SEMESTER I

18ZS01 APPLIED STATISTICS AND RELIABILITY

2 2 0 3

Course Objective:
1.
2.
3.
Course Outcome:
CO1:
CO2:
CO3:
CO4:

REGRESSION AND CORRELATION: Curve fitting, method of least squares - inferences based on the least squares estimator - correlation - curvilinear regression - multiple regression. (8+7)

STATISTICAL QUALITY CONTROL: Statistical process control – chance and assignable causes of quality variation, statistical basis of control charts - control charts for variables - $\bar{X}\bar{X}$, R and s charts - control charts for attributes – p, np, c and u charts. (8+7)

ACCEPTANCE SAMPLING: Lot-by-Lot acceptance sampling for attributes – single sampling plans for attributes, double, multiple and sequential sampling plans, acceptance sampling by variables - chain sampling, continuous sampling, skip-lot sampling plans. (8+7)

RELIABILITY: 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 distributions - serial configuration, parallel configuration, combined series parallel systems, system structure function, minimal cuts and minimal paths, state dependent systems. (8+7)

Total L:32 +T: 28 = 60

REFERENCES:

1. Richard A Johnson, Irwin Miller and John Freund's, "Probability and Statistics for Engineers", Pearson Education, New Delhi, 2018.
2. Charles E Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata McGraw Hill, New Delhi, 2017.
3. Eugene L Grant, Richard S Leavenworth, "Statistical Quality Control", Tata McGraw Hill, New Delhi, 2016.
4. Trivedi K S, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley & Sons, New Delhi, 2016.
5. Douglas C Montgomery, "Introduction to Statistical Quality Control", John Wiley & Sons, New York, 2009.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1	S		W	
CO2	S		W	
CO3	S		W	
CO4	S		W	

18ZS02/18ZC02 ADVANCED DATA STRUCTURES AND ALGORITHMS

3 0 0 3

Course Objective:

1. To analyze the complexity of algorithms and understand parallel algorithms.
2. To use search trees, heaps, kd trees, graph algorithms, sets and hashing to solve problems.

Course Outcome:

CO1: Analyze the time complexity of algorithms and describe the working of parallel algorithms
CO2: Solve problems using tree structures
CO3: Solve problems using graphical structures
CO4: Solve problems using disjoint sets and describe the various hashing and collision resolution techniques

ALGORITHM ANALYSIS: Analysis of iterative and recursive Algorithms – Asymptotic notations – Parallel Algorithms:Introduction-Scalar Product of two vectors- Matrix multiplication. (10)

TREES: Search Trees – Balanced Search Trees: AVL, RBT, Splay-Heaps: Binary heap, leftist heap, binomial heap, Fibonacci heap, Multi-dimensional data structure: kd tree (15)

GRAPHS: Representation – Shortest path algorithms: Unweighted shortest path, Dijikstra's algorithm, Graphs with negative edge costs, Acyclic graphs, All pairs shortest path – Network Flow problems – Activity Networks – DFS applications: Biconnectivity, Euler Circuits (10)

DISJOINT SETS AND HASHING: Disjoint Sets: Representation – Union and find operations - Hashing: Static hashing – Dynamic hashing - Overflow handling - Bloom filters - Locality sensitive hashing (10)

Total L: 45

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", PHI learning Pvt. Ltd., New Delhi, 2010..
2. Venkatesan R and Lovelyn Rose S, "Data Structures", Wiley India Pvt. Ltd., New Delhi, 2015.
3. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2013.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, Hyderabad, 2012.
5. Peter Brass, "Advanced Data Structures", Cambridge University Press, New York, 2011.

CO - PO MAPPING

PO CO	**PO*1***	**PO*2***	**PO*3***	**PO *4***
CO1	S		M	
CO2	S		M	
CO3	S		M	
CO4	S		M	

18ZS03/18ZC03 DATABASE MANAGEMENT SYSTEMS

3 2 0 4

Course Objective:

1.To impart knowledge in various database systems and their concepts for modern application development

2.To develop applications using NoSQL database

Course Outcome:

CO1: Describe relational database concepts and write queries in SQL

CO2: Understand query processing and apply optimization algorithms

CO3: Understand system implementation techniques and security in database

CO4: Explain NoSQL databases and explore Neo4J

RELATIONAL DATABASE: Relational database Design – ER Diagram, Extended ER Diagram, Reduction to relational schemas, Normalization- Functional Dependencies, Normal Forms, SQL (11+8)

QUERY OPTIMIZATION: Algorithms for Query Processing – external sorting, SELECT and JOIN operation, PROJECT and set operation, aggregate operation and OUTER JOINs, Heuristics of Query Optimization, Cost Based Query Optimization. (11+7)

TRANSACTION AND SECURITY: Properties of Transaction, Serializability, Concurrency Control – locking, timestamp, validation based protocols, Deadlock – prevention, detection, recovery, Database security – issues, access control. (12+7)

TRENDS IN DATABASE: Introduction to NoSQL databases - Key-Value Stores – Columnar Stores – Document Stores, Graph database - The Power of Graph Databases - Options for Storing Connected Data -Data Modeling with Graphs-Building a Graph Database Application - Case Study - Neo4J. (11+8)

Total L: 45 +T: 30=75

REFERENCES:

1. Thomas Connolly and Carlolyn Begg, “Database Systems, A Practical Approach toDesign, Implementation and Management”, Pearson Education,Harlow,2015.
2. Sadalage, P. & Fowler,”NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Pearson Education,USA,2013
3. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education,USA,2016.
4. Redmond, E. &Wilson, “Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement”,Prsgmatic Programmers, LLC,USA,2012.
5. Ian Robinson, Jim Webber, Emil Eifrem, Graph Databases, , New Opportunities for Connected Data, O'Reilly Media,USA, 2015.

CO - PO MAPPING

PO **CO**	**PO*1***	**PO*2***	**PO*3***	**PO *4***
CO1	M	W		
CO2	M		M	
CO3			M	W
CO4			M	M

18ZS04 OPEN SOURCE SOFTWARE

2 2 0 3

Course Objective:

1. To understand why Python is a useful scripting language for developers and how to design and program Python applications.
2. To understand how server-side programming (PHP) works on the web and process data in a MySQL database.

Course Outcome:

CO1: Apply Python programs to illustrate concise and efficient algorithms
CO2: Implement methods and functions to improve readability of programs
CO3: Develop programs in PHP to solve any given problem.
CO4:Develop a php application with MySQL

BASICS OF PYTHON: Python - Variables - Executing Python from the Command Line - Editing Python Files - Python Reserved Words - Basic Syntax-Comments - Strings and Numeric Data Types - Simple Input and Output. Control Flow and Syntax - Indenting - if Statement - Relational Operators - Logical Operators - Bit Wise Operators - while Loop - break and continue - for Loop - Lists – Tuples - Sets - Dictionaries. (8+8)

PYTHON PROGRAMMING: Functions - Passing parameters to a Function - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary – Lambda - Modules - Standard Modules – sys – math – time - dir Function. Error Handling: Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories. (7+7)

BASICS OF PHP: Introduction to Open Source Programming and Scripting Language PHP - Variables – data types – arrays – array functions - Control structures – String manipulation – anonymous function - File Handling and Data Storage - Working with Forms – development of applications using PHP with Mysql (8+8)

WEB SERVERS AND MYSQL: Web Server – Feature – Architectures - Case Study: Apache Web Server - Configuring and Using Web Server - Comparison of Apache Web Server with Commercial Web Servers. MySQL - Internals and Portability - Data Types - Security - Scalability - Connectivity – Localization – PostgreSQL - CouchDB - Hbase (7+7)

Total L:30 + T:30 = 60

REFERENCES:

1. Julie Meloni, “Teach Yourself PHP, MySQL and Apache All in One”, Pearson Education, USA, 2012.
2. Wesley J Chun, “Core Python Applications Programming”, Prentice Hall, 2012.
3. Allen B Downey, “Think Python”, O’Reilly, 2012.
4. Mark Summerfield, “Programming in Python 3: A Complete introduction to the Python Language”, Addison Wesley Professional, 2009.
5. Martin C. Brown, “PYTHON: The Complete Reference”, McGraw Hill, 2001.

