DEPARTMENT OF POST GRADUATE STUDIES AND RESEARCH IN MATHEMATICS AND COMPUTER SCIENCE

R. D. UNIVERSITY, JABALPUR

Ph.D. Course Work in Computer Science

(From 2025-26 onwords)

Course Work

(According to Ph.D. Ordinance – 11)

(As per UGC Notification No. F.4-1(UGC-NET Review Committee)/2024 (NET)/140648 dated March 27, 2024/7)

Ph.D. student shall be required to undertake course work of 18 credits/ 600 marks of one semester, for which he/she has to deposit a prescribed fee. The course work shall be treated as Pre – Ph. D. preparation. All courses prescribed for Ph. D. course work shall be inconformity with the credit hour instructional requirement and shall specify content, instructional and assessment method. The examination scheme of credit marks is as approved by the university. The course work comprises of:

S.No.	Title of Paper	Max. Marks	Min. Passing Marks	Credit
I	Research Methodology	100	50	4
II	Review of Published Research in the relevant field	100	50	3
III	Computer Application	100	50	3
IV	Advance course in the relevant subject (Any one)	100	50	3
V	Research and Publication Ethics	100	50	2
VI	Comprehensive Viva- Voce	100	50	3

A candidate shall have to obtain minimum 50% passing marks or equivalent grade (C) in all the papers separately.

The candidate has to obtain a minimum of 55% of marks or its equivalent grade point in aggregate in the course work in order to be eligible to continue in the Ph.D. program.

If a student obtains F or Ab grade in a course/ subject, he/she will be treated to have failed in that course. He/she have to reappear in the examinations of the course as and when conducted or arrange by the UTD in next semester. If the student fails in aggregate, then he can opt up to, maximum of any two papers to re appear in the examination. Marks obtained earlier in continuous assessment may be carried forward and added to the marks obtained in repeat end semester examination to decide the grade in the repeat course. If he/she further fails in the course, he/she shall not be given another chance and he/she shall be out of the Ph. D. program. No students shall be allowed to repeat the course to improve the grade if he/she passes the course.

I -- Research Methodology

Maximum marks = 100
Minimum Marks = 50
(04 Credits)

Unit-I:

Introduction to research methodology: Meaning, Objectives and types of research, Motivation in research, Research approaches and Research methods verses methodology, Significance of research, Criteria of good research, Research design, Components.

Unit-II:

Research problem: What is research problem? Identification and Selection of Research problem, Formulation of Research objectives, Domain and boundaries of research problem, Research problem analysis, Variables and parameters, Technique selection.

Unit-III:

Writing of research paper: Research and scientific method, Survey method, Experimental method, Research process, Research paper preparation, Synopsis writing, Writing a research project, Research support agencies, Preparation of project report, Writing a dissertation, Writing thesis, Writing of review articles, Plagiarism prevention.

Unit-IV:

Research presentation: Presentation of project proposal, Presentation of project report, Presentation at research degree meeting, A poster presentation of research paper, Direct (Oral) presentation of research, Presentation of Talk, Presentation and Delivering of Plenary Lecture, Virtual/ Tele presentation.

Unit-V:

Testing of Hypothesis: Definition, elements of testing of hypothesis – simple and compound hypothesis, null and alternate hypothesis, degrees of freedom, level of significance, errors of two kinds, Parametric test-t, F, Z Chi-square etc. and non-parametric tests- Run, median, Mann Whitney etc. for testing of hypothesis, Limitations of tests of hypothesis.

Reference books:

1. C.R. Kothari, Research Methodology, New Age International publishers (2004).
2. Catherine Dawson, Practice Research Methods, UBS Publishers Distributors, New Delhi (2002).
3. Ranjit Kumar, Research Methodology – A Step by step guide for Beginners (2nd Ed.), Singapore, Pearson Education (2005).
4. Michael Davis, Ethics and the University, Routledge (1999).
5. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India).
6. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers (Wiley India).

