MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SFC11 / 18LNI11 / 18SCE11 / 18SCS11 / 18SCN11 / **18SSE11** / 18SIT11	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- To acquaint the students with mathematical/logical fundamentals including numerical techniques,
- To understand probability, sampling and graph theory that serve as an essential tool for applications of computer and information sciences.

Module 1	**Contact Hours**
Numerical Methods: Significant figures, Error definitions, Approximations and round off errors, accuracy and precision. Roots of Equations: Bairstow-Lin's Method, Graeffe's Root Squaring Method. Computation of eigen values of real symmetric matrices: Jacobi and Givens method. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non linear) **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Probability Theory: Probability mass function (p.m.f), density function (p.d.f), Random variable: discrete and continuous, Mathematical expectation, Sampling theory: testing of hypothesis by t-test and chi - square distribution. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycle. Specialized techniques to solve combinatorial enumeration problems. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Vector Spaces: Vector spaces; subspaces; Linearly independent and dependent vectors ; Bases and dimension; coordinate vectors-Illustrative examples. Linear transformations; Representation of transformations by matrices; linear functional; Non singular Linear transformations; inverse of a linear transformation- Problems. **RBT:L1, L2, L3**	**10 Hours**

Course Outcomes

- Understand the numerical methods to solve and find the roots of the equations.
- Utilize the statistical tools in multi variable distributions.
- Use probability formulations for new predictions with discrete and continuous RV's.
- To understand various graphs in different geometries related to edges.
- Understand vector spaces and related topics arising in magnification and rotation of images.

Question paper pattern:
The question paper will have ten questions.

There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Steven C. Chapra and Raymond P Canale: " Numerical Methods for Engineers, 7th Edition, McGraw-Hill Publishers, 2015.
2. T.Veerarajan: "Probability, Statistics and Random Process",3rd Edition,Tata Mc-Graw Hill Co.,2016.
3. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
2. **John Vince :** "Foundation Mathematics for Computer Science", Springer International Publishing, Switzerland, 2015
3. **M.K.Jain, S.R.K.Iyengar and R.K.Jain:** Numerical Methods for Scientific and Engineering Computation. 6th Ed.,New Age Int.Publishers.2012.
4. **Norman L.Biggs**: Discrete Mathematics, 2nd Ed., Oxford University Press, 2017.

Web links and Video Contacts:

1. *http://nptel.ac.in/courses.php?disciplineId=111*
2. *http://www.class-central.com/subject/math(MOOCs)*
3. *http://ocw.mit.edu/courses/mathematics/*

ADVANCES IN SOFTWARE TESTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	**18SSE12**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explore the basics and goals of software testing.
- Discuss various types of software testing and its techniques
- List out various tools which can be used for automating the testing process
- Introduce various software quality standards for establishing quality environment
- Discuss various methods and evaluation procedures for improving the quality Models

Module 1	**Contact Hours**
Basics of Software Testing and Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Decision Table-Based Testing: Decision tables, Test cases for the triangle problem, Test cases for the NextDate function, Test cases for the commission problem, Guidelines and observations. **Data Flow Testing:** Definition-Use testing, Slice-based testing, Guidelines and observations. **Levels of Testing:** Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. **Integration Testing:** A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations, Case study. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
System Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. **Interaction Testing:** Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing,. **Issues in Object-Oriented Testing:** Units for object-oriented testing, Implications of composition and encapsulation, inheritance, and polymorphism, Levels of object-oriented testing, GUI testing, Dataflow testing for object-oriented software, Examples. **Class Testing:** Methods as units, Classes as units. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Object-Oriented Integration Testing: UML support for integration testing, MM-paths for object-oriented software, A framework for object-oriented dataflow integration testing.**GUI Testing:** The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program. **Object-Oriented System Testing:** Currency converter UML description, UML-based system testing, Statechart-based system testing. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Exploratory Testing: The context-driven school, Exploring exploratory testing, Exploring a familiar example, Exploratory and context-driven testing observations. **Model-Based**	**10 Hours**

Testing: Testing based on models, Appropriate models, Use case-based testing, Commercial tool support for model-based testing. **Test-Driven Development:** Test-then-code cycles, Automated test execution, Java and JUnit example, Remaining questions, Pros, cons, and open questions of TDD, Retrospective on MDD versus TDD. **RBT:L1, L2, L3**	

Course Outcomes

The students should be able to:

- Compare and pick out the right type of software testing process for any given real world problem
- Carry out the software testing process in efficient way
- Automate the testing process by using several testing tools
- Establish a quality environment as specified in standards for developing quality software
- Analyze and improve the quality procedures based on the past experience

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2013.