CO - PO MAPPING

PO CO	**P O*1***	**P O*2***	**P O*3***	**PO *4***
CO1	M		M	
CO2	M		M	

CO3	M		M	
CO4	M		M	

18ZS05/18ZC05 ANALYSIS AND DESIGN OF SOFTWARE SYSTEMS

3 0 0 3

Course Objective:

1. Understand characteristics of software engineering paradigms

2. Analyze and identify appropriate models for designing software systems.

Course Outcome:

CO1: Outline the significant role of software development in large scale software systems and identify suitable software process model for a project.

CO2: Apply suitable analysis modeling approaches for a software system.

CO3: Design and develop behavioural and structural models based on system requirements.

CO4: Apply appropriate methods for system design.

SOFTWARE ENGINEERING CONCEPTS: Software Characteristics –Software Myths – Software life cycle models – The Linear Sequential Model - The Incremental Model - The RAD Model - Evolutionary Software Process Models - The Prototyping Model - Spiral Model-Agile methods – Requirement Engineering - Requirement Engineering Tasks. (12)

SYSTEM ANALYSIS: Requirement Analysis – Analysis Modelling Approaches – Data Flow Oriented Modelling – Context diagram, Data flow diagrams – Elements of Analysis Model - Data Modeling – Objects and Classes – Object Identification – Relationship among objects – classification . (11)

UML MODELING: Unified Software Development Process – Scenario Based Modeling – Class Based Modeling – Behavioral Model – CASE tools. (11)

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. (11)

Total L: 45

REFERENCES:

1. Roger Pressman S, “Software Engineering: A Practitioners”, Tata McGraw Hill, New Delhi, 2014
2. Booch G, Maksimchuk R A, Engel M W, Young B J, Conallen J, Houston K A, “Object Oriented Analysis and Design with Applications”, Addison-Wesley,USA,2007.
3. Booch G, Rumbaugh J and Jacobson I, “The Unified Modeling Language User Guide”, Addison Wesley Professional,USA, 2005.
4. Ian Sommerville, “Software Engineering”, Pearson Education, New Delhi, 2007.

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CO - PO MAPPING

PO **CO**	**PO*1***	**PO*2***	**PO*3***	**PO*4***
CO1	M	M		M
CO2	M		M	S

CO3			M	M
CO4	M		M	S

18ZS51/18ZC51 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

0 0 4 2

Course Objective:

1. To understand various advanced data structures and identify their strengths and weaknesses.
2. To identify and apply the suitable data structure for the given real world problem.

Course Outcome:

CO1: Use suitable data structures to design solution for real world problems

CO2: Develop, debug, test and document the designed solutions

The students will design, analyse and implement suitable data structures like Arrays, linked lists, stacks, queues,Search Trees,Heaps,kd Tree, Graph Algorithms, Sets,Hashing for real world problems.

Total P: 60

CO - PO MAPPING

PO CO	**PO*1***	**PO*2***	**PO*3***	**PO*4***
CO1	M		S	S
CO2		S	M	S

18ZS81 ENGLISH FOR RESEARCH PAPER WRITING

0 0 4 0

Course Objective:

1. To learn the english language skills to write a good technical paper

2. To learn the structure and elements of a good research paper

Course Outcome:

CO1: Understand the usage of appropriate english words and phrases in preparing a technical report

CO2: Understand the meaning of the structure and various elements of a technical paper

CO3 : Convert a project work into a publishable paper

CO4: Conduct a literature survey on a chosen topic and write a survey paper

Planning and preparation, word order, breaking up of long sentences, structuring paragraphs and sentences, being concise and removing redundancy, avoiding ambiguity and vagueness, clarifying who did what, highlighting the findings, hedging and criticising, paraphrasing and plagiarism. (15)

Sections of a paper - Abstract, introduction, review of the literature, methods, results and discussions, conclusions, acknowledgements, references and the final check. (10)

Key skills needed to write title, abstract, introduction, review of the literature, methods, results and discussions, and conclusions of a research paper. (20)

Use of appropriate phrases to ensure the research paper is as good as it could possibly be the first- time submission. (15)

Total P: 60

REFERENCES:

1. Adrian Wallwork, “English for Writing Research Papers”, Springer New York Dordrecht Heidelberg London, 2011.
2. Goldbort R., “Writing for Science”, Yale University Press, 2006.
3. Day R., “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006
4. Highman N., “Handbook of Writing for the Mathematical Sciences”, SIAM, Highman’s Book, 1998.

PO **CO**	**PO*1***	**PO*2***	**PO*3***	**PO*4***
CO1	S	S		
CO2	S	S		
CO3	S	S		
CO4	S	S		

SEMESTER II

18ZS06/18ZC06 DATA INTENSIVE COMPUTING SYSTEMS

3 0 0 3

Course Objective:

1. To analyze, design, and implement effective solutions for data-intensive applications.
2. To decide the algorithms and programming models for a data intensive application.

Course Outcome:

CO1: Describe big data infrastructure and characteristics.
CO2: Describe characteristics of NoSQL stores and study components of NoSQL platforms.
CO3: Use appropriate preprocessing, Correlation, regression to solve problems.
CO4: Apply clustering and classification techniques and time series concepts for forecasting.

INFRASTRUCTURE: Cloud, Data intensive systems and Industry 4.0 – Cloud Architecture – Virtualization – Data Virtualization – Storage Virtualization – Network Virtualization: SAS,SAN – File Systems – Big Data Characteristics – Use cases – Data Analytics Life cycle – Case study. (12)

STORAGE PLATFORMS: NoSQL – Key-value store - Hadoop Architecture – Map Reduce programming – Examples - Spark; Column-oriented stores – HBase architecture, Hive; Document stores – MongoDB architecture – examples ; Graph stores – Neo4j architecture – examples ; Realtime Processing – Storm (11)

THEORY AND METHODS-I: Preprocessing – Statistical measures – Hypothesis testing – ANOVA - feature selection – PCA Regression – linear, logistic – LDA – Association Rule Mining – Text Analysis (11)

THEORY AND METHODS-II: Clustering – partitioning and hierarchical approaches – Classification – KNN, Decision trees, Naive Bayes, SVM– Time Series Analysis – ACF, AR, MA, ARMA, ARIMA – Stream Analysis (11)

Total L: 45

REFERENCES:

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Big Data Science & Analytics : A Hands-on Approach”, Wiley, 2015.
2. Jared Dean, “Big Data, Data Mining and Machine Learning: Value Creation for Business Leaders and Practitioners”, Wiley, USA, 2014.
3. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, “An Introduction to Statistical Learning with Applications in R”, Springer, USA, 2013.
4. Nathan Marz and James Warren, “Big Data - Principles and Best Practices of Scalable Realtime Data Systems”, MEAP Began, USA, 2012.
5. Venkata Josyula, Malcolm Orr & Greg Page, “Cloud Computing: Automating the Virtualized Data Center”, CISCO Press, USA, 2011.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*
CO1	S		M	
CO2	S		M	
CO3	S		M	

CO4	S		M	

18ZS07 SOFTWARE TESTING AND QUALITY ASSURANCE

3 2 0 4

Course Objective:

1.To present the concepts, techniques and metrics for quality assurance in software development and gain knowledge of techniques for managing of testing projects.
2. To work on software testing tool and get working experience on testing projects.