PAPER-II **100 Marks**
3 Credits

Review of Published Research in the Relevant Field This includes report writing evaluation and presentation/Viva Voce each of 50 marks

This part would be based on the study of research papers published in

I. UGC approved Journal/ SCI Journal

II. SCI Journal/ Scopus Journal

The review should be as per specified format-

I. It should be in spiral binding.

II. The number of pages should not exceed 200.

III. It should be submitted in three copies in the department.

III -- Computer Application

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

Theory

UNIT – I : CASE Tools for Software Engineering- What is CASE tool, An overview of CASE tools, Components of CASE tool, types of CASE tools, Functions of a CASE tool(upper CASE, lower CASE and Integrated CASE) CASE tools and the different stages of the SDLC. CASE tool and the development of software.

UNIT – II: Data Mining with WEKA Tool- Introduction to WEKA Explorer, mining techniques and Attribute Relation File Format (ARFF), Comparison of various data mining techniques available in WEKA, Implementation of data set into WEKA, Rules generated using charts, Analysis of data using WEKA, Comparison of various algorithms.

UNIT – III: Software Design in UML using CASE tool Argo UML- Introduction- Basic layout of the Argo UML main window, how to use Argo UML tools, Class diagrams, use cases, activity diagrams, sequence diagrams, state diagrams, package notation, Start, blank design. **Class diagrams:** adding new classes, adding instance/ class variables, adding methods, Class properties, Operation properties, Association properties, To Do Item, Source code.

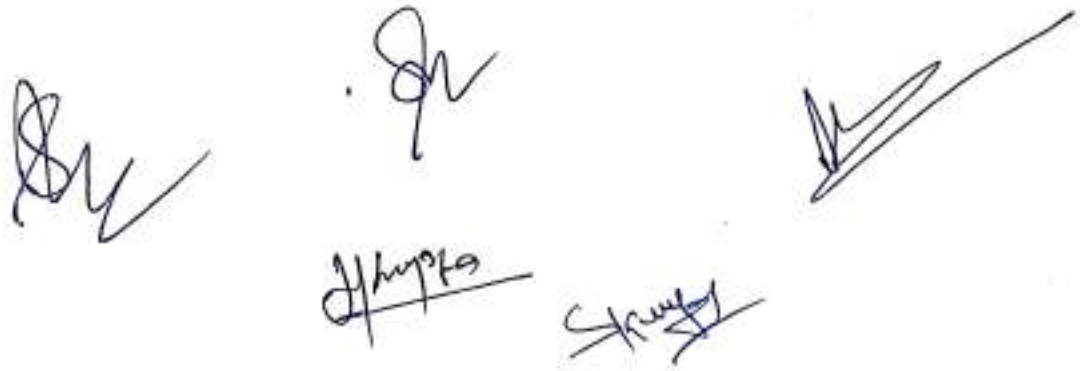
UNIT – IV : Network Simulator tool(NS-2)- Introduction to NS-2, Installation of NS-2, Components and tools of NS-2, using NS-2 in modern networking research, speed and scalability issues for NS-2, Sample C++ programs for NS-2, Network emulation in NS-2, Using NS-2 in education and teaching.

UNIT – V: MATLAB – Input output of data from Matlab command File types, Creating, saving and executing the script file, Creating and executing functions file, Working with files and directories, Matrix manipulation, Creating vectors, Arithmetic operations, Relational operations, Logical operations, Matrix functions, Determinant of matrix. **Graphics:** Two and three dimensional plots, Subplot to Layout multiple graphs, Matlab plotting tools, Mesh and surface plots, Handle Graphics – Saving and printing.