Reference Books:

1. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, John Wiley & Sons, 2008.

OBJECT ORIENTED SOFTWARE ENGINEERING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SCE334 / 18 SCS253 / 18SIT333 / **18SSE13**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss the fundamental principles underlying Object-Oriented software design
- Illustrate the requirements of various domain applications
- Interpret object-oriented analysis and to familiarize UML concepts
- Design, implement and test the software in object oriented approach
- Explore the factors related to software maintenance and software configuration management

Module 1	**Contact Hours**
INTRODUCTION: What is software engineering? Software Engineering Concepts, Development Activities, Managing Software Development, Modeling with UML, Project Organization and Communication. **RBT:L1, L2**	**10 Hours**
Module 2	
REQUIREMENT ELICITATION AND ANALYSIS: Requirements Elicitation: Requirements Elicitation Concepts, Requirements Elicitation Activities, Managing Requirements Elicitation, **Analysis:** Analysis Concepts, Analysis Activities, Managing Analysis. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
SYSTEM DESIGN : System design-Decomposing the system: Overview of System Design, System Design Concepts, System Design Activities: Objects to Subsystems, **System Design –Addressing design goals**: Activities: An overview of system design actives, UML deployment diagrams, Addressing Design Goals, Managing System Design. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
OBJECT DESIGN, IMPLEMENTATION AND TESTING : Object design-Reusing pattern solutions: An Overview of Object Design, Reuse Concepts: Design Patterns, Reuse Activities, Managing Reuse, **Object design-Specifying interface:** An overview of interface specification, Interfaces Specification Concepts, Interfaces Specification Activities, Managing Object Design, **Mapping model to code**: Mapping Models to Code Overview, Mapping Concepts, Mapping Activities, Managing Implementation, Testing: An overview of testing, Testing concepts, Managing testing. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
SOFTWARE MAINTENANCE AND SOFTWARE CONFIGURATION MANAGEMENT: Software maintenance: What is Software Maintenance?, Factors that Mandate Change, Lehman's Laws of system evolution, Types of software maintenance, Software maintenance process and actives, Reverse Engineering, Software Re-engineering, Patterns for Software Maintenance, Tool support for Software Maintenance**. Software**	**10 Hours**

Configuration Management: The baseline of Software Life Cycle, What is Software Configuration Management, Why Software Configuration Management, Software Configuration Management Functions, Software Configuration Management Tools. **RBT:L1, L2, L3**	

Course Outcomes

The students should be able to:

- Apply Object Oriented Software Engineering approach in every aspect of software project
- Analyze the requirements from various domains
- Adapt appropriate object oriented design aspects in the development process
- Implement and test the software projects using object oriented approach
- Learn the issues and concepts relating to maintenance of software projects
- Adapt the concepts and tools related to software configuration management

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, Pearson Education, 3rd edition, 2014.
2. David C. Kung, "Object oriented software engineering", Tata McGraw Hill,2015

Reference Books:

1. Stephan R. Schach, "Object oriented software engineering", Tata McGraw Hill,2008
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

SERVICE ORIENTED ARCHITECTURE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SIT153 / **18SSE14**	IA Marks	20
Number of Contact Hours/Week	04	Exam Marks	80
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Interpret various architecture for application development
- Demonstrate the importance of SOA in Application Integration
- To learn web service and SOA related tools
- To Learn implementation details of SOA
- To understand varies case studies

Module 1	**Contact Hours**
SOA BASICS :Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
SOA GOVERNANCE:SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software s a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
SOA IMPLEMENTATION:SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB Data binding. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
APPLICATION INTEGRATION:JAX –WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends. **RBT:L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Compare different IT architecture
- Analyze and design of SOA based applications

- Implement web service and realize of SOA
- Implement REST full services
- Design and implement of SOA based Application Integration using BPEL

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service–Oriented Architecture for Enterprise Applications",Wiley 2008.

Reference Books:

1. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.
2. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

ADVANCES IN DATA BASE MANAGEMENT SYSTEMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SCE252 / 18SCS13 / 18SIT14 / **18SSE151**	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define parallel and distributed databases and its applications.
- Show applications of Object Oriented database
- Explain basic concepts, principles of intelligent databases.
- Utilize the advanced topics of data warehousing and mining .
- Infer emerging and advanced data models
- Extend knowledge in research topics of databases.

