiley India. New Delhi
5.   Marther, T., Kumaraswamy, S.,& Latif, S. (2009). Cloud Security and Privacy: An Enterprise Perceptive on Risk and Complaince. O'Reilly.

WEB SITES

1.   http://www.csc.ncsu.edu/faculty/ning
2.   csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf
3.   www2.warwick.ac.uk/fac/sci/dcs/teaching/modules/cs134/

23RCS309   Paper – III: Special Paper IX: Machine Learning   4H – 4C

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

End Semester Exam: 3 Hours

Course Objectives

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand graphical models of machine learning algorithms
- To study the concepts of deep learning

Course Outcomes (COs)

1. Distinguish between, supervised, unsupervised and semi-supervised learning.
2. Apply the apt machine learning strategy for any given problem.
3. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.
4. Design systems that use the appropriate graph models of machine learning.
5. Modify existing machine learning algorithms to improve classification efficiency.
6. Implement various deep learning models.

UNIT I – INTRODUCTION

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 – DEEP NETWORKS

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning. **DIMENTIONALITY REDUCTION:** Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT III – LINEAR MODELS

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

SUGGESTED READINGS
1.   Ashok, K.Talukder,& Roopa, R. Yavagal. (2019). Mobile Computing. 4th Edition. Tata Mc-Graw Hill Publishing Company Pvt Ltd, New Delhi.
2.   Raj Kamal . (2018). Mobile Computing.3rd edition. Pearson Education. Tomasz Imielinski,
3.   Henry F. Korth . (2017). Mobile Computing.2nd edition. Springer , US.
4.   Mischa Schwartz. (2017). Mobile Wireless Communications.2nd edition. Cambridge University Press.
5.   J.Schiller. (2016). Mobile Communication,2nd edition. Addison Wesley.
6.   William Stallings. (2014). Wireless Communication and Networks.3rd edition. Pearson Education
7.   Singhal. (2013). AP-Wireless, Application Protocol.2nd edition. Pearson Education.
8.   Lother Merk,Martin, S.Nicklaus and Thomas Stober. (2013). Principles of Mobile
9.   Computing, 2nd Edition, Springer.
10. William C.Y.Lee. (2013). Mobile Communication Design Fundamentals. 2nd edition.John Wiley.

23RCS310   **Paper – III: Special Paper X: Cloud Computing**   **4H – 4C**

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

End Semester Exam: 3 Hours

Course Objectives

- To learn about the characteristics and types of cloud.
- To know about the services such as IaaS, PaaS, SaaS, IDaaS and CaaS.
- To understand the Virtualization Technologies.
- To understand the Information Security, Privacy and Compliance Risks.
- To learn commercial Google Web services – Open Nebula.

Course Outcomes (COs)

1. Understand cloud architecture and model.
2. Implement working of service models.
3. Explore cloud infrastructure.
4. Learn Threat issues and Database Integrity Issues.
5. Learn Open Source and Commercial Clouds such as Microsoft Azure, Amazon EC2
6. Learn Service Level Agreement for Cloud

Unit I – INTRODUCTION TO CLOUD COMPUTING

Characteristics of Cloud Computing -Paradigm shift - Benefits of cloud computing - Disadvantages of cloud computing- Role of Open Standards-Cloud Computing Architecture: Cloud computing stack-Public cloud -Private cloud -Hybrid cloud -Community cloud.

Unit II – SERVICE MODELS

Infrastructure as a Service (IaaS) -Platform as a Service (PaaS) -Software as a Service (SaaS) -Identity as a Service (IDaaS) -Compliance as a Service (CaaS)- Cloud storage.
.
Unit III – VIRTUALIZATION TECHNOLOGIES

Load Balancing and Virtualization -Advanced load balancing -The Google cloud - Hypervisors -Virtual machine types -VMware vSphere - Machine Imaging -Porting Applications -The Simple Cloud API - AppZero Virtual Application Appliance

Unit IV – CLOUD INFORMATION SECURITY OBJECTIVES

Confidentiality Integrity and Availability -Cloud Security Services - Relevant Cloud Security Design Principles -Cloud Computing Risk Issues -The CIA Triad Privacy and Compliance Risks -Threats to Infrastructure Data and Access Control -Cloud Access Control Issues - Database Integrity Issues -Cloud Service Provider Risks Architectural Considerations

Unit V – HOW TO MOVE APPLICATION INTO THE CLOUD

Web Application Design- Machine Image Design-privacy design –Database Management-Specialized cloud Architecture: Workload distribution architecture-Dynamic scalability-Cloud bursting-hypervisor clustering-service quality metrics & SLA.

SUGGESTED READINGS

1. BarrieSosinsky .(2017). Cloud Computing.3rd edition Bible, Wiley- India. New Delhi:
2. Rajkumar Buyya, James Broberg, & Andrzej, M. Goscinski. (2016). Cloud Computing.2nd edition New Delhi: Tata Mc-Graw Hill.
3. Ronald, L. Krutz, Russell Dean Vines. (2016). Cloud Security: A Comprehensive Guide to Secure Cloud Computing.2nd editon New Delhi: Wiley –India
4. Dr Kumar Saurabh. (2015). Cloud Computing 2nd edition. New Delhi: Wiley India.
5. Anthony T.Velte Toby J.Velte Robert Elsenpeter. (2015). Cloud Computing Practical Approach 3rd edition. New Delhi:Tata McGraw Hill.
6. Nikos Antonopoulos, Lee Gillam. (2014). Cloud Computing: Principles Systems and Applications .2nd edition. Springer.
7. Giovanni Toraldo. (2012). Open Nebula 3 Cloud Computing.1st editon.

