

## SEMESTER I

### 15ZS01 APPLIED STATISTICS AND RELIABILITY

2 2 0 3

**REVISION:** Probability, axioms of probability, conditional probability, Baye's theorem, probability distributions - random variables, binomial distribution, Poisson distribution, normal distribution, exponential distribution, and Weibull distribution. (4+4)

**TWO DIMENSIONAL RANDOM VARIABLES:** Joint distributions-discrete and continuous, marginal distributions. (3+3)

**ESTIMATION:** Point estimation, confidence intervals for mean, difference of two means, variances and proportions, maximum likelihood estimators. (3+3)

**TESTS OF STATISTICAL HYPOTHESES:** Tests about proportions, one mean and one variance, tests of the equality of two normal distributions, chi-square goodness of fit tests, contingency tables, one factor and two factor analysis of variance. (4+4)

**REGRESSION AND CORRELATION:** Introduction, estimation using the regression line, correlation analysis, making inferences about population parameters, multiple regression and modelling - multiple regression and correlation analysis, finding the multiple regression equation. (4+4)

**TIME SERIES ANALYSIS:** Introduction, variations in time series, trend analysis, cyclical and seasonal variation. (3+3)

**RELIABILITY:** Introduction, failure distribution - reliability function, mean time to failure, Hazard rate function, bathtub curve, conditional reliability, constant failure rate model – exponential reliability function, failure models, time dependent failure models - Weibull and normal distribution. (3+3)

**RELIABILITY OF SYSTEM AND MODELS:** Serial configuration, parallel configuration, combined series parallel systems, system structure function, minimal cuts and minimal paths, state dependent systems – load sharing systems, standby systems, degraded systems, three state devices, physical reliability models - covariate models, static models, dynamic models, physics of failure models . (6+6)

**Total L: 30 + T: 30 = 60**

#### REFERENCES:

1. Richard A Johnson, "Miller and Freund's Probability and Statistics for Engineers", Prentice Hall, New Delhi, 2013.
2. Robert V Hogg, Elliot A Tanis and Jagan Mohan Rao, "Probability and Statistical Inference", Pearson, New Delhi, 2007.
3. Richard I Levin and David S Rubin, "Statistics for Management", Pearson, New Delhi, 2011.
4. Charles E Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata Mc Graw Hill, New Delhi, 2010.
5. Saeed Ghahramani, "Fundamentals of Probability with Stochastic Processes", Pearson, New Delhi, 2012.

### 15ZS02/15ZC02 DATA STRUCTURES

2 2 0 3

**ALGORITHM ANALYSIS:** Algorithm: Definition - Analysis of Complexity - Asymptotic Notation - P, NP, NP Hard and NP Complete - Amortized Analysis. Data Structures - Abstract Data Types - Types of Data Structures. (6+6)

**ARRAYS AND LISTS:** Representation - 2D Array - Sparse Matrix Representation - Representation and Operation: Singly Linked List, Doubly Linked List, Circular Linked Lists, Multi Lists - Applications: Sparse Matrix. (6+6)

**STACKS AND QUEUES:** Representation of stacks - Operations on stacks - Applications: Infix to Postfix Conversion of Arithmetic Expression - Evaluation of Postfix Expressions - Stacks and Recursive Algorithms. Representation of queues - Operations on queues - Simple Queue - Circular Queue - Deque - Priority Queues. (5+5)

**TREES:** Binary Trees: Types - Representation - Traversals - Application: Expression Trees - Threaded Binary Trees - Binary Search Trees: Operations - B Trees – Tries. (7+7)

**GRAPHS AND SETS:** Representation - Traversals - Applications: Single Source Shortest Path - All Pairs Shortest Path - Minimum Spanning Trees - Topological Sort.Representation of sets - Operations on sets - Maintaining a Collection of Disjoint Sets: Union - Find - Path Compression. (6+6)

**Total L: 30+T: 30=60**

**REFERENCES:**

1. Venkatesan R and Lovelyn Rose S, "Data Structures", Wiley India Pvt. Ltd., New Delhi, 2015.
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2011.
3. Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi, 2007.
4. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press, England, 2009.
5. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Publications, New Delhi, 2009.

**15ZS03/15ZC03 DATABASE DESIGN AND MANAGEMENT****3 2 0 4**

**INTRODUCTION TO DATABASE:** File System Organization: Sequential, Pointer, Indexed, And Direct - Purpose of Database System - Database System Terminologies - Database Characteristics - Types of Data Models - Components of DBMS - Codd's Rules - Integrity Constraints - Keys - Relational Algebra - Relational Calculus - Aspects of ER Modelling - ER Model - Extended ER Model - Transformation of ER Model to Relational Model - Schema Refinement: Design Considerations - Functional Dependency - Normalization and Normal Forms - Denormalization. (10+7)

**SQL & QUERY OPTIMIZATION:** SQL Standards - Data Types - Database Objects - DDL - DML - DCL - TCL - Embedded SQL - Static vs Dynamic SQL - Overview of Physical Storage Media: Magnetic Disk - RAID - Tertiary Storage. File Organization - Organization of Records in Files - Indexing and Hashing - Order Indices - B+ Tree Index Files - B Tree Index Files - Static Hashing - Dynamic Hashing - Query Processing and Optimization - Overview of Database Administration and Tuning. (10+7)

**TRANSACTION PROCESSING AND CONCURRENCY CONTROL:** Transaction Concepts - ACID Properties - Transaction States - Concurrency Control Problems - Serializability- Recoverability - Pessimistic and Optimistic Concurrency Control Schemes. (9+6)

**DATABASE BACKUP, RECOVERY AND SECURITY:** Introduction- Major Causes of Database Failure - Backup Types - Recovery and Buffer Management - Types of Recovery Techniques - Security Violations- Identification and Authentication - Access Control Mechanisms - Statistical Database - audit Policy. (8+5)

**ADVANCED TOPICS:** Overview: Parallel Database - Spatial Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database - Data Warehouse. OLTP vs OLAP. (8+5)

**Total L: 45+T: 30=75****REFERENCES:**

1. Abraham Silberchatz, Henry F Korth and Sudarshan S, "Database System Concepts", Tata McGraw-Hill, New Delhi, 2010.
2. Ramez Elmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Addison Wesley, USA, 2010.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Tata McGraw-Hill, New Delhi, 2008.
4. Gupta G K, "Database Management System", Tata McGraw-Hill, New Delhi, 2011.
5. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2009.

**15ZS04 ANALYSIS AND DESIGN OF SOFTWARE SYSTEMS****3 2 0 4**

**INTRODUCTION:** Software Characteristics – Comparison with other Engineering disciplines – Software Crisis and Myths – Software life cycle models – Selection of process models for projects – Unified Process Model - Agile methods – Software Engineering paradigms. (8+5)

**SYSTEM ANALYSIS:** Requirement Analysis – Analysis Modeling Approaches – Data Flow Oriented Modeling – Context diagram, Data flow diagrams – Object Oriented Analysis – Objects and Classes – Object Identification – Relationship among objects – classification. (9+6)

**UML MODELING:** Use cases – UML Diagrams to support Object Oriented Analysis – Scenario Based Modeling – Class Based Modeling – Creating a Behavioral Model – CASE tools. (9+6)

**SYSTEM DESIGN:** Design Process – Design Concepts – Modularity – Functional Independence - Modular Design – Coupling – Cohesion – Refactoring – Design Model – Architectural Design - Component Level Design Element – Deployment Level Design – Architectural Styles and Patterns – IEEE Standard for Software Design Descriptions. (10+7)

**USER INTERFACE DESIGN AND PROGRAMMING STANDARDS:** User Interface design – Human factors – Human computer interaction – Interface Design Considerations – Interface standards – Case study. Structured flow charts – Structured programming coding standards - Programming Practices – Maintainability of code. (9+6)

**Total L: 45 + T: 30 = 75**

**REFERENCES:**

1. Roger Pressman S, "Software Engineering: A Practitioners", Tata McGraw Hill, New Delhi, 2010.
2. Sommerville I, "Software Engineering", Pearson Education, New Delhi, 2010.
3. James Peter and Pedrycz W, "Software Engineering: An Engineering Approach", John Wiley & Sons, New York, 2007.
4. Shari Lawrence Pfleeger, "Software Engineering: Theory and Practices", Pearson Education, New Delhi, 2009.
5. Rumbaugh, Jacobson and Booch, "The Unified Modeling Language Reference Manual", Pearson, India, 2009.