Module 1	**Teaching Hours**
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. **Object and Object-Relational Databases:** Overview of Object Database Concepts, Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard. **RBT:L1, L2**	**10 Hours**
Module 2	
Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures: Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files) , Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures. **Distributed Database Concepts:** Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases,Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems , Distributed Database Architectures, Distributed Catalog Management. **RBT:L1, L2**	**10 Hours**
Module 3	
NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. **Big Data Technologies Based on MapReduce and Hadoop:** What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General	**10 Hours**

Discussion **RBT:L1, L2, L3**	
Module 4	
Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases: Active Database Concepts and Triggers, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Introduction to Deductive Databases. **Introduction to Information Retrieval and Web Search:** Information Retrieval (IR) Concepts, Retrieval Models, Types of Queries in IR Systems, Text Preprocessing, Inverted Indexing, Evaluation Measures of Search Relevance, Web Search and Analysis. Trends in Information Retrieval **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Data Mining Concepts: Overview of Data Mining Technology, Association Rules, Classification, Clustering, Approaches to Other Data Mining Problems, Applications of Data Mining, Commercial Data Mining Tools **Overview of Data Warehousing and OLAP:** Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Difficulties of Implementing Data Warehouses. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Select the appropriate high performance database like parallel and distributed database • Infer and represent the real world data using object oriented database • Interpret rule set in the database to implement data warehousing of mining • Discover and design database for recent applications database for better interoperability	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013. 2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.	
Reference Books: 1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.	

DISTRIBUTED OPERATING SYSTEM
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SCE152 / 18SIT154 / **18SSE152**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain distributed systems principles associated with communication, naming, synchronization, distributed file systems, system design, distributed scheduling, and several case studies
- Extend foundational concepts and as well as practical deployments.
- Recall distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- Explain the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols

Module 1	**Contact Hours**
Fundamentals: What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE). **Message Passing:** Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Distributed Shared Memory: Introduction, General Architecture of DSM Systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. **Synchronization:** Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Resource Management: Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach **Process Management:** Introductjion, Process Migration, Threads. **RBT:L1, L2, L3**	**10 Hours**

Module 5	
Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • The concepts underlying distributed systems • Demonstrate an ability to apply theory and techniques to unseen problems. • Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system • Explore the various resource management techniques for distributed systems.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.	
Reference Books: 1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.	

ADVANCES IN STORAGE AREA NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI243 / 18SCE323 / 18SCN241 / 18SCS241 / 18SIT253 / **18SSE153**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and contrast storage centric and server centric systems
- Define metrics used for Designing storage area networks
- Illustrate RAID concepts
- Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

Module 1	**Contact Hours**
Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized	**10 Hours**

Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary **RBT:L1, L2, L3**	

Course Outcomes

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize strong virtualization concepts
- Develop techniques for evaluating policies for LUN masking, file systems

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

WEB SERVICES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI242 / 18SIT21 / **18SSE154**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and explain Web Services.
- Summarize WSDL Web Services.
- Analyze Web service Architecture.
- Explain Building Blocks of Web services.

Module 1	**Contact Hours**
Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Web Services: Web Services Technologies, Web Services Architecture. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example. **RBT:L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to

answer 5 full questions, selecting one full question from each module.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Reference Books:

NIL

SOFTWARE TESTING AND DATA BASE MANAGEMENT SYSTEMS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**18SSEL16**	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Apply Software Testing for various applications.
- Demonstrate use of various tools which can be used for automating the testing process and evaluate it.
- Examine various software quality standards for establishing quality environment
- Analyze and infer advanced databases and its applications.
- Examine Storage, Retrieval, Multi valued attributes, Triggers and other complex objects, Algorithms etc related to ADBMS.
- Evaluate recent applications database for better interoperability

PART – A Software Testing LABORATORY WORK

1. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.

2. Design, develop, code and run the program in any suitable language to solve the NextDate problem. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.

3. Design, develop, code and run the program in any suitable object-oriented language to solve the calendar problem. Analyze it from the perspective of OO testing, derive test cases to test the method that increment the date and the method that increments the month., execute these test cases and discuss the test results.

4. Design, develop, code and run the program in any suitable object-oriented language to solve the currency converter problem. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases, execute these test cases and discuss the test results.

5. Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

6. Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute

these test cases and discuss the test results

PART – B ADBMS LABORATORY WORK

Note: The following experiments may be implemented on MySQL/ORACLE or any other suitable RDBMS with support for Object features

1. **Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.**
   a. Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter.
   b. Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.