Course Outcome:

CO1: Comprehend the principles of testing and Apply software testing techniques and strategies for testing software systems.
CO2: Identify and use software test automation tools.
CO3: Understand and Apply the software testing tool selenium to test any application
CO4: Recall the importance of quality assurance and significance of measurement, metrics and standards in managing software quality.

TESTING FUNDAMENTALS, TECHNIQUES AND STRATEGIES: Objectives and Principles - V Process Model - Testing techniques: White Box Testing: Static testing – Structural Testing - Black Box Testing: Cause Effect Graphing Technique – Orthogonal Array Testing - Testing Strategies for Conventional Software - Testing Strategies for Object Oriented Software – Acceptance Testing – Ad Hoc Testing - Art of Debugging: Debugging Process - Debugging Strategies. (12+8)

TEST AUTOMATION AND MANAGEMENT: People and Organizational Issues in Testing - Test Planning – Management – Execution – Reporting - Software Test Automation: Design and Architecture for Testing - Generic requirements for test tool/framework - Selection of Test Tool - Automation for Extreme Programming Model - Challenges in Automation. (11+7)

SOFTWARE TESTING TOOLS: Introduction to Selenium – Selenium Components – Introduction to IDE and test scripts creation using IDE – Webdriver: Introduction to locators, WebDriver scripts, WebDriver methods – Get, FindElement, close; WebElement Methods – SendKeys, clear, click, wait type and window maximize:Browser Verification – getTitle, getCurrentUrl, Interacting with Edit, Buttton, checkbox, Link, Radio button, Dropdown - Interacting with alerts, Frames, Windows, Exceptions. (11+8)

SOFTWARE QUALITY CONCEPTS, QUALITY METRICS AND STANDARDS: Views of Quality - Quality Control vs Quality Assurance - Cost of Quality - Quality Assurance Group - Roles and Responsibilities - SQA Activities - Formal Technical Reviews - Statistical Approach to Quality Assurance - Software Quality Measurement - Project Metrics – Progress Metrics – Productivity Metrics - Standards: Role of ISO, TMM. (11+7)

Total L: 45 +T: 30 = 75

REFERENCES:

1. Roger Pressman S, “Software Engineering: A Practitioners”, 6th Ed, Tata McGraw Hill, New Delhi, 2014.
2. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing Principles and Practices”, Pearson Education, New Delhi, 2009
3. Rex Allen Jones II, “Absolute Beginner (Part 1) JAVA 4 Selenium WebDriver: Come Learn How to Program for Automation Testing (Practice how to selenium Tutorials)”, Createspace Independent Publishing Platform, 2016
4. Milind Limaye, “Software Quality Assurance”, Tata McGraw Hill, New Delhi, 2011.
5. Glenford J. Myers, “The Art of Software Testing”, Second Edition, John Wiley & Amp; Sons, Inc., Hoboken, New Jersey.

CO - PO MAPPING

PO **CO**	**P** **O*1***	**P** **O*2***	**P** **O*3***	**PO** ***4***
CO1			M	M

CO2			M	
CO3			M	S
CO4			M	S

18ZS08 SOFTWARE ENGINEERING MANAGEMENT

3 0 0 3

Course Objective:

1.To understand the various software processes, estimation models, risk levels in software development, risk plan, implementation and tracking risks.

2.To realize the importance of people management, software maintenance process, measurement and benchmarking

Course Outcome:

CO1:Comprehend software process management, people management and framework for productivity improvement.
CO2:Perform software estimation, Conduct feasibility study and develop project plan
CO3:Apply quantitative techniques to monitor software project.
CO4:Recall the importance of product management in a software organization and Summarize the issues in software maintenance.

SOFTWARE PROCESS AND PEOPLE MANAGEMENT: Process-Process Maturity - Capability Maturity Model and its variants - CMMI - PEOPLE MANAGEMENT: Basic organization structures - Decision making - Issues in people management. Effective Team building - Organizational Behavior - Productivity improvement. (9)

SOFTWARE ESTIMATION AND FEASIBILITY STUDY: Components of Software Estimation - Problems associated with estimation - Estimation methods - Full Function Points – LOC Estimation- COCOMO II – Putnam Estimation Model - Cost Estimation – Economical, Technical and Operational Feasibility studies. Discounted cash flow and return on investment - Stepwise planning - Identifying scope and objectives. (12)

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. (12)

SOFTWARE CONFIGURATION MANAGEMENT AND MAINTENANCE: Need for Configuration Management - check in check out process - Versions and Variations – Baselines - Software Configuration Audit - Software Maintenance Process, Activities and Categories – Maintenance Measurement – Service Measurement and Benchmarking (12)

Total L: 45

REFERENCES:

1. Roger Pressman S, “Software Engineering: A Practitioners”, Tata McGraw Hill, New Delhi, 2014.
2. Gopalaswamy Ramesh and Ramesh Bhattiprolu, “Software Maintenance: Effective Practices for Geographically Distributed Environments”, Tata McGraw Hill, New Delhi, 2009.
3. Rajesh Naik and Swapna Kishore, “Software Requirements and Estimation”, Tata McGraw Hill, India, 2008.
4. Pankaj Jalote, “Software Project Management in Practice”, Pearson Education, New Delhi, 2005.
5. Watts Humphrey, “Managing the Software Process”, Pearson Education, New Delhi, 2000.

CO - PO MAPPING

PO CO	PO1	PO2	PO3	PO4
CO1			S	M
CO2	W	M	S	M
CO3				M
CO4			M	M

18ZS09 SOFTWARE ARCHITECTURE

3 0 0 3

Course Objective:

1.To describe a software architecture using various documentation approaches and architectural description languages.
2.To motivate the architectural concerns for designing and evaluating a system's architecture.
3.To identify different structural patterns.

Course Outcome:

CO1: Describe the importance and role of software architecture in large scale software systems.
CO2: Identify and assess software architecture quality attributes
CO3: Create UML views and describe the needs,concepts of aspect oriented architecture and MDA.
CO4: Describe and apply architectural styles and patterns

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. (12)

SERVICE ORIENTED ARCHITECTURE: Service Oriented Systems – Web Services – Components – Restful Web Services - Advanced Middleware Architectures – Business Process Orchestration, Integrating Architecture Issues, ESB - Message Brokers. (11)

SOFTWARE ARCHITECTURAL PROCESS AND MDA: Process – Requirements, Design, Validation-Documentation - UML 2.0, Architectural Views, Component Diagrams, Templates - Aspect Oriented Architecture-Aspects, AOP, Example - Architecture, Aspects and Middleware, Tools, Model Driven Architecture - Need, Tools, MDA and Software Architecture - Requirements, Transformation. (11)

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 (11)

Total L: 45

REFERENCES:

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

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1		M	S	
CO2		S	S	
CO3		S	S	S
CO4		S	M	

18ZS52/18ZC52 DATA INTENSIVE COMPUTING SYSTEMS LABORATORY

0 0 4 2

Course Objective:

1. Demonstrate an ability to use tools like MongoDB,Neo4J,Hadoop, R-tool to efficiently store retrieve and process Big Data.
2. Implement Several Data Intensive tasks using Map Reduce paradigm and R.

Course Outcome:

CO1: Use suitable framework to efficiently store, retrieve and process data intensive problems.

CO2: Develop, debug, test and document the designed solutions for data intensive problems.