**15ZS05 SOFTWARE REQUIREMENTS AND ESTIMATION**

**3 0 0 3**

**INTRODUCTION:** Definitions – Interpretation – levels – Requirements Development and Management – Bad Requirements – Benefits of High-Quality Requirements – Process Characteristics – Tools for requirements gathering – Benefits of using a requirements management tool – Commercial requirements management tools. (8)

**REQUIREMENTS ENGINEERING:** Requirements elicitation – Analysis models and documentation – Reviews – Quality attributes of Requirement document - Risk reduction through prototyping - Setting requirements priorities – Verifying requirements quality. (10)

**REQUIREMENTS MANAGEMENT:** Requirements management Principles and practices – Requirements attributes – Change Management Process - Requirements Traceability Matrix – Links in requirements chain. (9)

**SOFTWARE ESTIMATION:** Components of Software Estimation – Estimation methods – Problems associated with estimation – Key project factors that influence estimation – Size Estimation – Two views of sizing. (9)

**ESTIMATION TECHNIQUES:** Function Point Analysis – Mark II FPA – Full Function Points – LOC Estimation – Conversion between size measures – Factors and Approaches to Effort and Schedule Estimation – COCOMO II – Putnam Estimation Model – Algorithmic models – Cost Estimation – CASE Tools. (9)

**Total L: 45**

**REFERENCES:**

1. Rajesh Naik and Swapna Kishore, "Software Requirements and Estimation", Tata Mc Graw Hill, India, 2008.
2. Karl Engene Wiegenger, "Software Requirements", Microsoft Press WP Publishers and Distributors, Redmond, 2003.
3. Dean Leffingvell and Don Widnig, "Managing Software Requirements", Pearson Education, Addison-Wesley Profession, India, 2003.
4. Suzanne Robertson and James Robertson, "Mastering the Requirements Process", Pearson Education, 2007.

**15ZS51/15ZC51 ENTERPRISE COMPUTING LABORATORY**

**0 0 4 2**

1. Java Enterprise Application Creation and Testing.
2. Development of a Servlet with Session Management.
3. Servlet Session Tracking and Servlet Filter Implementation.
4. Web Application Development using JavaServer Faces.
5. JavaServer Faces Web Application: Validation and Navigation Implementation.
6. Session Beans: Stateless and Stateful Session Beans Implementation.
7. Java Messaging and Message Driven Bean Implementation.
8. Enterprise Persistence Implementation using Entity.
9. Web Socket Implementation.

**Total P: 60**

**REFERENCES:**

1. Jendrock E & Cervera-Navarro, R & Evans, I & Haase, K & Markito, W, "Java EE 7 Tutorial", Oracle, USA, 2014.
2. Rubinger A L and Burke B, "Enterprise JavaBeans 3.1", O'Reilly Media, USA, 2010.
3. Gupta A, "Java EE 6 Pocket Guide: A Quick Reference for Simplified Enterprise Java Development", O'Reilly Media, USA, 2012.
4. Kogent Learning Solutions Inc., "Java Server Programming Tutorial Java EE6 (J2EE 1.6) Black Book", Dreamtech Press, New Delhi, 2011.
5. Schildt H Java, "The Complete Reference", Tata McGraw-Hill Education Private Ltd., India, 2011.

## 15ZS61/15ZC61 INDUSTRY VISIT AND TECHNICAL SEMINAR

0 0 2 1

The student will make atleast two technical presentations on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of the semester covering the various aspects of his/her presentation together with the observation in industry visits. A quiz covering the above will be held at the end of the semester.

Total P: 30

## SEMESTER II

### 15ZS06/15ZC06 ADVANCED DATA STRUCTURES AND ALGORITHMS

3 2 0 4

**EFFICIENT BINARY SEARCH TREES:** AVL Trees - Red-black Trees - AA Trees - Splay Trees. (8+5)

**HEAPS:** Binary Heaps - d-heaps - Leftist Heaps - Binomial Heaps - Fibonacci Heaps - Pairing Heaps. (9+6)

**MULTIDIMENSIONAL DATA STRUCTURES:** k-d trees - Point Quad trees - MX-Quad trees - R-trees - TV trees. (10+7)

**ALGORITHM DESIGN TECHNIQUES:** Divide and Conquer - Greedy method - Dynamic Programming - Backtracking - Branch and Bound. (10+ 7)

**RANDOMIZED ALGORITHMS:** Random number generators - Skip lists - Primality Testing –Treaps (8+5)

Total L: 45+P: 30 = 75

#### REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press, Massachusetts, 2009.
2. Subrahmanian V S, "Principles of Multimedia Database Systems", Morgan Kaufman, USA, 2013.
3. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2011.
4. Ellis Horowitz, Sartaj Sahni and Dinesh P. Mehta, "Fundamentals of Data Structures in C++", Universities Press (India) Pvt. Ltd, 2008.

### 15ZS07 SOFTWARE TESTING AND QUALITY ASSURANCE

3 2 0 4

**TESTING FUNDAMENTALS AND TECHNIQUES :** Objectives and Principles- V Process Model- Relationship between Testing and Development Life Cycle- Verification Vs Validation- Characteristics Of Good Test Case- Test Case Design-Testing techniques: White Box Testing- Basis Path Testing – Control Structure Testing- Black Box Testing- Graph Based Testing- Equivalence Partitioning- Boundary Value Analysis. (10+8)

**TESTING STRATEGIES:** Unit Testing- Integration Testing- System Testing- Acceptance Testing- Special Test Strategies- Art of Debugging-IEEE Standard for Software Unit Testing. (8+4)

**TEST AUTOMATION AND MANAGEMENT:** People and Organizational Issues in Testing- Test Planning- Management- Execution- Reporting- Software Test Automation- Tools for Testing- Selection of Test Tool- Challenges in Automation. (8+4)

**QUALITY CONCEPTS:** Views of Quality- Quality Control vs Quality Assurance- Cost of Quality- Quality Movement- Quality Assurance Group- Roles and Responsibilities- SQA Activities- Formal Technical Reviews- Statistical Approach to Quality Assurance- SQA plan. (9+6)

**SOFTWARE QUALITY METRICS AND STANDARDS:** Software Quality Measurement- Product Quality Metrics- Software Maintenance Metrics- Collecting Software Engineering Data- Software Reliability Models - Models and standards: Role of CMM/CMMI- ISO Standards- Trends in Quality. (10+8)

Total L: 45+P: 30=75

#### REFERENCES:

1. Roger Pressman S, "Software Engineering: A Practitioners", Tata McGraw Hill, New Delhi, 2010.
2. Srinivasan Desikan and Gopaldaswamy Ramesh, "Software Testing Principles and Practices", Pearson Education, New Delhi, 2009.
3. Alan C Gillies, "Software Quality Theory and Management", Thomson, New Delhi, 2006.
4. Miliind Limaye, "Software Quality Assurance", Tata McGraw Hill, New Delhi, 2011.
5. <http://www.akitaonrails.com/files/std1008-1987.pdf>

## 15ZS08 SOFTWARE ENGINEERING MANAGEMENT

3 0 0 3

**SOFTWARE PROCESS MANAGEMENT:** Process-Process Maturity-Capability Maturity Model and its variants- CMMI - Productivity improvement. (7)

**SOFTWARE ECONOMICS AND FEASIBILITY STUDY:** Effect of cost, time and Resources on software development-Economical-Technical and Operational Feasibility studies. Discounted cash flow and return on investment-software project planning: Stepwise planning-Identifying scope and objectives. (10)

**PROJECT SCHEDULING AND TRACKING:** Principles of project scheduling-Critical Path-Tracking methods-Timeline chart-Earned value Analysis.**RISK MANAGEMENT:** Nature, Type of Software Risks-Risk identification-Risk exposure-Risk prioritization-Risk Mitigation, Monitoring and Management plan. (11)