2. **Develop a database application to demonstrate the representation of multi valued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.**

   Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach.
   a. Show how to implement the schema -- Implementing the Application under the Relational Model -- using only Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views

3. **Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each subject for which he/she has enrolled and Internal Assessment Using TRIGGERS, write active rules to do the following:**
   a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
   b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

Use the following guidelines when designing triggers:

- Use triggers to guarantee that when a specific operation is performed, related actions are performed.
- Use database triggers only for centralized, global operations that should be fired for the triggering statement, regardless of which user or database application issues the statement.
- Do not define triggers that duplicate the functionality already built into Oracle. For example, do not define triggers to enforce data integrity rules that can be easily enforced using declarative integrity constraints.
- Limit the size of triggers (60 lines or fewer is a good guideline). If the logic for your trigger requires much more than 60 lines of PL/SQL code, it is better to include most of the code in a stored procedure, and call the procedure from the trigger.
- Be careful not to create recursive triggers. For example, creating an AFTER UPDATE statement

trigger on the EMP table that itself issues an UPDATE statement on EMP causes the trigger to fire recursively until it has run out of memory.

1. **Design, develop, and execute a program to implement specific Apriori algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.**

   Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk."

Course Outcomes

The students should be able to:

- Assess Software Testing and ADBMS at the practical level
- Compare and pick out the right type of software testing process for any given real world problem
- Experiment software testing process in efficient way
- Determine a quality environment as specified in standards for developing quality software
- Examine real world data using object oriented database
- Choose, design and implement recent applications database for better interoperability

Conduction of Practical Examination:

All laboratory experiments are to be included for practical examination.
Students are allowed to pick one experiment from **each part and execute both**
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

SOFTWARE PROJECT PLANNING AND MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - II

Subject Code	**18SSE21**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and highlight importance of software project management.
- Formulate strategy in managing projects
- Estimate the cost associated with a project
- Plan, schedule and monitor projects for the risk management
- Define the software management metrics

Module -1	**Contact Hours**
Metrics: Introduction, The Metrics Roadmap, A Typical Metrics Strategy, What Should you Measure?, Set Targets and track Them, Understanding and Trying to minimize variability, Act on data, People and Organizational issues in Metrics Programs, Common Pitfalls to watch out for in Metrics Programs, Matrices implementation checklists and tools, Software configuration management: Introduction, Some Basic Definitions and terminology, the processes and activities of software configuration management, configuration status accounting, configuration audit, software configuration management in geographically distributed teams, Metrics in software configuration management, software configuration management tools and automation. **RBT:L1, L2**	**10Hours**
Module -2	
Risk Management: Introduction, What is risk management and why is it important?, Risk management cycle, Risk identification: common tools and techniques, Risk Quantifications, Risk Monitoring, Risk Mitigation, Risks and Mitigation in the context of global project teams, some practical techniques risk management, Metrics in risk management. Project Planning and Tracking: Components of Project Planning and Tracking, The "What " Part of a Project Plan, The "What Cost " Part of a Project Plan, The "When " Part of Project Planning, The "How " Part of a Project Planning: Tailoring of Organizational Processes For the Project, The " By Whom " Part of the Project Management Plan : Assigning Resources, Putting it all together : The Software Management Plan, Activities Specific to Project Tracking, Interfaces to the Process Database. Project Closure: When Does Project Closure Happen?. Why Should We Explicitly do a Closure?, An Effective Closure Process, Issues that Get Discussed During Closure, Metrics for Project Closure, Interfaces to the Process Database. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Software Requirements gathering: Inputs and start criteria for requirements gathering, Dimensions of requirements gathering, Steps to be followed during requirements gathering, outputs and quality records from the requirements phase, skill sets required during requirements phase, differences for a shrink-wrapped software, challenges during the requirements management phase, Metrics for requirements phase. Estimation: What is Estimation? when and why is Estimation done?, the three phases of Estimation, Estimation methodology, formal models for size Estimation, Translating size Estimate into effort	**10 Hours**