The students will learn to use data intensive computing platforms like Hadoop, Spark, Hbase, MongoDB, Neo4j and R for techniques like MapReduce, Machine Learning, Data Visualization, Regression, Clustering, Association Rule Mining, Classification, Time Series Analysis etc and are then applied to solve a data intensive problem

Total P: 60

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1	M		S	S
CO2		S	M	S

18ZS61/18ZC61 INDUSTRY VISIT & TECHNICAL SEMINAR

0 0 4 2

Course Objective:

1.To provide an opportunity to the students to interact with industry people as well as to learn practically through interaction, working methods and employment practices.

2.To provide an exposure to current work practices as opposed to possibly theoretical knowledge being taught at college.

Course Outcome:
CO1:Visit the relevant industries and gain knowledge about their process and functioning
CO2:Generate technical presentations to communicate complex, technical ideas to various types of audiences

The student will make at least two technical presentations on current topics related to the programme. 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.

Total P: 60

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1		S		
CO2		S		

18AE82 RESEARCH METHODOLOGY AND IPR

0 0 6 0

Course Objective:
1.
2.
3.
Course Outcome:
CO1:
CO2:
CO3:
CO4:

Meaning of research problem, sources of research problem, criteria and characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem, approaches of investigation of solutions for research problem, data collection, analysis and interpretation. (25)

Effective literature studies approaches, analysis of plagiarism, research ethics, effective technical writing, how to write report, developing a research proposal, format of research proposal, presentation of research proposal for assessment by a review committee.
(20)

Nature of intellectual property: Patents, designs, trade and copyright. Process of patenting and development: Technological research, innovation, patenting, development, international cooperation on intellectual property, procedure for grants of patents, patenting under PCT. (20)

Patent rights: scope of patent rights, licensing and transfer of technology, patent information and databases, geographical indications. New developments in IPR: Administration of patent system, IPR of biological systems and computer software, traditional knowledge case studies on IPR. (25)

Total P: 90

REFERENCES:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
2. Ranjit Kumar, “Research Methodology: A Step by Step Guide for Beginners”, Sage Publication, 2nd Edition, 2010.
3. Ramappa T., “Intellectual Property Rights Under WTO”, S Chand Publication, 2008.
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.

5. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”, 2001.
6. Stuart Melville and Wayne Goddard, “Research Methodology: An Introduction for Science & Engineering Students”, 1996.
7. Mayall, “Industrial Design”, McGraw Hill, 1992.
8. Niebel, “Product Design”, McGraw Hill, 1974.

PO CO	**P O*1***	**P O*2***	**P O*3***	**PO *4***
CO1				
CO2				
CO3				
CO4				

SEMESTER III

18ZS53/18ZC53 SOFTWARE DEVELOPMENT LABORATORY

0 0 4 2

Course Objective:

1. To enable students to continue exposition of methods and tools of software development.
2. Provides an opportunity to apply and investigate theoretical and conceptual knowledge of software development.
3. To enable students to learn and practice the stages of software development.

Course Outcome:

Students will be able to
CO1:Prepare project plan, SRS, Design document, code document and test case documentations at appropriate stages of software development.
CO2:Acquire software development skills through various stages of software development.

The student will demonstrate the ability to design research methodology that adequately addresses the following:

❖ Idea generation and Concept Selection
  ▪ Identification of real time problem in the field of computers.
  ▪ Comparing and contrasting different types of research methods.
  ▪ Patent search for foolproof concept selection
  ▪ Time line of activities

❖ Design
  ▪ Conceptualizing a research design and propose an innovative solution for the problem identified.

❖ Development and Testing
  ▪ Model/prototype development
  ▪ Validation and testing

Report submission and presentation

Total P: 60

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO*4*
CO1	S	S	S	
CO2	S	S	S	S

18ZS71/18ZC71 PROJECT WORK I

0 0 6 3

Course Objective:

1.Identify the real world problem and understand literature related to the problem
2.Develop a model to solve the problem and propose suitable solution.
3. Present and Document the work done by following ethical practices.

Course Outcome:

CO1: Identification of Problem, Conduct of Literature survey and Solution Generation, code development, interpretation of results by application of relevant knowledge and skill, Evaluation of results obtained.
CO2: Documentation and Presentation of the work done in the given structure and format.

- Identification of a real world problem.
- Conduct literature survey
- Formulate a solution for the problem based on literature survey.
- Implementation of the modules
- Compare the results with existing solutions
- Write a technical report on the work done
- Publish the work in reputed national / international conferences

Total P: 90

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO*4*
CO1	S		S	S
CO2	M	S	M	M

SEMESTER IV

18ZS72/18ZC72 PROJECT WORK II

0 0 28 14

Course Objective:

1.Identify the real world problem and understand literature related to the problem
2.Develop a model to solve the problem and propose suitable solution.
3. Present and Document the work done by following ethical practices.

Course Outcome:

CO1: Identification of Problem, Conduct of Literature survey and Solution Generation, code development, interpretation of results by application of relevant knowledge and skill, Evaluation of results obtained and performance analysis with existing methods.
CO2: Documentation and Presentation of the work done in the given structure and format.

- Problem Identification.
- Define the scope and objectives of the problem
- Develop a mathematical model with realistic assumptions.
- Propose a novel and original solution for the identified problem
- Implementation of the modules
- Interpretation and validation of results using formal research methods
- Comparison with existing solutions
- Publish the work in refereed national / international journals

Total P: 420

CO - PO MAPPING

PO CO	**P O*1***	**P O*2***	**P O*3***	**PO *4***
CO1	S		S	S
CO2	M	S	M	M

ELECTIVE THEORY COURSES

18ZS21 USER INTERFACE DESIGN

2 2 0 3

Course Objective:

1. To learn about designing the user interfaces considering human and computer capabilities and constraints.
2. To understand the user-centered design and usability principles.
3. To Know about Web UI design principles.

Course Outcome:

CO1: Design user interfaces using task oriented approach.
CO2: Use the object oriented and CSCW approach to design and test the User Interfaces.
CO3: Demonstrate the approaches, techniques, and methods available to design, evaluate and test usability and understand the need of accessibility
CO4: Describe characteristics and principles of Web UI

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. (7+7)

OBJECT ORIENTED DESIGN AND CSCW 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. (8+8)

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 (8+8)

WEB INTERFACE DESIGN: Designing Web Interfaces - Drag and Drop-Direct Selection-Contextual Tools, Overlays, Inlays and Virtual Tags - Process Flow - Case Studies (7+7)

Total L: 30 + T: 30 = 60

REFERENCES:

1. Jeniffer Tidwell," Designing Interfaces", O'Reilley, USA, 2011
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly Media Inc., USA, 2009
3. Ben Schneiderman, "Designing the User Interface", Pearson Education, New Delhi, 2009.
4. Andrew Sears and Julie A Jacko, "HCI handbook", Lawrence Erlbaum Associates, New York, 2008.
5. Linda Mcaulay, "HCI for Software Designers", International Thompson Computer Press, USA, 1998.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1		M		M
CO2		M		M
CO3		M		W
CO4		M		S

18ZS22/18ZC24 AGILE SOFTWARE DEVELOPMENT

2 2 0 3

Course Objective:

1. Learn the practices and values of Agile methods and compare them with other methodologies

2. Learn extreme programming methodology

3. Learn the practices in Scrum and apply them for IoT and bigdata projects using tools

Course Outcome:

CO1: Understand values and practices in Agile Methodology and compare agile method with traditional methods.