**SOFTWARE CONFIGURATION MANAGEMENT:** Need for Configuration Management-check in check out process-Versions and Variations-Baselines-Software Configuration Audit.**PEOPLE MANAGEMENT:** Basic organization structures-Decision making-Issues in people management. Effective Team building- Organizational Behavior. (10)

**SOFTWARE MAINTENANCE:** Customer's Viewpoint - Economics of Maintenance - Issues in Maintenance - Software Maintenance Process, Activities and Categories – Maintenance Measurement – Service Measurement and Benchmarking – Problem Resolution – Reporting – Fix Distribution. (7)

**Total L: 45**

### REFERENCES:

1. Roger Pressman S, "Software Engineering: A Practitioners", Tata McGraw Hill, New Delhi, 2009.
2. Watts Humphrey, "Managing the Software Process", Pearson Education, New Delhi, 2000.
3. Watts Humphrey, "Introduction to the Team Software Process", Pearson Education, New Delhi, 2002.
4. Pankaj Jalote, "Software Project Management in Practice", Pearson Education, New Delhi, 2005.
5. Gopalaswamy Ramesh and Ramesh Bhattiprolu, "Software Maintenance: Effective Practices for Geographically Distributed Environments", Tata McGraw Hill, New Delhi, 2009.
6. Bob Hughes and Mike Cotterell, "Software Project Management", Tata McGraw Hill, New Delhi, 2010.

## 15ZS09 ADVANCED SOFTWARE ENGINEERING

3 0 0 3

**FORMAL METHODS:** Basic Concepts, Mathematical Preliminaries, Applying Mathematical Notations for Formal Specification, Formal Specification Languages, Using Z to Represent an Example Software Component, The Ten Commandments of Formal Methods, Formal Methods- The Road Ahead Cleanroom Software Engineering:- The Clean Room Approach, Functional Specification, Clean Room Design, Clean Room Testing. (10)

**COMPONENT-BASED SOFTWARE ENGINEERING:** Engineering of Component-Based Systems, The CBSE Process, Domain Engineering, Component-Based Development, Classifying and Retrieving Components, And Economics of CBSE. (8)

**CLIENT/SERVER SOFTWARE ENGINEERING:** The Structure of Client/Server Systems, Software Engineering for C/S Systems, Analysis Modeling Issues, Design for C/S Systems, Testing Issues. (8)

**WEB ENGINEERING:** The Attributes of Web-Based Applications, TheWebe Process, a Framework for Webe, Formulating/Analyzing Web-Based Systems, Design for Web-Based Applications, Testing Web-Based Applications, Management Issues. (9)

**REENGINEERING:** Business Process Reengineering, Software Reengineering, Reverse Reengineering, Restructuring, Forward Reengineering, Economics of Reengineering.- CASE Building Blocks, Tools, Integrated CASE Environments, Integration Architecture, CASE Repository, Case Study. (10)

**Total L: 45**

### REFERENCES:

1. Roger S Pressman, "Software Engineering - A Practitioners Approach", McGraw-Hill, New York, 2005.
2. Bowan J, "Formal Specification and Documentation using Z - A Case Study Approach", International Thomson Computer Press, New York, 1996.
3. Antoni Diller Z., "An Introduction to Formal Methods", Wiley, France, 1993.
4. Dyer M, "The Cleanroom Approach to Quality Software Development", Wiley, USA, 1994.
1. Prowell S, Trammell C J and Poore J H, "Cleanroom Software Engineering: Technology and Process", Addison-Wesley, Massachusetts, USA, 1993.
2. Allen and Frost and Yourdon, "Component-Based Development for Enterprise Systems: Applying the Select Perspectives", Cambridge University Press, New York, 1998.

3. Zantinge and Adriaans, "Managing Client/Server", Addison-Wesley, Massachusetts, USA, 2005.
4. Sami Beydeda, Matthias Book and Volker Gruhn, "Model-Driven Software Development, Springer Verlag", Berlin Heidelberg, 2005.

## 15ZS10 SOFTWARE ARCHITECTURE

**3 0 0 3**

**MIDDLEWARE ARCHITECTURES**– Definition – Architecture For Non-Functional Requirements – Role Of Software Architect – Technologies – Software Quality Attributes - Classification – Distributed Objects – Message Oriented Middleware – Application Servers – Enterprise Java Beans Architecture. (10)

**SERVICE ORIENTED ARCHITECTURE**– Service Oriented Systems – Web Services – Components – Restful Web Services-Advanced Middleware Architectures –Business Process Orchestration, Integrating Architecture Issues, ESB- Message Brokers. (9)

**SOFTWARE ARCHITECTURAL PROCESS AND DOCUMENTATION:** Process – Requirements, Design, Validation-Documentation - UML 2.0, Architectural Views, Component Diagrams, Templates. (8)

**ARCHITECTURAL STYLES AND PATTERNS:** Patterns In Software Architecture – Layers, Pipes And Filters, Blackboard, Broker, MVC, Presentation-Abstraction-Control, other styles - event-based, data centred, interpreter, message dispatcher, multitier distributed - Adaptable Systems. (9)

**ASPECT ORIENTED ARCHITECTURE AND MDA:** Aspect Oriented Architecture-Aspects, AOP, Example- Architecture, Aspects And Middleware, Tools, Model Driven Architecture-Need, Tools, MDA And Software Architecture- Requirements, Transformation.(9)

**Total L: 45**

### REFERENCES:

1. Ian Gorton "Essential Software Architecture", Springer. New York, 2011.
2. Frank Buschmann, RegineMuine, Hans Rohner, Peter Sommerlad and Michael Stal, "Pattern Oriented Software Architecture", John Wiley, England, 2001.
3. George Fairbanks, "Just enough Software Architecture", Marshall and Bainerd, Boulder, USA, 2010.
4. Simon Brown, "Software Architecture for Developers", Lean Publishing, Vancouver, BC, Canada, 2013.
5. Mahesh P Matha, , "Object Oriented Analysis & Design Using UML - An Introduction To Unified Process & Design Patterns", Prentice-Hall of India Pvt. Ltd., India, 2010

## 15ZS52 SOFTWARE DESIGN AND DEVELOPMENT LABORATORY

**0 0 2 1**

The students will create a Web application/prototype using the concepts learnt in various courses in the programme. The student will choose a problem in the domain/technology of his choice. The 4+1 Architecture view model of architecture of the application will be studied and documented. The application will also be analysed for the use of suitable design patterns. A simple multi-tier application will also be developed using distributed objects. The student will make two presentations and submit a consolidated report on the work done at the end of the semester.

**Total P: 30**

### SEMESTER III

## 15ZS53 XML AND WEB SERVICES LABORATORY

**0 0 4 2**

1. Study of XML technology.
2. Create a well-formed XML document.
3. Validate an XML document using XML schema.
4. Parse an XML document and extract data.
5. Traverse and search XML documents using XPath and XQuery.
6. Transform an XML document using XSLT.
7. Study of architecture of Web services
8. Create a simple SOAP-XML web service and invoke from client.
9. Implement a SOAP-XML web service using arguments in SOAP
10. Study of REST services.
11. Create a REST web service and invoke from client.
12. Create a REST-JSON web service using arguments.

**Total P: 60**

**REFERENCES:**

1. Fawcett J, Ayers D and Liam REQ, "Beginning XML", Wrox, USA, 2012.
2. Hansen M D, "SOA Using Java Web Services", Prentice Hall, USA, 2007.
3. Kalin M, "Java Web Services: Up and Running", O'Reilly Media, USA, 2008.
4. Richardson, L and Ruby S, "Restful Web Services", O'Reilly, USA, 2007.
5. <https://msdn.microsoft.com/en-us/library/ms950421.aspx>.

**15ZS71/15ZC71 PROJECT WORK I****0 0 6 3**

Identification of real time problem in the field of computers.

Developing a mathematical model for solving the identified problem.

Finalization of system requirements and specification.

Proposing different solutions for the problem based on literature survey.

Future trends in providing alternate solutions.

Consolidated report preparation on the work done.