Estimate, Translating effort Estimates into schedule Estimate, common challenges during Estimation , Metrics for the Estimation processes. Design and Development Phases: Some differences in our chosen approach, salient features of design, evolving an architecture/ blueprint, design for reusability, technology choices/ constraints, design to standards, design for portability, user interface issues, design for testability, design for diagnose ability, design for maintainability, design for install ability, inter-operability design, challenges during design and development phases, skill sets for design and development, metrics for design and development phases. **RBT:L1, L2, L3**	
Module-4	
Project management in the testing phase: Introduction, What is testing?, what are the activities that makeup testing?, test scheduling and types of tests, people issues in testing, management structures for testing in global teams, metrics for testing phase. Project management in the Maintenance Phase: Introduction, Activities during Maintenance Phase, management issues during Maintenance Phase, Configuration management during Maintenance Phase, skill sets for people in the maintenance phase, estimating size, effort, and people resources for the maintenance phase, advantages of using geographically distributed teams for the maintenance phase, metrics for the maintenance phase. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Globalization issues in project management: Evolution of globalization, challenges in building global teams, Models for the execution of global projects, some effective management techniques for managing global teams. Impact of the internet on project management: Introduction, the effect of internet on project management, managing projects for the internet, Effect on the project management activities. People focused process models: Growing emphasis on people centric models, people capability maturity model(P-CMM), other people focused models in the literature, how does an organization choose the models to use? **RBT:L1, L2, L3**	**10 Hours**
Course outcomes:	
At the end of this course students will be able to: • Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities • Apply risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales • Identify the resources required for a project and to produce a work plan and resource schedule • Monitor the progress of a project and to assess the risk of slippage, revising targets counteract drift • Use appropriate metrics to management the software development outcome • Develop research methods and techniques appropriate to defining, planning and carrying out a research project within your chosen specialist area within the management of software projects.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Ramesh Gopalaswamy: "Managing Global Projects ", Tata McGraw Hill, 2013.	
Reference Books: 1. Watts Humphrey, "Managing the Software Process ", Pearson Education, New Delhi, 2000	

2. Pankaj Jalote, “Software Project Management in practice”, Pearson Education, New Delhi, 2002.

ENTERPRISE APPLICATION PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18SFC253 / 18SIT12 / **18SSE22**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain Web Application Development and related terminologies
- Demonstrate persistent framework and other ORM tools.
- Illustrate solutions using Design Patterns
- Outline latest WEB frameworks

Module 1	**Contact Hours**
Web application and java EE 6: Exploring the HTTP Protocol, Introducing web applications, describing web containers, exploring web architecture models, exploring the MVC architecture. **Working with servlets 3.0** Exploring the features of java servlet, Exploring new features in servlet 3.0, Exploring the servlet API, explaining the servlet life cycle, creating a sample servlet, creating a servlet by using annotation, working with servlet config and servlet context objects, working with the HTTP servlet request and HTTP servlet response interfaces, Exploring request delegation and request scope, implementing servlet collaboration. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Handling sessions in servlet 3.0: Describing a session, introducing session tracking, Exploring the session tracking, mechanisms, using the java servlet API for session tracking, creating login application using session tracking. **Implementing event handling** Introducing events, Introducing event handling, working with the servlet events, developing the online shop web application. **Working with java server pages:** Introducing JSP technology, Exploring new features of JSP2.1, listing advantages of JSP over java servlet, Exploring the architecture of a JSP page, Describing the life cycle of a JSP page, working with JSP basic tags and implicit objects, working with the action tags in JSP, exploring the JSP unified EL, using functions with EL. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Implementing JSP tag extensions: Exploring the elements of tag extensions, Working with classic tag handlers, Exploring the tag extensions, Working with simple tag handlers. **Implementing java server pages standard tag library 1.2:** Introducing JSTL, Exploring the tag libraries JSTL, working with the core tag library. **Implementing filters:** Exploring the need of filters, exploring the working of filters, exploring filters API, configuring a filter, creating a web application using filters, using initializing parameter in filters. **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Persistence Management and Design Patterns: Implementing java persistence using hibernate Introducing hibernate, exploring the architecture of hibernate, downloading hibernate, exploring HQL, understanding hibernate O/R mapping, working with hibernate, Implementing O/R mapping with hibernate. **Java EE design patterns:** Describing the java EE application architecture, Introducing a design patterns, discussing the role of design	**10 Hours**

patterns, exploring types of patterns. **RBT:L1, L2, L3**	
Module 5	
Web Frameworks: Working with struts 2 Introducing struts 2, understanding actions in struts 2.**Working with java server faces 2.0:** Introducing JSF, Explaining the features of JSF, Exploring the JSF architecture, describing JSF elements, Exploring the JSF request processing life cycle. **Working with spring 3.0:** Introducing features of the spring framework, exploring the spring framework architecture, exploring dependency injection & inversion of control, exploring AOP with spring, managing transactions. **Securing java EE 6 applications:** Introducing security in java EE 6, exploring security mechanisms, implementing security on an application server. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Explain WEB basics and their functionalities • Develop JAVA support and API skills • Build a WEB application. • Build Security mechanisms	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Kogent learning solution: JAVA SERVER PROGRAMMING JAVA EE6(J2EE 1.6), Dreamtech press 2014	
Reference Books: 1. **NIL**	