References:

1. Computer aided software engineering http://en.wikipedia.org/wiki/computer aided software engineering.
2. What is case? http://www.sei.cmu.edu/legacy/case/case_whatis.html.
3. Upper Case tool- http://www.opfro.org/index.html?Components/Producers/Tools/UpperCASETools.html~Contents.
4. Lower Case tool- http://www.opfro.org/index.html?Components/Producers/Tools/LowerCASETools.html~Contents.

5. Jefferey A. Hoffer, Joey F. George, and Joseph S. Valacich. Modern Systems Analysis and Design. Fourth edition.2005.New Jersey. Pg 602-617.
6. " Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations", 2nd Edition. Ian Witten and Eibe Frank. Morgan Kaufmann Publishers,2005.
7. http://www.cs.waikato.ac.nz/ml/weka
8. https://www.cs.auckland.ac.nz/courses/compsci230s2c/resources/ArgoUML.Tool.pdf
9. http://www.cs.grinnell.edu/~walker/courses/223.fa06/labs/uml-1.shtml
10. The Unified Modeling Language User Guide. Booch. Rumbaugh and Jacobson. AddisonWesley.1999.
11. http://www.isi.edu/nsnam/ns/
12. http://www.isi.edu/nsnam/ns/ns-documentation.html



IV – Choose any one paper out of the following optional papers:-

Paper-I : Data Mining and Data Warehousing

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT-I

Data Warehousing Introduction –Definition – Architecture-Warehouse Schema – Warehouse sever – OLAP operations Data Warehouse technology –Hardware and operating system. Warehousing Software-Extraction tools- Transformation tools- Data quality tools –Data loaders-Data Access and retrieval tools-Data Modeling tools –fact tables and dimensions Data warehousing case studies: Data warehousing in Government, Tourism Industry, Genomics data.

UNIT-II

Data mining definition –DM Techniques – current trends in data mining -Different forms of knowledge –Data selection, cleaning, Integration Transformation Reduction and Enrichment Data types of Data – data Quality – Data Preprocessing – Measures of similarity and dissimilarity, Expiration: Summary statistics –Visualization.

UNIT-III

Association rules: Introduction –Method to discover association rule – Apriori algorithm partition Algorithm – Pincher search Algorithm .Classification: Decision Tree classification – Bayesian Classification by back Propagation.

UNIT -IV

Clustering Techniques : Introduction –Clustering Paradigms – Partitioning Algorithms K means & K Mediod algorithms -CLARA –CLARANS –Hierarchical clustering DBSCAN –BIRTH –Categorical Clustering algorithms –STIRR-ROCK-CACTUS Introduction to machine learning – Supervised learning –Unsupervised Learning – Machine Learning and Data mining Neural Networks: Introduction –Use of NN –Genetic Algorithm: Introduction Working of GA.

UNIT –V

Web Mining Introduction –Web Content Mining- Web structure mining –web usage mining – text mining –Text mining _text clustering Temporal Mining –spatial mining –Visual data mining – Knowledge mining.

Reference BOOKS:

1. Arun k Pujari ", Data Mining Techniques "University press, edition. 2001.

2. Jaiwei Han, Michelinne Kamber "Data Mining: Concepts and Techniques.

3. Pang-Ning Tan Michael Steinbach Vipin Kumar "Introduction to Data Mining" 2007

4. Sushmita mitra Tir ku Acharaya, Data Mining Multimedia, soft computing & bioinformaties wiley Interscience publications, 2004

5. Michal J A Berry ,Giordon Linoff "Mastering Data Mining " john Wiley & Sons ,2000

6. Alex Berson , Stephen J Smith ,"Data Warehousing Data Mining & OLAP " Tata Mc-Graw Hill.

7. C S R Prabhu "Data Warehousing – concepts, techniques and application "Prentice Hall of India 2nd edition, 2002.

Paper-II: Software Testing and Quality Assurance

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT -I

Introduction to software quality –Software modeling –Soft ware quality program- Establishing quality goals –Purpose ,quality of goals –SQA planning software –Productivity and documentation ,Software quality assurance management –Organization –Quality task –Responsibilities –Documentation Standards Practices Convention process Walk through process –Audit process -Test process –ISO CMM compatibility – problem reporting and corrective action.