**Total P: 90****SEMESTER IV****15ZS72/15ZC72 PROJECT WORK II****0 0 28 14**

The project involves the following:

- ❖ **Preparing a project - brief proposal including**
  - ❖ Problem Identification
  - ❖ A statement of system / process specifications proposed to be developed
  - ❖ List of possible solutions including alternatives and constraints
  - ❖ Cost benefit analysis
  - ❖ Time Line of activities
- ❖ **A report highlighting the design finalization [based on functional requirements & standards (if any) ]**
- ❖ **A presentation including the following:**
  - ❖ Implementation Phase (Hardware / Software / both)
  - ❖ Testing & Validation of the developed system
  - ❖ Learning in the Project

**Total P: 420****ELECTIVE THEORY COURSES****Group-I****15ZS22 USER INTERFACE DESIGN****2 0 2 3**

**TASK ORIENTED UI DESIGN:** User Interface –Importance-Goals- UI and Software Designer – Human Factors in Design – User Needs and Requirements- Task Oriented UI Design - Principles–Design Evaluation – Choice of Color –Design Phases – Case Study. (6+6)

**OBJECT ORIENTED DESIGN ANDCSCW UI:** Object Oriented UI Design: Design of Icons – Use of Metaphors – GUI Design – Case Study, CSCW Characteristics – Examples – CSCW UI – Method of Specifying and Designing UI for CSCW Systems – Case Study. (6+6)

**USABILITY AND ACCESSIBILITY:**Usability - The Viewpoint of User, Customer and Designer – Usability Specification – Stages in Usability Specification and Evaluation - Accessibility - Need – Incorporating Accessibility – Involving People with Disability – Accessibility in User Centered Design Process. (6+6)

**MOBILEHCI:** Mobile Ecosystem – Platforms, Application Frameworks, Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile Design – Elements, Tools, Case Studies. . (6+6)

**WEB INTERFACE DESIGN:** Designing Web Interfaces- Drag and Drop-Direct Selection-Contextual Tools, Overlays, Inlays and Virtual Tags-Process Flow-Case Studies. (6+6)

**LABORATORY COMPONENT:**

1. Exercises for verification of HCI laws.
  - a. Serial Position Effect
  - b. Fitts Law
  - c. Hick Hyman's Law
  - d. Sensitivity Analysis
  - e. Weber's Law
  - f. GOMS Model
2. Color Theory
  - a. Consistency and Inconsistency in Interaction
  - b. Graphic Icons and Typography in GUIs
  - c. The Visual Coding of Information.
3. Design of Web UI and Usability Testing.
4. Design of Mobile UI and Usability Testing.

**Total L: 30+P: 30=60**

**REFERENCES:**

1. Linda Mcaulay, "HCI for Software Designers", International Thompson Computer Press, USA, 1998.
2. Brian Fling, "Mobile Design and Development", O'Reilly Media Inc., USA, 2009.
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly Media Inc., USA, 2009.
4. Ben Schneiderman, "Designing the User Interface", Pearson Education, New Delhi, 2009.
5. Andrew Sears and Julie A Jacko, "HCI handbook", Lawrence Erlbaum Associates, New York, 2008.
6. Jeniffer Tidwell, "Designing Interfaces", O'Reilly, USA, 2011.
7. MSDN Library's Documentation on c#.
8. Programming Microsoft Windows with C# by Charles Petzold.
9. HCI Bibliography: Human – Computer Interaction Resources <http://hcibib.org/>

## 15ZS23 OPEN SOURCE SYSTEMS

**2 0 2 3**

**PRINCIPLES OF OPEN SOURCE SOFTWARE:** Introduction to Open Source - The Philosophy of OSS - The Cathedral and Bazaar (Catb) - Commercial Software and OSS - Free Software and Freeware - Open Source Licenses - Copyrights and Copyleft, Patents. Economics Of FOSS : Zero Marginal Cost, Income - Generation Opportunities, Problems with Traditional Commercial Software, Internationalization. (6+6)

**OPEN SOURCE OPERATING SYSTEMS AND DATABASE:** Kernel Types- Architectures- Supported File Systems-Security Issues - Case Study: Flavors of Linux-SQL Standard Compliance- Supported Platforms- Programming Interfaces - Case Study: MySQL- Internals and Portability - Data Types - Security - Scalability -Connectivity - Localization - PostgreSQL- CouchDB- Hbase (6+6)

**OPEN SOURCE PROGRAMMING LANGUAGES:** Introduction to Open Source Programming and Scripting Languages- Execution Environment- Programming in Web Environment- File Handling and Data Storage - Working with Forms - Case Study: PHP, Python. (6+6)

**OPEN SOURCE WEB SERVER:** Web Server- Feature- Architectures- Case Study: Apache Web Server - Configuring and Using Web Server - Comparison of Apache Web Server with Commercial Web Servers. (6+6)

**OPEN SOURCE TOOLS AND TECHNOLOGIES:** Integrated Development Environment for Development and Testing - Text Processing Tools - E-Learning Tools- Version Control and Content Management Tools - Parallel and System Programming Tools- Virtualization and Cloud Computing - Social Network Engine (6+6)

**LABORATORY COMPONENT**

1. Linux System Administration.
2. Kernel configuration, compilation and installation.
3. Virtualization environment.
4. Installing various software packages.
5. Version Control System.
6. Text processing with Perl.
7. Simple programs with PHP.
8. Simple programs with Python.

**Total L: 30+P: 30=60**



## REFERENCES:

1. Kailash Vadera and Bhavyesh Gandhi, "Open Source Technology", University Science Press, New Delhi, 2009.
2. Richard Petersen, "Linux: The Complete Reference", Tata McGraw Hill, New Delhi, 2007.
3. Julie Meloni, "Teach Yourself PHP, MySQL and Apache All in One", Pearson Education, USA, 2012.
4. Sandeep Koranne, "Handbook of Open Source Tools", Springer Science & Business Media, Heidelberg, 2010.
5. Christopher Negus and Christine Bresnahan, "Linux Bible", Wiley, USA, 2015.
6. Brian D Foy, "Mastering Perl", O'Reilly Media, USA, 2014.
7. Julie Meloni, "Teach Yourself PHP, MySQL and Apache All in One", Sams Publishers, USA, 2012.

## 15ZS24 COMPUTER NETWORKS

2 0 2 3

**MAC PROTOCOLS AND LAN ACCESS TECHNIQUES:** MAC Protocols - Multiple Access Communications, Random Access, Scheduling Approaches to MAC, Channelization, Delay Performance of MAC And Channelization Schemes (Polling – Contention – ALOHA – Slotted ALOHA – CSMA – CSMA/CD – CSMA / CA) – Standards - Ethernet, Token Ring, FDDI And WLAN. (6+6)

**IP ADDRESSING:** IPV4-Masking – Sub Netting – Super Netting – Mapping Internet Addresses to Physical Addresses(ARP) – RARP – Routing IP Datagrams – ICMP- IGMP - Motivation for Changing IPV4 – Features Of IPV6 – Header Format – IPV6 Source Routing – IPV6 Options-- Migration Issues from IPV4 to IPV6. (6+6)

**TRANSMISSION CONTROL PROTOCOL:**Introduction – TCP Services - TCP Header – TCP Connection Establishment and Termination – Interactive Data Flow – Bulk Data Flow – Timeout and Retransmission - Congestion Control - Congestion Avoidance (6+6)

**SOCKET INTERFACE AND APPLICATION:**UNIX I/O Paradigm and Network I/O – Creating A Socket – Inheritance and Termination – Connecting Sockets to Destination Address – Obtaining Information about Host, Network Protocols, Network Services - Electronic Mail (SMTP, POP, IMAP, MIME). (6+6)

**NETWORK MANAGEMENT AND ADVANCED NETWORK ARCHITECTURES:** - Internet Security and Firewall Design- Configuration Management – Internet Management (SNMP V1, V2, V3 &RMON) – Integrated Services in the Internet, RSVP, Differentiated Services – Network Interconnection Models, MPLS, Real Time Transport Protocol and Session Control Protocols. (6+6)

### LABORATORY COMPONENT:

1. Simple Chat Program using TCP Sockets.
2. Simulation of HTTP Protocol using TCP Sockets.
3. Simulation of Sliding Window Protocol using TCP Sockets.
4. Simulation of DNS using UDP Sockets.
5. Simulation of Ping using Raw Sockets.
6. Learn to use commands like TCP Dump, Netstat, Trace Route.
7. Develop applications and understand the behavior of TCP Options.
8. Study of TCP/UDP performance using OPNET tool.
9. Performance comparison of MAC protocols using OPNET tool .
10. Performance comparison of Routing protocols using OPNET tool .
11. Study and configure functionalities of a router and switches (or by simulation)

Total L: 30+P: 30=60

## REFERENCES:

1. Alberto Leon Garcia and Indra Widjaja, "Communication Networks – Fundamental Concepts and Key Architectures", Tata McGraw Hill, India, 2011.
2. Larry L Peterson and Bruce S Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, USA, 2011.
3. James F Kurose and Keith W Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Pearson Education, India, 2012.
4. Nader F Mir, "Computer and Communication Networks", Pearson Prentice Hall, Publishers, India, 2010.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks - An Open Source Approach", McGraw Hill Publisher, India, 2011.