CO2: Understand extreme programming process model and apply it for a case study

CO3: Understand Scrum process model and apply it for a case study of Iot Projects and Big data Projects

CO4: Know and compare other agile methods like FDD, DSDM etc

AGILE PRINCIPLES AND MODELING: Introduction - Traditional, IID and Agile Methodologies – Comparison - Need - Manifesto – Values and Practices – Agile Modeling Values, principles and practices – Agile modeling with RUP (8+8)

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 – case study (7+7)

SCRUM: Introduction – Practices - Applying Scrum – Need – Scrum Values – Practices - Tools in Agile Software Development – Case Study – Applying Scrum for IoT projects, Applying Scrum for Big Data Projects (7+7)

OTHER AGILE DEVELOPMENT METHODOLOGIES: FDD – DSDM - Lean and Kanban Software development – Comparison of agile approaches - Case Studies - Defining Data Warehousing Projects for Iterative Development – User stories – agile estimation - Adapting Iterative Development for Data warehousing Projects**.** ` (8+8)

Total L: 30 + T: 30 = 60

REFERENCES:

1. Robert Martin, “Agile Software Development: Principles, Patterns, and Practices”, Pearson Education Ltd. 2014.
2. Jim Highsmith, “Agile Data Warehousing Project Management”, Morgan Kaufmann, 2012.
3. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, Pearson Education, USA, 2006.
4. Scott Ambler, “Agile Modeling: Effective Practices for eXtreme Programming and the Unified Process”, Wiley Computer Publishing, 2002.
5. Ken Schwaber and Mike Beedle, “Agile Software Development with Scrum”, Prentice Hall, USA, 2001.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*
CO1	W		S	M
CO2	W		S	S
CO3	W		S	S
CO4	W		S	S

18ZS23/18ZC25 INTERNET OF THINGS

2 2 0 3

Course Objective:

1.

2.

3.

Course Outcome:

CO1:

CO2:

CO3:

CO4:

IOT ARCHITECTURE: Introduction to IoT - M2M Architecture - Design Principles for Connected Devices - Definitions and Functional Requirements – Sensors and Actuators IOT Architecture - IETF Architecture for IoT - OGC Architecture - Communication Model. (8+6)

COMMUNICATION PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNET Protocol – MODBUS– Zigbee Architecture – 6LOWPAN – LoRA-COAP - MQTT (8+6)

ELECTRONIC PROTOTYPING: Prototypes and Production - Open Source versus Closed Source - Prototyping Embedded Devices - Prototyping IoT Projects With Arduino - Prototyping IOT Projects With Raspberry PI (7+9)

CASE STUDIES AND IOT DATA ANALYTICS: Real world design constraints - Applications - Asset management, Industry 4.0, Smart grid, Commercial building automation, Smart cities Data Analytics for IoT – Edge analytics - sensor data fusion techniques - Cloud Storage Models & Communication APIs - Cloud for IoT - Predictive analytics (7+9)

Total L: 30 + T: 30 = 60

REFERENCES:

1. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons Ltd., UK, 2014.
2. Olivier Hersent, David Boswarthick and Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Wiley & Sons Ltd., UK, 2012.
3. David Boswarthick, Omar Elloumi and Olivier Hersent, “M2M Communications: A Systems Approach”, John Sons Ltd, UK, 2012
4. Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*
CO1				
CO2				
CO3				
CO4				

18ZS24/18ZC07 ADVANCED OPERATING SYSTEMS

2 2 0 3

Course Objective:

1. To understand and apply Process scheduling and process synchronization.

2. Be familiar with Distributed operating systems and resource management

3. To know about Real time and Mobile operating system

Course Outcome:

CO1:Apply process scheduling and synchronization concepts and also describe memory management techniques.

CO2:Analyze Mutual exclusion, Deadlock detection and agreement protocols in Distributed operating system.
CO3:Summarize various resource management techniques for distributed systems.
CO4:Illustrate different features of real time and mobile operating systems.

PROCESS SCHEDULING & PROCESS SYNCHRONIZATION: Overview, Process scheduling, Operations on process, Inter process communication, Process scheduling criteria, process scheduling algorithms. Process Synchronization: Background, Hardware Support to Process Synchronization, Semaphores, Monitors - Memory Management Techniques. Case study: process scheduling in Linux. (8+7)

DISTRIBUTED OPERATING SYSTEMS: Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols - Case Study: Remote Procedure call in Distributed Computing Environment. (7+7)

DISTRIBUTED RESOURCE MANAGEMENT: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection. (7+8)

REAL TIME AND MOBILE OPERATING SYSTEMS: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system – case study - iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System. (8+8)

Total L: 30 + T: 30 = 60

REFERENCES:

1. William Stallings, "Operating Systems – Operating System: Internals and Design Principles", Prentice Hall, 2014.
2. Mukesh Singhal, Niranjan Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill, 2011
3. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson, 2006.
4. HagitAttiya, Jennifer Welch, "Distributed Computing: Fundamentals, Simulations and Advanced Topics", McGraw Hill, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufmann Series, Elsevier, 1996.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*
CO1	S	S	M	
CO2	S	S	M	
CO3	S	S	M	
CO4	M	S	M	

18ZS25 PRIVACY PRESERVING DATA MINING

2 2 0 3

Course Objective:

1.To Learn the various concepts, metrics and data mining techniques related to privacy.
2.To Learn the various privacy preserving methods and privacy security models.
3.To Learn the different privacy preserving distributed data mining techniques.

Course Outcome:

CO1: Describe the concepts of privacy and data mining techniques associated with it.

CO2: Illustrate the metrics for privacy preservation and apply various privacy preserving methods.

CO3: Employ various privacy and security models.

CO4: Describe various privacy preserving distributed data mining techniques.

INTRODUCTION: Introduction to Data Mining : Data Mining Architecture, Data Preprocessing, Techniques: Association Rule mining – Classification and Prediction – Clustering 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. (4+7)

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. (6+8)

PRIVACY AND SECURITY MODELS: Privacy 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, Sutherland Model, Graham-Denning Model. (10+10)

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. 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) (10+5)

Total L: 30 + T: 30 = 60

REFERENCES:

1. James Michael Stewart ,Mike Chapple, Darril Gibson, ”CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide,Wiley Publisher, 2015.
2. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems Morgan Kaufmann Publishers, July 2011.
3. 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.
4. Charu C. Aggarwal, “Privacy-Preserving Data Mining: Models and Algorithms”, Springer, 2008.
5. Jaideep Vaidya, Chris Clifton and Michael Zhu, “Privacy Preserving Data Mining”, Springer, 2006.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1	S		M	S
CO2	S		S	S
CO3	S		S	S
CO4	S		S	S

18ZS26 SOCIAL NETWORKS DATA ANALYTICS

2 2 0 3

Course Objective:

1.To impart knowledge in Social Network Models

2. Understand Node classification, Link Prediction in Social Netwoks

3. Learn various algorithms in social networks

Course Outcome:
CO1:Describe Social Network models
CO2:Describe Node classification methods in Social networks
CO3:Analyse various link prediction models
CO4: Analyse various algorithms for community discovery in social networks

SOCIAL NETWORK MODELS: Social Network data : nodes, relations – social networks as graphs ; mathematical representation of social network data - 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 (8+8)

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+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 (7+7)

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 betweeness 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. (8+8)

Total L: 30 + T: 30 = 60

REFERENCES:

1. Charu C Agarwal, "Social Networks Data Analytics", Springer, USA, 2011.
2. Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", 2014.
3. Guandong Xu and Lin Li, "Social Media Mining and Social Network Analysis: Emerging Research", 2013.
4. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World Cambridge University Press", New Delhi, 2010.
5. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups - Finding Connections on the Social Web", O'Reilly Media, 2011.
6. Jeroen Bruggeman, "Social Networks: An Introduction", Routledge, 2008.