UNIT-II

Tools, techniques and methodologies Code control Media control, Supplier control, Records collection Maintenance and retention, training and risk management, ISO 9000 Model, CMM Model, Comparison, ISO 9000 weaknesses, CMM weaknesses SPICE –Software Process Improvement and Capability determination.

UNIT –III

Purpose of Software testing – Some Dichotomies – a model for testing – Playing pool and consulting oracles – Is complete testing possible – The Consequence of bugs – Taxonomy of bugs, Software testing Fundamentals –Test case Design – Introduction of Black Box Testing and White Box testing –Flow Graphs and Path testing – path testing Basics –Predicates, path Predicates and Achievable path –path sensitizing –Path Instrumentation –Implementation and Application of path Testing.

UNIT –IV

Transaction Flow testing – Transaction Flow –techniques –Implementation Comments –Data Flow Testing –Basics-Strategies –Application ,Tools and effectiveness –syntax Testing – Why, What , How-Grammar for formats – Implementation – Tips. Logic Based Testing – Motivational Overview –Decision tables – path Expression- KV Chats, Specification states, State Graphs and transition Testing – State Graph – Goods & bad states –state testing Metrics and Complexity.

UNIT –V

Testing GUIs – Testing Client – Server Architecture –Testing for Real –time System- A Strategic Approach to software testing –issues –unit testing –Integration testing –VALIDATION TESTING – System testing – the art of Debugging.

REFERENCE BOOKS:

1. Mordechai Ben Meachem and Garry S. Marliss "Software Quality Producing practical . Consistent Software "International Thompson Computer press .1977

2 .Watt. S. Humphrey,"Managing Software Process ". Addison –Wesley 1998.

3. Philip. B. Crosby "Quality is free The Art of making quality certain "Mass MARKET 1992

4. BORIS Beizer. Software Testing Techniques. Dreamtech Press Second Edition -2003.

5. Myers and Glenford B.The Art of Software Testing john-Wiley & Sons. 1979

6. Roger. S. Pressman. software Engineering –A practitioner's Approach. Mc-Graw Hill. 5th edition. 2001

7. Marnie. L. Hutcheson. Software Texting Fundamentals. Wiley – India. 2

Paper-III: Advance Data Base Management

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

Unit I: INTRODUCTON AND CONCEPTUAL MODELING

Introduction to file and database systems. Database system structure. Database languages, DDL, DML, database access for application programs, .database users and administrator ,data models, Introduction to network and hierarchical models ,ER-Models, conceptual design for large enterprises, Relational models, relational algebra and calculus, relational algebra selection and projection set operations ,renaming, joins, division, examples of algebra ,overview of relational calculus, tuple relational calculus, domain relational calculus.

Unit –II RELATIONAL MODEL

SQL: Form of basic SQL Query, examples of basic SQL queries, introduction to nested queries ,correlated nested queries, set ,comparison operators ,Aggressive operators, Null values, comparisons using null values, logical connectivity – AND, OR and NOT, Outer joins, complex integrity constraints in SQL ,Updates ,views, Relational database designs , Functional dependencies and Normalization for relational databases.

Unit –III DATA STORAGE AND FILE ORGANISATION

Record storage, File organization and indexing- cluster indexing, primary and secondary indexes, primary file organization, secondary storage devices, operations on files -heap file, sorted files, hashing techniques, index structure for files, different types of indexes, B-tree, B+ tree.

Unit –IV TRANSACTION MANAGEMENT

Transaction processing introduction, need for concurrency controls, desirable properties of transaction-schedule and recoverability, serializability and schedule, concurrency controls, types of locks -two phases locking ,deadlock, time stamp based concurrency controls recovery techniques concepts, immediate update, deferred update , shadow paging.