## 15ZS25 DATA INTENSIVE COMPUTING SYSTEMS

2 0 2 3

**BIG DATA AND INFRASTRUCTURE:** Big Data Overview – Characteristics – Role of Data Scientist – Big Data in Industry Verticals – Infrastructure- Cloud Computing – Data Centre Architecture – Compute, Network, Storage and Desktop Virtualization – Storage Devices. (6+6)

**DATA ANALYTICS AND MAP REDUCE:** Data Analytics Lifecycle – Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalizing – MapReduce Architecture – Sample Case Studies. (6+6)

**STORAGE PLATFORMS:** NoSQL Stores – Key-Value Stores – Columnar Stores – Document Stores - Graph Databases – Case Studies – Hadoop Distributed File System, HBase, Hive, MongoDB, Neo4j. (6+6)

**THEORY AND METHODS I:** ANOVA – PCA- K Means Clustering, Hierarchical Clustering, Naïve Bayesian Classifier, Decision Tree Classifier, Association Rule Mining. (6+6)

**THEORY AND METHODS II:** Linear Regression, Logistic Regression, SVM, Time Series Analysis, Text Analysis- Rtool Features. (6+6)

#### LABORATORY COMPONENT

1. Installation of Hadoop and HBase.
2. Execution of WordCount in Hadoop.
3. Execution of Kmeans on Hadoop.
4. Learning to use Pig.
5. Uploading data and scanning data in HBase.
6. Identifying friend-of-friends relationship in Neo4j.
7. Basic Statistics and Visualization Using statistical language R.
8. Graphics Package Plots and Hypothesis Tests in R.
9. Linear Regression and Logistic Regression in R.
10. Clustering, association rule mining and Classification in R.
11. Time Series Analysis.

**Total L: 30+P: 30=60**

#### REFERENCES:

1. Venkata Josyula, Malcolm Orr & Greg Page, "Cloud Computing: Automating the Virtualized Data Center", CISCO Press, USA, 2011.
2. Runkler and Thomas "A, Data Analytics - Models and Algorithms for Intelligent Data Analysis", Springer, USA, 2012.
3. Nathan Marz and James Warren, "Big Data - Principles and Best Practices of Scalable Realtime Data Systems", MEAP Began, USA, 2012.
4. Jared Dean, "Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners", Wiley, USA, 2014.
5. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, USA, 2013.
6. Dharminder Kumar and Suman, "Performance Analysis of Various Data Mining Algorithms: A Review", International Journal of Computer Applications (0975 – 8887) Volume 32– No.6, 2011.

### Group-II

#### 15ZS26 SYSTEMS ENGINEERING

**3 0 0 3**

**OVERVIEW:** Definition –Origin - The Hierarchy Within a System - Systems of Systems - Use and value of Systems Engineering - SE life cycle - characteristics – life cycle stages – approaches – plan driven – incremental and iterative, lean , agile – choosing the best approach – case study. (9)

**TECHNICAL PROCESSES:** Key interactions – Stakeholder's requirements definition – requirements analysis – Architectural design – implementation – Verification - Transition - Validation - Operation - Maintenance - Disposal Process - Cross-Cutting Technical Methods - Case study. (9)

**PROJECT AND AGREEMENT PROCESSES:** Project Planning - Project Assessment and Control - Decision Management - Risk Management - Configuration Management - Information Management -Measurement Process - Agreement Processes - Acquisition and Supply Processes – Case study. (9)

**ORGANIZATIONAL PROJECT-ENABLING PROCESSES:** Life Cycle Model Management - Infrastructure Management - Project Portfolio Management - Human Resource Management - Quality Management – tailoring processes – case study. (9)

**SPECIALTY ENGINEERING ACTIVITIES:** Design for Acquisition Logistics - Cost-Effectiveness Analysis - Electromagnetic Compatibility - Environmental Impact Analysis - Interoperability Analysis - Life-Cycle Cost - Manufacturing and Producibility - Safety & Health Hazard - Sustainment Engineering - Training Needs - Human Systems Integration - Value Engineering. (9)

**Total L: 45**

#### REFERENCES:

1. Benjamin S Blanchard and Wolter J Fabrycky, "Systems Engineering and Analysis", Prentice Hall , USA, 2010.
2. SE Handbook Working Group, "Systems Engineering Handbook: A guide for System Lifecycle Processes and Activities", INCOSE, USA, 2011.

3. National Aeronautics and Space Administration, "NASA Systems Engineering Handbook", Washington, USA, 2007. <http://ntrs.nasa.gov/>.

## 15ZS27 SOFTWARE RELIABILITY

3 0 0 3

**RELIABILITY FUNDAMENTALS:** Need for Reliability-Definition-Causes of Failures-Types of Failures-Maintainability and Availability-Reliability Measures-Design for Higher Reliability- Redundancy Techniques-Reliability and Cost. (9)

**RELIABILITY MATHEMATICS:** Random Experiments- Probability – Random Variables-Distribution Functions-Discrete Distributions-Continuous Distributions. (9)

**SYSTEM RELIABILITY MODELS:** Basics of Component Reliability- Systems with Components in Series – Systems with Parallel Components-K-Out-of-M Systems- Non Series Parallel Systems –Systems with Mixed Mode Failures – Fault Tree Techniques. (9)

**RELIABILITY PREDICTION:** Purpose- Classification –General Requirements –Prediction Methodologies –Software Prediction Packages – Role and Limitation of Reliability Prediction. (9)

**REDUNDANCY TECHNIQUES IN SYSTEM DESIGN:** Component Versus Unit Redundancy – Weakest Link Techniques – Mixed Redundancy – Stand by Redundancy – Redundancy Optimization- Double Failures and Redundancy-Economic Issues – Manufacturer's Cost – Customer's Cost –Reliability Achievement Cost Models –Reliability Utility Cost Models –Depreciation Cost Models – Reliability Application – Banking System. (9)

**Total L: 45**

### REFERENCES:

1. Michael R. Lyu, "Software Reliability Engineering", McGraw-Hill, New York, 2011.
2. John D Musa "Reliability Engineering - More Reliable software, Faster and Cheaper", Tata McGraw Hill, New Delhi, 2009.
3. John D Musa, "Software Reliability Engineering", Tata McGraw Hill, New Delhi, 2005.
4. Ann Marie Neufelder, "Ensuring Software Reliability", Marcel Dekkar, New York, 1993.
5. Balagurusamy E, "Reliability Engineering", Tata McGraw Hill, New Delhi, 1984.
6. Aggarwal K K, "Reliability Engineering", Kluwer Academic Publishers, Netherland, 1993.