CO - PO MAPPING

PO **CO**	**P** **O*1***	**P** **O*2***	**P** **O*3***	**PO** ***4***
CO1		M	M	
CO2	M	M		
CO3	M		M	S
CO4	M	M	M	S

18ZS27 SYSTEMS ENGINEERING

3 0 0 3

Course Objective:

1. Gain knowledge in engineering complex systems using appropriate processes
2. Gain knowledge in implementing complex systems using methodical approach

Course Outcome:

CO1: Describe need and application of systems engineering considering structure of complex systems
CO2: Illustrate the system development and management process
CO3: Use concept development to analyze, explore and define concepts
CO4: Develop systems using systems engineering development processes and approaches

SYSTEMS ENGINEERING: Systems Engineering and Modern systems - Systems Engineering Landscape – Structure of complex systems (11)

SYSTEM DEVELOPMENT PROCESS AND MANAGEMENT: System Life Cycle - Evolutionary Characteristics of the Development Process - Systems Engineering Method - Testing throughout System Development - Managing System Development and Risks – WBS, SEMP, Risk Management - Organization of Systems Engineering (11)

CONCEPT DEVELOPMENT: Analysis – Concept Exploration – Concept Definition – Decision analysis and support (11)

ENGINEERING DEVELPOMENT: Advanced development: Requirements analysis, Risk analysis and reduction, Functional analysis, Prototype development, Software Systems Engineering, Engineering Design, Integration and evaluation (12)

Total L: 45

REFERENCES:

1. Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour and Steven M. Biemer, “Systems Engineering Principles and Practice”, Wiley-Interscience, Hoboken, 2011.
2. Ed. Garrett Shea, “NASA Systems Engineering Handbook”, Revision 2, NASA, USA, 2017.
3. Charles S. Wasson, “System Engineering Analysis, Design, and Development: Concepts, Principles, and Practices”, 2nd Edition, Wiley, New York, 2015.
4. Department of Defense, “Systems Engineering Fundamentals”, Defense Acquisition University Press, Fort Belvoir, 2001.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1			M	M
CO2			M	M
CO3			M	M
CO4			M	M

18ZS28 SOFTWARE RELIABILITY

3 0 0 3

Course Objective:

1. Learn reliability modeling with respect to software products, using ODC for measuring software project, scope of fault tolerant software systems.

Course Outcome:

CO1: Comprehend the fundamental concepts of reliability and apply reliability measures, mathematical and probability concepts to address reliability issues.

CO2: Analyze system reliability models and design solutions for given problems using reliability models.

CO3: Describe and apply concepts of reliability prediction to solve given problems

CO4: Describe and apply concepts of redundancy techniques in real time environment to solve given problems

RELIABILITY FUNDAMENTALS AND MATHEMATICS: Need for Reliability – Definition - Causes of Failures - Types of Failures - Maintainability and Availability - Reliability Measures - Design for Higher Reliability - Redundancy Techniques - Reliability and Cost - Random Experiments - Probability – Random Variables - Distribution Functions - Discrete Distributions - Continuous Distributions. (12)

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.(11)

RELIABILITY PREDICTION: Purpose - Classification – General Requirements – Prediction Methodologies – Software Prediction Packages – Role and Limitation of Reliability Prediction. (11)

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. (11)

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.

CO - PO MAPPING

PO **CO**	**P** **O*1***	**P** **O*2***	**P** **O*3***	**PO** ***4***
CO1	W			
CO2	M	M		M
CO3	M			
CO4	M			S

18ZS29 SOFTWARE METRICS

3 0 0 3

Course Objective:

1.To provide a basic understanding and knowledge of the software metrics and measurement techniques.
2.To understand the importance of Metrics data collection and analysis for external product attributes and Resource measurement.
3.To obtain objective measurements that can be useful for quality assurance, debugging & estimating costs.

Course Outcome:

CO1: State importance of quantification in software engineering and Select software metrics based on project goals
CO2: Identify internal and external product attributes for measurement.
CO3: Identify the various techniques and models for effort, cost and time estimation
CO4: Discuss Plans to establish measurement programs in an organization

QUANTIFICATION IN SOFTWARE ENGINEERING: Measurement in Software Engineering - Measurement Scales and Scale Types - Classification of Software Measures - Software Measurement Validation - Data Analysis – Analysis Methods – Statistical Methods. 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 (12)

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. (11)

RESOURCE MEASUREMENT: Productivity, Teams and Tools - Making Process Predictions - Good Estimates - Models of Effort and Cost - Dealing with Problems of Current Estimation Methods (11)

MEASUREMENT AND MANAGEMENT: Planning - Measurement Program - Measurement Tools-Measurers - Analysts - Audience - Measurement in Practice. (11)

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.

CO - PO MAPPING

PO CO	**PO*1***	**PO*2***	**PO*3***	**PO *4***
CO1	W			
CO2			W	M
CO3	S	M		M
CO4		M		

18ZS30 DESIGN PATTERNS

3 0 0 3

Course Objective:

1.To solve problems related to software development using a proven solution
2.To develop a solution with high cohesive modules and minimal coupling

Course Outcome:

CO1 : Describe solutions to programming problems using design patterns
CO2: Apply the patterns on responsibility patterns to solve problems
CO3: Apply the patterns on responsibility patterns to solve problems
CO4: Apply operation and extension patterns to solve problems

INTRODUCTION TO PATTERNS: Introduction to patterns – Describing Design Patterns, Relationship between Design Patterns, Solving Design Problems Using Patterns, Procedure to Apply and Use a Design Pattern (5)

INTERFACE PATTERNS: Introduction to interfaces – Adapter – Façade – Composite – Bridge pattern (7)

RESPONSIBILITY PATTERNS: Introduction to responsibility – Singleton – Observer – Proxy – Mediator - Chain of Responsibility – Flyweight (11)

CONSTRUCTION PATTERNS: Introduction to construction - Builder, Factory Method, Abstract Factory, Prototype, Memento (11)

OPERATION & EXTENSION PATTERNS: Introduction to operations - Template, State, Strategy, Command – Extensions- Decorator, Iterator, Visitor (11)

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 Wessley, 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. Vascaaran sarcar, “Java Design patterns”, Apress, 2015.
5. Kerievsky J, “Refactoring to Patterns”, Addison-Wesley Professional, Boston, MA, USA, 2004

CO - PO MAPPING

PO **CO**	**P** **O*1***	**P** **O*2***	**P** **O*3***	**PO** ***4***
CO1	W			
CO2	M		M	
CO3	M		M	
CO4	M		M	

18ZS31 DECISION SUPPORT SYSTEMS

3 0 0 3

Course Objective:

1. To impart knowledge in Decision Support Systems Concepts, Methodologies And Technologies

2. To apply Intelligence for Decision Making

Course Outcome:

CO1: Describe the decision making models and Phases of Decision making

CO2: Appraise the decision support systems and management support system modeling

CO3: Recognize the role of Data mining in Business Intelligence (BI) and describe text mining

CO4: Illustrate Artificial Intelligence and Expert systems and their role in developing DSS

DECISION SUPPORT SYSTEMS (DSS) AND BUSINESS INTELLIGENCE (BI): Introduction to decision support systems - framework for business intelligence - tools and techniques for managerial decision support. Decision making Models - phases of decision making process - intelligence phase - design phase - implementation phase. (11)

DECISION SUPPORT SYSTEMS CONCEPTS, METHODOLOGIES AND TECHNOLOGIES: Decision support systems configuration and descriptions - characteristics and capabilities – classifications – components - data management subsystem - model management subsystem - user interface subsystem - the knowledge based management subsystem Modeling and analysis - Management support systems modeling - structure of mathematical models for decision support - certainty, uncertainty and risk.(11)