Unit –V CURRENT TRENDS

Object oriented Databases, need for complex data types,- multimedia database ,distributed database , homogeneous and heterogeneous , distributed data storage, data mining and data ware housing, recovering from a system crash, media recovery.

Reference Books:

1. Abraham silberschatz, Henry F. Korth and S. Sudarshan –"Database System concepts "Fourth Edition, McGraw-Hill, IV Edition.
2. Database Management System –Mathew Leon, Leon Vikas.
3. Introduction to Database Management System –C. J. Date, Pearson Education.

Paper-IV: Knowledge Management

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT – 1

Basics – What is Knowledge Management - Key Challenges KM Life Cycle –Understanding Knowledge – Definitions-Cognition and Knowledge Management – Data Information, and Knowledge - Type of Knowledge – Expert Knowledge.

UNIT -2

Knowledge Management System Life Cycle – Challenges in Building KM Systems –Conventional Versus KM System Life cycle –KM System Life Cycle –System Justification –Role of Rapid Prototyping –Role of Knowledge Developer – user Training.

UNIT -3

Knowledge Creation - Nonaka's Model of Knowledge Creation and Transformation –Knowledge Architecture – Capturing Tacit Knowledge –Evaluating the expert Developing a relationship with expert – fuzzy reasoning and the Quality of the Knowledge Capture - interview as a tool –Brainstorming –Repertory Grid –Nominal – Group Techniques (NGT) –Delphi method –concept mapping.

Unit -4

Knowledge Codification –Codification tools and procedures – Knowledge Developers skill set knowledge transfer – transfer Methods – Role of the internet in knowledge Transfer, Knowledge Transfer in the E- World –E-Business, KM tools :- personal KM Tools ,What next –from GUI to CIM, software, Knowledge Technologies :- state of Technology ,KM Gets Unconventional ,Application is the Key ,Content Mgmt. Technology components of KM,ERP and BPR, Meta – data Architecture.

UNIT -5

Knowledge Management Tools and Knowledge Portals, Portals Basics, Business Challenge – Knowledge portal technologies – Ethical and Legal issues –Knowledge owners –legal issues- The ethical Factors –futuristic KM.

Reference Books:

1. Elias M. Awad, Hussan M. Ghaziri, " Knowledge Management " , Pearson Education (Edition 2004)

Paper-V: Digital Image Processing and Multimedia

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT-I: Digital Image fundaments and Image Transforms.

- Introduction, An Image model, sampling & quantization.
- Basic Relationships between Pixels, imaging geometry
- Properties of 2-D Fourier transform.
- FFT Algorithm and other separable image transforms.
- Walsh transforms, Hadamard, Cosine, Haar, Slant transforms.
- KL transforms and their properties.

UNIT-II: Image Enhancement and Image filtering

- Enhancement by point processing, histogram processing, spatial filtering and enhancement in frequency domain, color image processing.
- Image filtering and restoration: Algebraic approach to restoration, inverse filtering, least mean squares and interactive restoration, geometric transformations.

UNIT-III: Image Compression and Segmentation

- Image Compression mode, error free compression, lossy compression, image compression standards.
- Detection of discontinuities, edge linking and boundary detection thresholding, and region oriented segmentation use of motion in segmentation.
- Representation and description: Various schemes for representation, boundary descriptors and regional descriptors.
- Image reconstruction from Projections, Radon Transforms, Convolution/Filter back-Project Algorithms.