## 15ZS28 AGILE SOFTWARE DEVELOPMENT

3 0 0 3

**AGILE PRINCIPLES:**Introduction- Definition of Agile – Methodology – Need - Manifesto – Values and Practices – IID – Comparison with Traditional Approaches. (8)

**AGILE MODELLING:** Introduction - Misconceptions – Methodologies –Updation– Practices – Core and Supplementary Practices – Potential – of Agile Modelling with RUP. (10)

**EXTREME PROGRAMMING :**Life Cycle – User Stories – Architecture – Planning – Iteration – Testing – Release – XP Values – XP Practices – Planning – Coding – Pair Programming Model – Refactoring – Agile Modeling and XP. (9)

**SCRUM:** Introduction – Practices - Applying Scrum – Need – Scrum Values - Comparison– Tools in Agile Software Development – Case Study. (9)

**FEATURE DRIVEN DEVELOPMENT:** Values – Principles – Phases - Control –Planning – Case Study - Model Driven Development – Other Methods - Comparison of Agile Methods. (9)

**Total L: 45**

### REFERENCES:

1. John Hunt, "Agile Software Construction", Springer, USA, 2005.
2. Robert Martin, "Agile Software Development: Principles, Patterns, and Practices", Prentice Hall, USA, 2002.
3. Ken Schwaber and Mike Beedle, "Agile Software Development with Scrum", Prentice Hall, USA, 2001.
4. Alistair Cockburn, "Agile Software Development: The Cooperative Game", Pearson Education, USA, 2002.
5. Kent Beck and Cynthia Andreas, "Extreme Programming Explained: Embrace Change", Pearson Education, USA, 2005.

## 15ZS29 SOFTWARE METRICS

3 0 0 3

**FUNDAMENTALS OF MEASUREMENT:** Measurement in Software Engineering- Measurement Scales and Scale Types- Classification of Software Measures- Software Measurement Validation- Data Analysis – Analysis Methods –Statistical Methods. (9)

**SOFTWARE PROCESS AND PROJECT METRICS:** Metrics in The Process and Project Domains – Building Measurable Process Models – Reconciling Different Metrics Approaches – Metrics for Software Quality – Integrating Metrics within the Software Engineering Process- Managing Variation: Statistical Quality Control – Metrics for Small Organizations – Establishing a Software Metrics Program. (9)

**SOFTWARE PRODUCTS AND TECHNICAL METRICS:** Measuring of Internal Product Attributes - Measuring External Product Attributes – A Framework for Technical Software Metrics –Metrics for the Analysis Model – Metrics for the Design Model – Metrics for Source Code – Metrics for Testing- Metrics for Maintenance- Measurement of Quality. (9)

**RESOURCE MEASUREMENT:** Productivity, Teams and Tools- Making Process Predictions - Good Estimates - Models of Effort and Cost - Dealing with Problems of Current Estimation Methods. (9)

**MEASUREMENT AND MANAGEMENT:** Planning- Measurement Program - Measurement Tools-Measurers - Analysts - Audience - Measurement in Practice. (9)

**Total L: 45**

### REFERENCES:

1. Norman E Fenton and Shari Lawrence Pfleeger, "Software Metrics- A Rigorous& Practical Approach", Thomson Computer Press U S A, 2013.
2. Roger Pressman S, "Software Engineering: A Practitioners", Tata McGraw Hill, New York, 2009.
3. Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Boston, 2002.
4. Dick B Simmons and Newton C. Ellis, "Software Measurement", Prentice Hall, New York, 2002.

## 15ZS30 FORMAL METHODS IN SOFTWARE ENGINEERING

3 0 0 3

**INTRODUCTION:-** Need for Formal Methods – Problems in Natural Language Specifications, Formal Versus Informal Programming – Advantages of Formal Methods – Requirements of Formal System – Types – Propositional Logic – Predicate Logic – Sets, Relationships and Functions. (8)

**FORMAL SPECIFICATION AND VERIFICATION:-**Model-Oriented – Specifications – Concurrency-Based Specifications –Example Specification Languages – Formal verification – Approaches – Industry Use. (10)

**OCL AND Z LANGUAGE:-**The Interchange Language – User-Defined Identifiers – Data Types – Basic Types – Compound Types – Schemas – Operations - Additional Constructs. (10)

**VDM:** Introduction to VDM – Basic Types – Quote Types – Compound Types – Optional Types – Functions – Operations – Additional Constructs – Modules – structuring VDM++, VDM SL- case study. (9)

**FORMAL SEMANTICS AND TOOLS:** Operational Semantics – Denotational Semantics – Axiomatic Semantics Proof Editors – Proof Analyser – Symbolic Simulators –Translators – Test Generation Tools. (8)

**Total L:45**

### REFERENCES:

1. Andrew Harry, "Formal Methods: Fact File VDM and Z", John Wiley and Sons, USA, 1996.
2. Jim Woodcock and Jim Davies, "Using Z Specification, Refinement and Proof", Prentice Hall, USA, 1996.
3. Roger Pressman S, "Software Engineering: A Practitioners", Tata McGraw Hill, New Delhi, 2014.

## 15ZS31 DESIGN PATTERNS

3 0 0 3

**INTRODUCTION:** Describing Design Patterns, Relationship between Design Patterns, Solving Design Problems Using Patterns, Procedure to Apply and Use a Design Pattern, MVC. (8)

**INTERFACE PATTERNS:** Adapter, Facade, Composite, Bridge. (8)

**RESPONSIBILITY PATTERNS:** Observer, Proxy, Mediator, Flyweight, Chain of Responsibility. (9)

**CONSTRUCTION PATTERNS:** Builder, Factory Method, Abstract Factory, Prototype, Singleton, Memento. (10)

**OPERATION & EXTENSION PATTERNS:** Template, State, Strategy, Command, Interpreter, Decorator, Iterator, Visitor. (10)

**Total L: 45**

**REFERENCES:**

1. Metsker S J, "The Design Patterns Java Workbook", Addison-Wesley Longman Publishing, Boston, MA, USA, 2002.
2. Gamma E, Helm R, Johnson R, and Vlissides R, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison Wesley, Boston, MA, USA, 1998.
3. Freeman E, Robson E, Bates B and Sierra K, "Head First Design Patterns", O'Reilly Media, Sebastopol, CA, USA, 2004.
4. Vlissides J M, "Pattern Hatching: Design Patterns Applied", Addison-Wesley Professional, Boston, MA, USA, 1998.
5. Kerievsky J, "Refactoring to Patterns", Addison-Wesley Professional, Boston, MA, USA, 2004.

## 15ZS32 SOFTWARE AGENTS

**3 0 0 3**

**INTRODUCTION:** Basic Definitions- History – Intelligent Agents – Agents And Environments – Agent Architecture- Searching for Solutions – Uninformed Search Strategies – Informed Search Strategies. (9)

**KNOWLEDGE REPRESENTATION:** Knowledge Representation Issues - Logic – Proposition – Inference – First Order Logic – Inference in FOL - Algorithms –Knowledge/Ontological Engineering: Semantic Nets, Frames, Truth Maintenance Systems. (9)

**PLANNING &PROBABLISTIC AGENTS:** The Planning Problem – Partial Order Planning – Conditional Planning – Multi Agent Planning – Uncertainty and Probabilistic Reasoning. Case Study- Planning using STRIPS/ADL. (9)

**LEARNING AGENTS:** Learning from Observations – Learning Decision Trees – Statistical Learning Methods – Instance Based Learning – Neural Network Techniques for Learning. (9)

**MULTIAGENT SYSTEMS:** Interaction Between Agents – Reactive Agents – Cognitive Agents – Interaction Protocols– Agent Coordination – Agent Negotiation – Agent Cooperation – Agent Organization -Agent Communication and Agent Oriented Programming-Applications. (9)

**Total L: 45**

**REFERENCES:**

1. Stuart Russel and Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson, UK, 2013.
2. Gerhard Weiss, "Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence", MIT, Cambridge, 2000.
3. George F Luger, "Artificial Intelligence – Structures and Strategies for Complex Problem Solving", Pearson, UK, 2004.
4. Bradshaw, "Software Agents", MIT, Cambridge, 2010.