BUSINESS INTELLIGENCE: Data mining for business intelligence: data mining concepts and applications - data mining process and methods - Artificial Neural Networks for Data Mining applications of ANN - Case studies. Text and web mining: Text mining concepts - natural language processing - text mining applications and process - web mining overview. (11)

INTELLIGENT SYSTEMS: Artificial Intelligence and Expert Systems: Structure of expert systems - knowledge engineering - problem areas suitable for expert systems - benefits and limitations. Advanced Intelligent systems: Machine learning techniques - Case Based Reasoning - intelligent agents - implementing DSS and BI- RFID and new BI application opportunities - cloud computing and BI (12)

Total L: 45

REFERENCES:

1. Efraim Turban, Ramesh Sharda, Dursundelen, “Decision Support Systems and Intelligent Systems”, Prentice-Hall of India, 2011.
2. Efraim Turban, Jay E. Aronson, Richard V. McCarthy, “Decision Support Systems and Intelligent Systems”, Prentice-Hall of India, 2007
3. Clyde W. Holsapple and Andrew B. Whinston, “Decision Support Systems, A Knowledge-Based Approach”, West Group, 1996.
4. Vicki L. Sauter , “Decision Support Systems For Business Intelligence”, Wiley,2011.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1			M	M
CO2			M	
CO3			M	W

CO4	M		M	M

18ZS32 AGENT BASED INTELLIGENT SYSTEMS

3 0 0 3

Course Objective:

1. Understand the basics of agent based intelligent systems

2. Understand the role of knowledge and inference in agent based intelligent systems

3. Understand the basics and working of multi-agent intelligent systems

Course Outcome:

CO1: Describe and apply concepts of intelligent agents to problems in agent based intelligent systems

CO2: Describe and apply concepts of knowledge representation and inference to problems in agent based intelligent systems

CO3: Describe and apply concepts of uncertainty, probability and time to solve problems in agent based intelligent systems

CO4: Describe and apply concepts of multi-agent systems to solve problems in agent based intelligent systems

INTRODUCTION: Basic Definitions – Intelligent Agents – Problem Solving Agents – Searching for Solutions – Uninformed Search Strategies – Informed Search Strategies – Implementation (12)

KNOWLEDGE REPRESENTATION: Knowledge Based Agents – Propositional Logic (PL) – First-Order Logic (FOL) – Inferences in PL and FOL – Semantic Net (11)

PROBABILISTIC AGENTS: Quantifying Uncertainty – Probabilistic Reasoning – Bayesian Network – Probabilistic reasoning over time – Time and Uncertainty – Inference in Temporal Models (11)

MULTI–AGENT 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 (11)

Total L: 45

REFERENCES:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson, UK, 2015.
2. Bradshaw, “Software Agents”, MIT, Cambridge, 2010.
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CO - PO MAPPING

PO **CO**	**PO*1***	**PO*2***	**PO*3***	**PO*4***
CO1				W
CO2				W
CO3				W

CO4				W

18ZS33/18ZC27 EVOLUTIONARY COMPUTING TECHNIQUES

3 0 0 3

Course Objective:

1. Comprehend the fundamental theories and approaches of Evolutionary Computing Techniques

2. Understand and use heuristic and meta-heuristics approaches for solving complex optimization problems and multi-objective optimization problems

Course Outcome:

CO1: Illustrate evolutionary computing techniques and heuristics search approaches for solving problems

CO2: Select and apply appropriate representation and variant of GA or DE to solve a given optimization problem

CO3: Select and apply appropriate representation and variant of PSO or ACO to solve a given optimization problem

CO4: Describe and apply NSGA for solving multi-objective optimization problems

HEURISTIC AND METAHEURISTIC APPROACHES: Challenges in Solving Complex Problems - Evolutionary algorithms: Principles, Historical development, Features, Classification and Components, Advantages, Applications. Heuristic Search: Problem representation as search - Generate and Test - Breadth First Search - Depth First Search - Hill Climbing: Principles, Local and Global maxima, Ridges, Plateau - Steepest Ascent - Simulated annealing: Annealing schedule, Parameter Selection (12)

GENETIC ALGORITHM: Biological Background - Simple Genetic Algorithm (SGA) - Representation types - Recombination Types - Mutation types - GA Algorithm - Schema Theorem - Variations of GA: Adaptive GA, Real Coded GA - Differential Evolution: Principles, Mutation, Crossover, Selection (11)

SWARM INTELLIGENCE: Particle Swarm Optimization: Swarms, Operating principles, PSO Algorithm, Neighborhood Topologies - Variations of PSO: Binary, weighted - Ant Colony Optimization: Ant foraging behavior, Theoretical Considerations, ACO Algorithm, Variations of ACO: Elitist Ant System (EAS), MinMax Ant System (MMAS) and Rank Based Ant Colony System (RANKAS) (11)

MULTI-OBJECTIVE OPTIMIZATION: Principles - Classical Methods - Challenges - Evolutionary algorithms for multi-objective optimization - Multimodal function optimization - Non-Dominated Sorting Genetic Algorithm (NSGA): Non-elitist, elitist - Controlled elitism in NSGA (11)

Total L: 45

REFERENCES:

1. Eiben AE and Smith JE, “Introduction to Evolutionary Computing”, Second Edition, Springer, Heidelberg, 2015.
2. Rich E and Knight K, “Artificial Intelligence”, Tata McGraw Hill Education Private Limited, India, 2011.
3. Deb K, “Multi-Objective Optimization Using Evolutionary Algorithms”, Wiley-Blackwell, USA, 2008.
4. Dorigo M and Stutzle T, “Ant Colony Optimization”, Prentice Hall of India, New Delhi, 2005.
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CO - PO MAPPING

PO **CO**	**P** **O*1***	**P** **O*2***	**P** **O*3***	**PO** ***4***
CO1			S	S

CO2			S	S
CO3			S	S
CO4			S	S

18ZS34 DATA INTEGRATION

3 0 0 3

Course Objective:

1. Apply design thinking and the Agile methodology to integrate data from various sources

2. Apply Data virtualization Techniques and Data Integration frame work for Real time data.

Course Outcome:

CO1: Represent and query information semantically

CO2: Describe and apply ETL for batch data integration and real time data integration

CO3: Describe and apply data virtualization and schema mapping for integration

CO4: Describe and apply data integration in NoSQl systems

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. (12)

BATCH DATA INTEGRATION AND REAL TIME DATA INTEGRATION: ETL – Datawarehousing – Data Conversion – Archiving – Integration Architecture – Provenance Determination – ETL Tools – Case Study. Patterns – Technologies – Modelling – Master Data Management – Data Warehousing with Real – Time Updates – Stream Data – Architecture – Case Study. (11)

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. (11)

SQL/NoSQL INTEGRATION: Introduction – Architecture of NoSQL Systems – Schema Extraction Approaches – Data Integration Framework – Query Processing – Case Study. (11)

Total L: 45

REFERENCES:

1. Bo Ma, Tonghai Jiang, “A Novel Data Integration Framework based on Unified Concept Model”, IEEE, 2017.
2. Judith R. Davis, Robert Eve, “Data virtualization - Going beyond Traditional Data Integration to Achieve Business Ability.”Nine Five One Press, USA, 2014.
3. April Reeve, “Managing Data in Motion”, Elsevier, 2013.
4. 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.
5. Grigoris Antoniou, Frank Van Harmelen,“A Semantic Web Primer”, The MIT Press Cambridge, 2008.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*

CO1	M			M
CO2	S		M	S
CO3	M		M	M
CO4	M		M	S

18ZS35/18ZC08 ADVANCED COMPUTER NETWORKS

3 0 0 3

Course Objective:

1.