UNIT-IV: Multimedia System

- Project design: Setting up, requirements , navigation , storage, delivery
- Authoring tools: history , comparison of different approaches, functionality and principles
- Case study: Adobe Flash –Applications (eg. Kiosks, distance learning ,web based)

UNIT-V: Auditory Input and Output

- Auditory input and output : standards and techniques – Quality of service and usability in sound

REFERENCE BOOKS:

- A. K. JAIN, "Fundamental of Digital Image Processing" PHI.
- C.GONZALEX & R E WOODS " Digital Image Processing " Addison Wesley
- Macromedia Flash MX 2004 : The Complete Reference , Second Edition (Complete reference) (For Flash)
- Multimedia magic by S Gokul
- S McGloughlin Multimedia: Concepts and Practice, Prentice –Hall, 2001.
- N. Chapman & J. Chapman Digital Multimedia, Wiley, Second Edition, 2004 and Digital Media, Tools, 2nd or 3rd Editions, Wiley.

Paper-VI : TCP/IP Concepts

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

Unit I: Introduction

Introduction, layering, DNS- encapsulation, de-multiplexing, client/server model, port numbers, standardization process, the Internet. Link layer introduction, Ethernet and IEEE 802 encapsulation, trailer encapsulation, SLIP, PPP Loop back interface, MTU. Internet protocol: introduction, IP header, IP routing, subnet addressing, subnet mask-special case of IP addresses, a subnet example.

Unit II: Address Resolution Protocol

Introduction, an example, ARP cache, ARP packet format, ARP examples, Proxy ARP, ARP command. RARP: Introduction, RARP packet format, RARP examples, RARP server design. ICMP: Introduction, ICMP message types, ICMP address mask request and reply-ICMP timestamp request and reply-4.4 BSD processing of ICMP Messages.

Unit III: Ping Program

Introduction, ping program, IP record route option, IP time stamp option, Trace route program: Introduction, trace route program operation, LAN output, and WAN output- IP source routing option. IP routing: Introduction, routing principles, ICMP host and ICMP redirect errors. Dynamic routing protocols: Introduction, Dynamic routing, RIP-OSPF, BGP, CIDR. UDP: Introduction, UDP header, UDP checksum, IP fragmentation, UDP server design.

Unit IV: DNS

Introduction- basics, message format, simple example, pointer queries, resource records, caching, UDP.TFTP: introduction, protocol, security, BOOTP: introduction, packet format, server design through router.TCP: Introduction, services, headers, connection establishment and termination, timeout of connection establishment- maximum segment size- half, close, state transition diagram, reset segments, simultaneous open and close- options, server design.

Unit V: SNMP

Introduction, protocol, structure of management information, object identifiers, management information base, instance identification Telnet: rlogin protocols, examples, telnet protocol and examples FTP protocol, examples, SMTP protocols, examples, NFS, TCP/IP Applications.

Reference Books:

W. Richard Stevens, TCP/IP Illustrated Volume, 1 " The Protocols", Addison Wesley Longman
Jaiswal, S, TCP/IP Principles, Architecture, Protocols and Implementation, First Edition, Galgotia Publication

Paper-VII: CYBER SECURITY & CYBER LAW

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT – I: Network & Communication:
Basics of Communication Systems, Transmission Media , ISO/OSI and TCP/IP Protocol Stacks, HTTP, SHTTP Local Area Networks, Wide Area Networks, Internetworking, Packet Formats, Wireless Networks , The Internet.

UNIT – II: Cyber Crime & Law:

Cyber, Cyberspace, Types of Cyber Crime, Hacking, Cracking, Spyware, malware, Viruses & Worms, Trojan and backdoors, SQL Injection, IT Law and Cyber Crime, cyber pornography, Software piracy, Intellectual property right, Social Engineering, Legal system of information technology, Cyber Security, Information Warfare- concept, information as an intelligence weapon, attacks and retaliation, attack and defense, Attack on wireless Network, Cyber Law, and Indian IT ACT 2000.

UNIT – III: Security & Cryptography:

Security principles, threats and attack techniques, Introduction to security, Information, security, Security Issues and its types, Focus of control, Security threats and attacks, Security management, Protecting passwords, Access control structures, Types of access control, Cryptography, Plain Text, Encryption and Decryption.