## 15ZS33 DECISION SUPPORT SYSTEMS

**3 0 0 3**

**DECISION SUPPORT AND BUSINESS INTELLIGENCE:** Changing Business Environments and Computerized Decision Support- Managerial Decision Making Computerized Support for Decision Making- Early Framework for Computerized Decision Support- Concept of Decision Support Systems (DSS) – A Framework for Business Intelligence- Work System View of Decision Support- Major Tools and Techniques of Managerial Decision Support. (9)

**DECISION MAKING SYSTEMS:** Decision Making & Models, Phases – Intelligence, Design, Choice and Implementation, Supporting Decisions-Decision Making in the Digital Age, Decision Makers- Decision Styles- Decision Theory- Rational Decision Making- Bounded Rationality-Process of Choice – Cognitive Processes-Heuristics in Decision Making- Effectiveness and Efficiency - Hardness of Decisions. (9)

**MODELING AND ANALYSIS:** Management Support Systems Modeling- Structure of Mathematical Models for Decision Support- Management Support Systems Modeling with Spreadsheets- Using Mathematical Programming Optimization & Linear Programming- Multiple Goals- Sensitivity Analysis- What-If Analysis Goal Seeking- Decision Analysis with Decision Tables and Decision Trees- Multi-Criteria Decision Making with Pairwise Comparisons- Problem-Solving Search Methods- Simulation &Visual Interactivity- Quantitative Software Packages and Model Base Management. (9)

**IMPLEMENTING DSS:** DSS Implementation- Patterns of Implementation- System Evaluation-Importance of Integration-Creativity Decision Making: Definition of Creativity- Occurrence of Creativity- Creative Problem Solving Techniques- Intelligent DSS (Artificial Intelligence, Artificial Neural Networks, Expert Systems, Genetic Algorithms and Knowledge Based Systems)– Future of DSS, EIS and DSS Technologies (9)

**APPLICATIONS AND CASE STUDIES:** Norfolk Southern Using Business Intelligence- Alltel Wireless- United Sugars- Business Intelligence at Vodafone- Genetic Algorithms Managed Assembly Lines at Volvo Trucks- Intelligent System Beating Chess Grand Master- Identifying Sport Talents using Expert Systems. (9)

**Total L: 45**

**REFERENCES:**

1. Turban E, Aronson J E and Liang, T P, "Decision Support Systems and Intelligent Systems", Pearson Education & Prentice Hall, Upper Saddle River, New Jersey, USA, 2006.
2. Marakas G M, "Decision Support Systems", Pearson Education, Upper Saddle River, New Jersey, USA, 2005.
3. Stuart Russel and Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson, Upper Saddle River, New Jersey, USA, 2013.
4. Gerhard Weiss, "Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence", MIT, MA, USA, 2000.
5. George F Luger, "Artificial Intelligence – Structures and Strategies for Complex Problem Solving", Addison Wesley, Boston, MA, USA, 2004.
6. Bradshaw, "Software Agents", MIT, MA, USA, 2010.

**15ZS34 PROGRAM ANALYSIS**

**3 0 0 3**

**CONTROL FLOW ANALYSIS:** Flow Graphs – Flow Sensitivity - Optimisation– Loops and Loop Transformations – Loop Invariant Code Motion - Code Hoisting - Control Flow Analysis Approaches – DFS, Preorder, Post Order Traversals, BFS – Dominators And Post Dominators – Loops And Strongly Connected Components – Reducibility – Interval Analysis and Control Trees – Structural Analysis. (10)

**DATA FLOW ANALYSIS:** Reaching Definitions – Lattices, Flow Functions – Fixed Points – Data Flow Problems and Solutions – Iterative Data Flow Analysis – Lattices of Flow Functions – Control-Tree Based Data Flow Analysis – Structural Analysis – Interval Analysis – Other Approaches – Du, UdChains, Static Single Assignment, Automating Construction of Data Flow Analysers. (9)

**DEPENDENCE AND ALIAS ANALYSIS:** Dependence Relations – Basic Blocks Dependence DAGs – Dependences in Loops – Dependence Testing – Program Dependence Graphs – Dependences between Dynamically Allocated Objects Aliases – The Alias Gatherer – The Alias Propagator. (9)

**OPTIMISATION:** Control Flow and Low-Level Optimisations - Unreachable Code Elimination- Straightening- If Simplifications-Loop Simplifications - Loop Inversion- Unswitching - Branch Optimisations -Tail Merging-Dead Code Optimisation-Branch Prediction – Interprocedural Analysis and Optimisation – Interprocedural Control Flow Analysis- Call Graph – Interprocedural Data Flow Analysis – Interprocedural Constant Propagation – Interprocedural Alias Analysis Interprocedural Optimisations - Program Analyses for Program Verification – ESP. (10)

**CASE STUDY:** Multicore Architectures –Program Optimisation- Parallelism and Shared Memory Programming- OpenMP- Data Flow Analysis- Pointer Analysis – Alias Analysis - Data Dependence Analysis – Loop Optimisations. (7)

**Total L: 45**

**REFERENCES:**

1. Steven Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann, USA, 1997.
2. Flemming Nielson and Hanne R. Nielson, "Principles of Program Analysis", Springer Science & Business Media, USA, 2004.

**15ZS35/15ZC39 PROFESSIONAL ETHICS**

**3 0 0 3**

**ENGINEERING ETHICS:** Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Moral Dilemmas –Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Consensus and Controversy – Professions and Professionalism -Professional Ideals and Virtues – Uses of Ethical Theories. (9)

**ENGINEERING AS SOCIAL EXPERIMENTATION:** Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics -Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study. (9)

**ENGINEER'S RESPONSIBILITY FOR SAFETY:** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal. (9)

**RESPONSIBILITIES AND RIGHTS:** Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. (9)

**GLOBAL ISSUES:** Multinational Corporations – Business Ethics - Environmental Ethics– Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct. (9)

**Total L: 45**

**REFERENCES:**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases", Cengage Learning, USA, 2009.
3. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 2011.
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, USA, 2012.
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, USA, 2001.
6. Bajaj PS and Raj Agrawal, "Business Ethics'– An Indian Perspective", Biztantra, New Delhi, 2004.
7. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, USA, 2003.

**15ZS36/15ZC07 OPERATING SYSTEMS**

**3 0 0 3**

**INTRODUCTION:** Operating Systems - Objectives and Functions - Evolution of Operating Systems - Structure of Operating System. (8)

**PROCESS MANAGEMENT:** Process Creation - Process States - Threads -Process Scheduling - Synchronization - Deadlock. (9)

**MEMORY MANAGEMENT:** Contiguous and non-contiguous allocation - Buddy Systems - Paging - Segmentation - Virtual Memory Management. (9)

**FILE AND I/O MANAGEMENT:** File System - Implementing File System - Secondary Storage Structure - I/O Systems. (9)

**LINUX KERNEL:** Introduction –POSIX APIs and System Calls - Process Communication: Pipes-FIFOs-POSIX Message Queues. (10)

**Total L: 45**

**REFERENCES:**

1. Silberschatz A, Galvin PB and Gagne G, "Operating System Concepts", John Wiley and Sons, Singapore, 2008.
2. Bovet D P and Cesati M, "Understanding the Linux Kernel", O'Reilly, USA, 2005.
3. Bach M J, "The Design of the UNIX Operating Systems", Prentice Hall of India/ Pearson Education, New Delhi, India, 2004.
4. Dhamdhare D M, "Operating Systems- A Concept based Approach", Tata McGraw Hill, New Delhi, India, 2006.
5. Love R, "Linux Kernel Development", Addison-Wesley, Boston, 2010.