WEB SITES

1. en.wikipedia.org/wiki/Cloud_computing
2. www.ibm.com/cloud-computing/in/en/
3. www.oracle.com/CloudComputing
4. www.microsoft.com/en-us/cloud/default.aspx

23RCS311   **Paper – III: Special Paper XI: Internet of Things**   **4H – 4C**

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

End Semester Exam: 3 Hours

Course Objectives

- To Understand the Introduction to IoT and Architectural Overview of IoT
- To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)
- To Understand the communication technologies in IoT
- To Know the IoT protocols and web of things
- To Know the various applications of IoT

Course Outcomes (COs)

1. Understand building blocks of Internet of Things and characteristics.
2. Understand IoT protocols, Web of Things and Integrating IOT.
3. Understand the application areas of IOT ·
4. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
5. Learn about communication technologies used in IoT and Web of Things
6. Learn about Structural models and applications of IoT

Unit I – OVERVIEW

IoT-An Architectural Overview– Building an architecture-Main design principle and needed capabilities-An IoT architecture outline- standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways- Local and wide area networking- Data Management-Business processes in IoT-Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

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 – point-to-point protocols - Ethernet protocols - cellular Internet access Protocol - Machine-to-machine protocol – Modbus Wireless HART- ZWave-Bluetooth Low Energy, DASH7 – KNX – Zigbee Architecture – Network layer – APS layer – Security- Threats to IOT system.

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 - Connectivity Technologies.

Unit IV – INTEGRATING IoT

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, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging - Case studies: Sensor body-area-network and Control of a smart home.

SUGGESTED READINGS

1. HonboZhou . (2019). The Internet of Things in the Cloud:A Middleware Perspective— 3rd edition. CRC Press .
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles- (2018). Architecting the Internet of Things– Springer.
3. David Easley and Jon Kleinberg . (2017). Networks, Crowds, and Markets: Reasoning About a Highly Connected World ,1st editon.CambridgeUniversity Press.
4. Olivier Hersent, Omar Elloumi and David Boswarthick . (2016). The Internet of Things: Applications to the Smart Grid and Building Automation .1st editon Wiley.
5. Olivier Hersent, David Boswarthick, Omar Elloumi. (2012). The Internet of Things – Key applications and Protocols. 2nd editon.Wiley.

WEB SITES

1. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot
2. https://www.i-scoop.eu/internet-of-things-guide
3. https://iot-analytics.com
4. https://www.elsevier.com/books/internet-of-things/tsiatsis/

23RCS312   Paper – III: Special Paper XII: Artificial Intelligence   4H – 4C
Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
End Semester Exam: 3

Course Objectives
- To know about the problem solving and AI
- To learn search methods and expert systems
- To enable the student to be familiar with AI theorems and algorithms
- To enables the students to understand the graph notations and search methods
- To gain knowledge in Acquisition
- To learn Automatic program writing with expert systems.

Course Outcomes (COs)
1. Able to understand the problem states and AI
2. Able to understand state space methods
3. Able to understand problem reduction search methods
4. Understand the search algorithms and its measures
5. Able to knowledge engineer in expert systems
6. Able to understand predicate calculus

Unit I – PROBLEM SOLVING AND AI
Puzzles and Games – Problem States and operators-problem solving Agents – Heuristic programming – state space representations – state descriptions-searching for solutions – graph notations – non- deterministic programs — Uninformed search strategies.

Unit II – STATE SPACE SEARCH METHODS
Breadth first and depth first search – heuristic – admissibility- Local search algorithms and Optimization problems – optimality of algorithms – Searching with Non-Deterministic Actions- Searching with partial observations – performance measures – problem reduction representations – AND/OR graphs and higher-level state space

Unit III – PROBLEM REDUCTION SEARCH METHODS
Cost of solution trees – ordered search – alpha beta and minimum procedure-alpha beta pruning -Imperfect Real time Decisions-Stochastic Games – theorem proving in predicate calculus – syntax, semantics, Herbrand universe: variables, qualifiers, unification, resolvents

Unit IV – PREDICATE CALCULUS IN PROBLEM SOLVING& AGENTS
Answer extraction process – resolution – Automatic program writing – predicate calculus – proof finding methods – Logical Agents – Knowledge Based Agents – the Wumpus world – propositional Logic – agents based on propositional logic

Unit V – EXPERT SYSTEMS
Expert systems and conventional programs – expert system organization – Knowledge engineering: knowledge representation techniques – knowledge acquisition – acquiring

knowledge from experts – automating knowledge acquisition –Building an expert system – difficulties in developing an expert system

SUGGESTED READINGS

1. Chandra.S.S.V. (2018). Artificial Intelligence and Machine Learning. Kindle Edition.
2. Dr.R.P.Das. (2018). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill, Delhi
3. Flasiński, Mariusz. (2017). Introduction to Artificial Intelligence.3rd edition. Tata Mcgraw Hill, Delhi.
4. E Charnail, CK Reiesbeck and D V Medermett. (2016). Artificial Intelligence Programming.2nd edition. Lawrence Erlbaum Associates, N J.
5. N J Nilson. (2015). Principles of Artificial Intelligence .2nd edition. Tiega Press, Polo Alto.
6. Elain Rich and Kevin Knight. (2014). Artificial Intelligence.1st edition. McGraw Hill.
7. Donald A Waterman. (2014). A Guide to Expert Systems, Tech knowledge series in knowledge engineering. 1st edition.

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2. www-formal.stanford.edu/jmc/whatisai/node3.html
3. http://aima.cs.berkeley.edu/contents.html
4. http://Artificial-Intelligence-3e-Modern-Approach/ contents.html