UNIT - IV: Network security:

Introduction to Network security Protocol design principles, ISO architecture, IP security, SSL/TLS, Firewalls, How a firewall protects Network, Intrusion detection, Web defacements and semantic attacks, DNS attacks cyber Law Industrial espionage and cyber terrorism.

UNIT – V: Windows security: Windows security, Subjects, objects and access control software security and database security, Memory management, Data and code, Virtual Private Network in Windows, how to connect devices and computer, Virtual Private Network Security.

Reference Books:

1. Computer Security, 2nd.- ed. , Author: Dieter Gollmann , Publisher: John Wiley & Sons, 2006.
2. Security in Computing, Fourth Edition, Author: Charles P. Pfleeger, Shari Lawrence , Publisher: Pearson India
3. Cryptography and Network Security, Principles and Practices 3rd. ed. Author: William Stallings, Pearson Education
4. Cyber Law & IT ACT 2000, Author: Vivek Sood,

Paper-VIII: Big Data Analytics

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

UNIT I

Overview of Big Data: What is Big Data? Evolution of Big Data. Structuring Big Data. Elements of Big Data. Big Data Analytics. Exploring the Use of Big Data in Business Context: Use of Big Data in Social Networking. Use of Big Data in Preventing Fraudulent Activities. Use of Big Data in Detecting Fraudulent Activities in Insurance Sector. Use of Big Data in Retail Industry. Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data. Introducing Hadoop. Understanding Hadoop Ecosystem: Hadoop Ecosystem. HDFS. Map Reduce. Hadoop YARN. HBase. Hive. Pig and Pig Latin. Sqoop. ZooKeeper. Flume. Oozie.

UNIT II

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework. Techniques to Optimize MapReduce Jobs. Role of HBase in Big Data Processing. Exploring the Big Data Stack. Virtualization and Big Data. Virtualization Approaches.Storing Data in Databases and Data Warehouses: RDBMS and Big Data. Non Relational Database. Integrating Big Data with Traditional Data Warehouses. Big Data Analysis and Data Warehouse. Changing Deployment Models in Big Data Era.Processing Your Data with MapReduce: Developing Simple MapReduce Application. Points to Consider while Designing MapReduce. Customizing MapReduce Execution: Controlling MapReduce Execution with Input Format. Reading Data with Custom RecordReader. Organizing Output Data with Output Formats. Customizing Data with Record Writer. Optimizing MapReduce Execution with Combiner. Implementing a MapReduce Program for Sorting Text Data

UNIT III

Understanding Hadoop YARN Architecture: Introduction YARN. Advantages of YARN. YARN Architecture, Working of YARN. Exploring Hive: Introducing Hive. Getting Started with Hive. Hive Services. Data Types in Hive. Built-In Functions in Hive. Hive DDL. Data Manipulation in Hive. Data Retrieval Queries. Using JOINS in Hive. Analyzing Data with Pig: Introducing Pig. Running Pig. Getting Started with Pig Latin. Working with Operators in Pig. Working with Functions in Pig. Debugging Pig. Error Handling in Pig.

UNIT IV

Using Oozie: Introducing Oozie. Installing and Configuring Oozie. Understanding the Oozie Workflow. Simple Application. NoSQL Data Management: Introduction to NoSQL . Types of NoSQL Data Models.

Schema-Less Databases, Materialized Views, Distributed Models, Sharding, MapReduce Partitioning and Combining, Composing MapReduce Calculations. Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Developing an Analytic Team.

UNIT V

Analytical Approaches and Tools to Analyze Data: Analytical Approaches, History of Analytical Tools, Introducing Analytical Tools, Comparing Various Analytical Tools.