2.

3.

Course Outcome:

CO1:

CO2:

CO3:

CO4:

INTERNET ROUTING, QOS ANALYSIS AND MULTICASTING: Internet Architecture - IP service Model – Routing Domains and Autonomous Systems – Intra Domain Routing Algorithms - Inter Domain-Routing: BGP - BGP Traffic Engineering. Routing Convergence. Need for QoS - End to End QoS - QoS Levels - Performance Measures: Bandwidth - Delay and Jitter - Packet Loss - Throughput. Routing Overheads .Multicast: Address Assignments - Multicast Routing – DVMRP- Protocol Independent Multicasting. (12)

TCP PERFORMANCE MODELING: TCP Segment format - TCP Sliding Windows - Congestion Control and Queuing - TCP Congestion Control - Analysis of TCP: Buffer Sizing - Throughput - Fairness - Random Early Detection Gateways for Congestion Avoidance. DRR - Core-Stateless Fair Queuing - Congestion Control for High Bandwidth - Delay Product Networks - Variations of TCP. (11)

HIGH SPEED NETWORKS: Packet Switching Vs Cell Switching - ATM Networks: ATM Protocol Architecture - Logical Connections - ATM Cells - Service Categories - ATM Adaptation Layer - Traffic and Congestion Control In Frame Relay and ATM Networks. High-Speed LANS - Fast Ethernet - Gigabit Ethernet. (11)

WIRELESS NETWORKS: Wireless Networks: Cellular Networks: GSM - UMTS - 3G and 4G Networks – IEEE E 802.11 - Bluetooth - WIMAX – WSN - Characteristics - Architecture – Applications - Network Virtualization and Software Defined Networking (11)

Total L: 45

REFERENCES:

1. James F Kurose, Keith W Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Pearson Education, India, 2012.
2. Larry L Peterson and Bruce S Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann Publishers Burlington, USA, 2011.
3. Andrew S Tanenbaum, “Computer Networks”, Prentice Hall, USA, 2010.
4. William Stallings, “High-Speed Networks and Internets: Performance and Quality of Service”, Pearson Education, India, 2002.
5. HolgerKarl , Andreas Willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2002.

CO - PO MAPPING

PO CO	P O*1*	P O*2*	P O*3*	PO *4*
CO1				
CO2				
CO3				
CO4				

18ZS36 PRIVACY IN SOCIAL NETWORKS

3 0 0 3

Course Objective:
1. Understand the risks and issues in maintaining privacy in social networks
2. Understand modeling and evaluation of privacy issues in various social networks using contemporary techniques

Course Outcome:
CO1: Describe the social network models, security and trust issues, and trust evaluation models
CO2: Explain privacy breach techniques, statistical methods for inferring information and privacy preservation strategy in MSN
CO3: Explain and apply of various algorithms in privacy preservation for social recommendations, profile matching, dynamic social networks, affiliation networks and peer to peer social networks
CO4: Model and evaluate and predict privacy issues in information sharing and privacy settings

INTRODUCTION AND SECURITY ISSUES: Online social networks – model - data collection – challenges – pitfalls – stealing reality - mobile social networks, characteristics, applications – OSN threats and issues. Security Issues: Trust in Online Social Networks: Properties, Components, Social Trust, Trust Evaluation Models - Access Control - Identity management - Identity as Self -Presentation - identity disclosure - identity theft – Phishing threat in OSN- Safety challenges in Mobile Social Networks (MSN). (16)

PRIVACY BREACHES: Introduction – Types - Statistical methods for inferring information – Crowdsourcing and Ethics - Cooperative Data Forwarding Strategy with Privacy Preservation in MSN. (10)

PRIVACY-PRESERVING MECHANISMS: k-anonymity, *l*-diversity and *t*-closeness, Differential Privacy - Profile Matching Protocol - Dynamic social networks privacy preservation - Privacy of Social Recommendation Algorithms - Providing Group Anonymity in Social Networks - Privacy Mechanisms for Affiliation networks, Complex Networks – Encryption for Peer-to-Peer Social Networks - case studies (10)

MODELING, EVALUATING, AND MANAGING PRIVACY RISKS: Information-sharing Model - Strategic Behavior and Information sharing – issues - case study - Privacy-score Model - Methods for Computing the Privacy Score - Managing Privacy Settings - Predicting Users' Privacy Settings – Recommendation-Based Trustworthy Service Evaluation in MSN (9)

Total L: 45

REFERENCES:

1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers, Nadav Aharony, Alex Pentland, "Security and Privacy in Social Networks", Springer, 2013
2. Yashar Najaflou, Behrouz Jedari, "Safety Challenges and Solutions in Mobile Social Networks", IEEE Systems Journal, 2013.
3. Xiaohui Liang, Rongxing Lu, Xiaodong Lin, Xuemin (Sherman) Shen, "Security and Privacy in Mobile Social Networks", Springer, 2013.
4. Elena Zheleva, Evimaria Terzi, Lise Getoor, "Privacy in Social Networks", Morgan & Claypool Publishers, 2012.

5. Barbara Carminati, Elena Ferrari, and Marco Viviani, “Security and Trust in Online Social Networks”, Morgan & Claypool Publishers, 2012.

CO - PO MAPPING

PO CO	PO*1*	PO*2*	PO*3*	PO *4*
CO1			M	M
CO2			M	M
CO3			M	M
CO4			M	M

18ZS37/18ZC41 MACHINE LEARNING

3 0 0 3

Course Objective:

1.Understand computational learning theory basics for different learning systems

2.Understand and design various linear and non-linear models for real world problems

3.

Course Outcome:

CO1: Understand, Design a learning system and evaluate hypotheses based on computational learning theory

CO2: Comprehend linear models for regression and classification problems

CO3: Understand and design neural networks for non-linear problems

CO4: Understand and design kernel and graphical models for real world problems

COMPUTATIONAL LEARNING THEORY BASICS: Introduction: Types of Learning - Designing a learning system – concept learning - Find-s – Candidate Elimination - PAC Learnabilty- Sample complexity for finite and Infinite hypothesis spaces-VC Dimension - Evaluating Hypothesis - Estimating Hypothesis Accuracy - Error Estimation - Bias-Variance - Confidence Interval - Central Limit Theorem (12)

LINEAR MODELS: Linear Models For Regression – Linear Regression Models, Maximum Likelihood Estimation - Least Squares, The Bias-Variance Decomposition, Bayesian Linear Regression, Linear Models for Classification, Probabilistic Generative Models, Probabilistic Discriminative Models, Linear Discriminant Analysis. (11)

NEURAL NETWORKS: Neural Networks - Feed-forward Networks - Network Training - Delta Rule- Gradient Descent - Error Backpropagation - Regularization in Neural Networks. (11)

KERNEL AND GRAPHICAL METHODS: Kernel Methods - Constructing Kernels- Radial Basis Function Networks - Gaussian Processes - Maximum Margin Classifiers – SVM - Graphical Methods – Bayes Theorem - Bayesian Networks - Markov Random Fields - Inference in Graphical Models - Mixture Models – Expectation Maximization. (11)

Total L: 45

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer-Verlag New York, 2013.
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning - Data Mining, Inference, and Prediction”, Second Edition, Springer Series in Statistics, Springer-Verlag New York, 2013.
4. Yaser S. Abu Mostafa, Malik Magdon Ismail, Hsuan Tien Lin, “Learning From Data A Short Course”, Amlbook.Com, 2012.

CO - PO MAPPING

PO **CO**	**P O*1***	**P O*2***	**P O*3***	**PO *4***
CO1			S	
CO2			S	
CO3			S	
CO4			S	