**15ZS37 PRIVACY PRESERVING DATA MINING**

**3 0 0 3**

**INTRODUCTION:** Social Aspects of Privacy, Legal Aspects of Privacy and Privacy Regulations, Effect of Database and Data Mining technologies on privacy - Privacy issues, Need for PPDM - Applications of PPDM (9)

**PRIVACY MODELS AND SECURITY MODELS:** Privacy models: Randomization - perturbation, Data Swapping, Anonymization Algorithms - K-anonymity, l-diversity, t-closeness, differential privacy. Security models: Trusted Computing Base, State Machine Model, Information Flow Model, Noninterference Model, Take-Grant Model, Access Control Matrix, Bell LaPadula Model, Biba Model, Clark-Wilson Model, Brewer and Nash Model, GoguenMeseguer Model, Sutherland Model, Graham-Denning Model. (9)

**QUANTIFICATION OF PRIVACY PRESERVING DATA MINING:** Metrics for quantifying privacy levels, Metrics for quantifying Hiding failure, Metrics for quantifying Data Quality, Complexity metrics, Selecting a proper metrics, Utility based privacy preserving methods: Types, Anonymization using local recoding, Utility based privacy preservation in classification, Association rule mining. (9)

**PRIVACY PRESERVING DISTRIBUTED DATA MINING:** Basic cryptographic Techniques for Privacy Preserving Distributed Data Mining, Common Secure Sub -protocols used, Anonymization for vertically partitioned data and Horizontally partitioned data, Limitations of cryptographic techniques for privacy preserving data mining. (9)

**ANONYMIZING SOCIAL NETWORKS AND SANITIZING TEXTUAL DATA:** Social Networks - Introduction, General Privacy Preservation Strategies, Anonymizing Networks. Textual Data: Introduction - ERASE - Health Information De-identification(HIDE)(9)

**Total L: 45**

## REFERENCES:

1. Benjamin C.M. Fung, Ke Wang, Ada Wai-Chee Fu and Philip S. Yu, "Introduction to Privacy-Preserving Data Publishing: Concepts and Techniques", Chapman & Hall/CRC, 2010.
2. Charu C. Aggarwal, "Privacy-Preserving Data Mining: Models and Algorithms", Springer, 2008.
3. JaideepVaidya, Chris Clifton and Michael Zhu, "Privacy preserving Data Mining", Springer, 2006

## 15ZS38 DATA INTEGRATION

3 0 0 3

**INTRODUCTION :** Data Integration – Importance – Types and Complexity – Process. Semantic Technology: Overview –Web Ontology Languages for Semantic Web – RDF schema –An Axiomatic Semantics for RDF and RDF Schema –Traditional Ontology Languages: OWL – SPARQL. (9)

**BATCH DATA INTEGRATION:** ETL – Datawarehousing – Data Conversion – Archiving – Integration Architecture –Provenance Determination – ETL Tools – Case Study. (8)

**REAL TIME DATA INTEGRATION:** Patterns – Technologies – Modelling – Master Data Management – Data Warehousing with Real–Time Updates –Stream Data– Architecture – Case Study. (9)

**DATA VIRTUALIZATION AND SCHEMA MAPPING:** Introduction – Architecture – Integration – Metadata –Data Virtualization– Bigdata Integration Architecture–Scheme Mapping Approaches – Semantic Approaches – Conceptual Layering –Global and Local as view Data Integration – Metadata Integration. (10)

**SQL/NoSQL INTEGRATION:** Introduction –Architecture of NoSQL Systems – SchemaExtraction Approaches– Data Integration Framework – QueryProcessing – Case Study. (9)

**Total L: 45**

## REFERENCES:

1. April Reeve, "Managing Data in Motion", Elsevier 2013.
2. Saurabh Vijay , Saurabh Mane, DeepaliKamthani, "Warehousing and OLAP Analysis of Students Data-A Case Study", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 10, October 2014.
3. Chung-Chih Lin, Ping-Yeh Lin, Po-Kuan Lu, Guan-Yu Hsieh, "A Healthcare Integration System for Disease Assessment and Safety Monitoring of Dementia Patients.", IEEE Transactions On Information Technology In Biomedicine, Vol. 12, No. 5, September 2008.
4. Olivier Curé, Robin Hecht, Chan Le Duc, Myriam Lamolle, "Data Integration over NoSQL Stores Using Access Path Based Mappings", Springer 2011.
5. Ronald Fagin, Phokion G. Kolaitis, Renée J. Miller, Lucian Popa, "Data exchange: semantics and query answering." Theoretical Computer Science 336 (2005) 89 – 124, Elsevier.

## 15ZS39 SOCIAL NETWORKS DATA ANALYTICS

3 0 0 3

**INTRODUCTION:** Social Network Data : Nodes, Relations –Social Networks as Graphs ; Mathematical Representation of Social Network Data : Graph Theoretic Sociometric, Algebraic Approaches – Graph Representations for Social Relationships : Directed, Undirected, Multigraphs and Hypergraphs – Matrix Representation; Network Statistics: Types of Centrality, Proximity Prestige, Eccentricity - Dyads, Triads, Relations, Walks, Reachability, Trails and Paths, Distances and Diameter - Statistical Properties of Social Networks. (9)

**MODELS:** Social Network Models :Erdosrenyi Model, Watts-Strogatz Model, Barabasi-Albert Model, Models for Social Influence Analysis: Edge & Node Measures - Social Similarity and Influence: Homophily - Existential Test for Social Influence - Influence and Actions, Interaction- Influence Maximization - Viral Marketing ; Randomwalks on Graphs: Proximity Measures, Graph Theoretic Measures, Algorithms for Hitting, Commute Times, Pageranking, Simrank, Computing Harmonic Functions – Applications in Text Analysis, Collaborative Filtering and Link Prediction (10)

**NODE CLASSIFICATION IN SOCIAL NETWORKS:** Iterative Classification Method - RandomWalk based Methods: Label Propagation, Graph Regularization, Adsorption - Applying Node Classification to Large Social Networks- Variations on Node Classification – Node Clustering Models – Clustering Graphs as Objects (7)



**LINK PREDICTION IN SOCIAL NETWORKS:** Feature based Link Prediction - Bayesian Probabilistic Models: Local - Network Evolution - Hierarchical Probabilistic Models- Probabilistic Relational Models- Relational Bayesian Network- Relational Markov Network - Linear Algebraic Methods - Case studies (9)

**COMMUNITY DISCOVERY IN SOCIAL NETWORKS:** Methods – Quality Functions – Direct Discovery of Communities – Cliques and Bipartite Subgraphs- Kernighan-Lin(KL) Algorithm - Agglomerative/Divisive Algorithms- Spectral Algorithms Multi-Level Graph Partitioning - Markov Clustering – Using Betweenness Measures to Find Communities –Community Evolution and Tracing – Finding Overlapping Communities – Maximum Likelihood and Affiliation Graph Models- Neighbourhood Properties of Graphs; Case studies: Community Discovery in Heterogeneous Networks - Coupling Content and Relationship Information for Community Discovery . (10)  
**Total L: 45**

**REFERENCES:**

1. Charu C Agarwal, “Social Networks Data Analytics”, Springer, USA, 2011.
2. Jure Leskovec, AnandRajaraman,Jeff Ullman, ,”Mining of Massive Datasets”, Cambridge University Press,2014.
3. GuandongXu and Lin Li, “Social Media Mining and Social Network Analysis: Emerging Research”IGI Global,2013.

## ONE CREDIT COURSE

### 15ZK01 TEST AUTOMATION USING OPEN SOURCE TOOLS

**1 0 0 1**

**SELENIUM - BASICS:** Introduction. Selenium Components, Introduction to IDE, Test Scripts Creation using IDE. Converting IDE Generated Scripts to WebDriver Code, Best Practices for Maven and Eclipse. (3)

**WEBDRIVER:** Introduction to Locators. Types of Locators, WebDriver scripts, WebDriver Methods - Get, FindElement, Close; WebElement Methods - SendKeys, Clear, Click, Wait types and window maximize, Fetching more than One WebElement. Browser Verifications - getTitle, getCurrentUrl, Interacting with Edit, Button, Checkbox, Link, Radio button, Dropdown. (5)

**ALERTS, FRAMES, AND WINDOWS:** Interacting with Alerts, Frames, Windows, Exceptions. (3)

**SELENIUM GRID:** Introduction, Grid Components - Starting Hub and Node, Integrating Script with Selenium Grid. (4)

**Total L: 15**

**TEXT BOOKS:**

1. Rex Allen Jones II, “Absolute Beginner (Part 1) Java 4 Selenium WebDriver: Come Learn How to Program For Automation Testing (Practical How To Selenium Tutorials)” CreateSpace Independent Publishing Platform, 2016.
2. Prashanth Sams “Selenium Essentials”, Packt Publishing Limited,2015

**REFERENCES:**

1. Mark Collin , “Mastering Selenium Webdriver”, Packt Publishing, 2015.
2. Satya Avasarala ,”Selenium Web Driver Practical Guide”, Packt Publishing, 2014.

## ONE CREDIT COURSES

**For the detailed syllabi of the electives and one credit courses offered by other departments refer to the syllabi of M.E- Automotive Engineering offered by Automobile Engineering Department.**