Text Books:

DT Editorial Services, Big Data – Black Book (dreamtech)

Reference Books:

1. Radha S, M. Vijayalakshmi, Big Data Analytics
2. Arshdeep B and Vijay M, Big Data Science & Analytics – A Hands-On Approach.
3. Frank Ohlhorst, Big Data Fundamentals – Concepts, Drivers, Techniques
4. Kuan-Ching Li, H Jiang, L T Yang, A Cuzzocrea, Big Data Algorithms, Analysis and Applications
5. Tom White, Hadoop: The Definitive Guide
6. Shiva Achari, Hadoop Essentials
7. Alex Holmes, Hadoop in Practice

Paper-IX: Advanced Software Engineering

Maximum marks = 100
Minimum Marks = 50
(03 Credits)

Unit - I: Software Engineering Basics

Introduction, Software Engineering Terminologies, Product Life Cycle, Project Life Cycle Models- Spiral model, Waterfall model, Evolutionary prototyping model, Reusable software model.

Software Engineering Methodologies- Introduction, Components of Software Engineering, Software Development Models- Capability Maturity Model, Rapid Application Development model, Incremental model.

Unit – II: Predictive Versus Adaptive Approaches to SDLC

Introduction, Traditional Predictive Approaches to SDLC, Adaptive Approaches to SDLC, Separation of Design and Construction, Unpredictability of Requirements.

Agile Programming- Introduction, Flavors of Agile Development, Agile Manifesto, Refactoring Techniques, Limitations of the Agile Process.

Unit - III: Extreme Programming (XP)

Introduction, XP Equation, XP Values, Assuming Sufficiency- Sufficient time and resources, Constant change of cost, Developer effectiveness, Freedom to experiment.

Introduction, Coding Practices, Developer Practices, Business Practices, **XP Events-** Introduction, Iteration Planning- Stories and tasks, Estimates and schedules, First iteration, Iteration, Releasing.

Unit – IV : Extreme Programming Practices

Introduction, Story Cards, Task Cards, Bullpens, **Roles in Extreme Programming-** Introduction, Customer's Roles, Developer's Roles, Supplementary Roles.

Unit - V: Coding XP Style

Introduction, Balance Functionality with Simplicity, Implement Only the Needed Features, Eliminate Repetition, **Adopting XP-** Introduction, Before Commencing XP, Eliminating Fear and Working Together, Starting Feedback, Including Managers and Customers **Agile Modeling with XP-** Introduction, Agile Modeling – Principles, Comparing XP and Agile Modeling, Scrum Methodology- The roles of Scrum.

Reference Books:

1. Software Engineering by Yogesh Singh
2. A practitioners Approach to . Software Engineering by Pressman, 2005.
3. Software Testing by Aditya Mathur, 2008
4. Agile Software Development by Cockburn, 2000.

PAPER-V **100 Marks**
2 Credits

Research and Publication Ethics

Unit 1: Philosophy and Ethics

Introduction to philosophy: definition, nature, and scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgments and reactions

Unit 2: Scientific Conduct

Ethics with respect to science and research, Intellectual honesty and research integrity, Selective reporting and misrepresentation of data Scientific misconducts: Falsification, Fabrication, Plagiarism, Redundant publications: Duplicate and overlapping publications, Salami slicing.

Unit 3: Publication Ethics

Publication ethics: Definition, Introduction, and importance, Conflicts of interest, Best practices / standards setting initiatives and guidelines: COPE (Committee on Publication Ethics), WAME (World Association of Medical Editors), ICMJE (International Committee of Medical Journal Editors), Others Publication Misconduct: Identification of publication misconduct, Complaints and appeals, Predatory publishers and journals.

Unit 4: Open Access Publishing

Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tools to identify predatory publications: Journal finder/journal suggestion tools (e.g., JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.).

Unit 5: Publication Misconduct

Group discussions Subject-specific ethical issues, FFP (Falsification, Fabrication, Plagiarism), Authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad

PAPER-VI **100 Marks**
3 Credits

Comprehensive viva-voce-

For Comprehensive viva-voce-

I. The power point presentation should be elaborative.

II. Viva-voce will be on any general topic of Mathematics