SOFTWARE DESIGN PATTERNS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - II

Subject Code	**18SSE23**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Develop functionality to designs while minimizing complexity.
- What code qualities are required to maintain to keep code flexible?
- Categorize the common design patterns.

Module -1	**Contact Hours**
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm **RBT:L1, L2, L3**	**10Hours**
Module -2	
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

The student should be able to

- Design and implement codes with higher performance and lower complexity
- Discover code qualities needed to keep code flexible
- Assess the quality of a design with respect to these principles.
- Apply principles in the design of object oriented systems.
- Demonstrate an understanding of a range of design patterns.
- Comprehending a design presented using this vocabulary.

- Select and apply suitable patterns in specific contexts

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013.
2. Design patterns, Erich Gamma, Richard Helan, Ralph Johman , John Vlissides, PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert “Pattern Oriented Software Architecture” – Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

DATA MINING & DATA WAREHOUSING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18SCE154 / 18SCS244 / 18SFC251 / 18SIT23 / **18SSE241**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define Data warehousing Architecture and Implementation
- Explain Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
- Interpret association rule mining for handling large data
- Classification for the retrieval purposes
- Explain clustering techniques in details for better organization and retrieval of data

Module -1	**Contact Hours**
Introduction and Data Preprocessing :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining .Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization. **RBT:L1, L2**	**10 Hours**
Module -2	
Data warehousing and online analytical processing: Data warehousing: Basic concepts, Data warehouse modeling: Data cube and OLAP, Data warehouse design and usage, Data warehouse implementation, Data generalization by attribute-oriented induction, **RBT:L1, L2**	**10 Hours**
Module – 3	
Classification: Basic Concepts: Basic Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Cluster Analysis: Basic concepts and methods: Cluster Analysis, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods, Evaluation of clustering. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Data mining trends and research frontiers: Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

The students shall able to:

- Demonstrate Storing voluminous data for online processing, Preprocess the data for mining applications
- Apply the association rules for mining the data

- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data
- Discover the knowledge imbibed in the high dimensional system

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining Concepts and Techniques, ELSEVIER(MK) 3rd edition 2012.

Reference Books: NIL

SOFTWARE METRICS AND QUALITY ASSURANCE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18SFC334 / 18SIT243 / **18SSE242**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define metrics, measurement theory and related Terminologies
- Assess the quality level of internal and external attributes of the software product
- Explain of software reliability and to illustrate how to perform planning, executing and testing for software reliability
- Evaluate various metrics and models of software reliability
- Compare various models of software reliability based on its application

Module -1	**Contact Hours**
What Is Software Quality: Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management and Summary. **Fundamentals Of Measurement Theory:** Definition, Operational Definition, And Measurement, Level Of Measurement, Some Basic Measures, Reliability And Validity, Measurement Errors, Be Careful With Correlation, Criteria For Causality, Summary. **Software Quality Metrics Overview:** Product Quality Metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples For Metrics Programs, Collecting Software Engineering Data. **RBT:L1, L2, L3**	**10Hours**
Module -2	
Applying The Seven Basic Quality Tools In Software Development : Ishikawa's Seven Basic Tools, Checklist, Pareo Diagram, Histogram, Run Charts , Scatter Diagram, Control Chart, Cause And Effect Diagram. **The Rayleigh Model:** Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Complexity Metrics And Models: Lines Of Code, Halstead's Software Science , Cyclomatic Complexity Syntactic Metrics, An Example Of Module Design Metrics In Practice .**Metric And Lessons Learned For Object Oriented Projects:** Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object oriented Projects. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Availability Metrics: Definition And Measurement Of System Availability, Reliability Availability And Defect Rate, Collecting Customer Outage Data For Quality Improvement, In Process Metrics For Outage And Availability .**Conducting Software Project Assessment :**Audit Ad Assessment , Software Process Maturity Assessment And Software Project Assessment , Software Process Assessment A Proponed Software Project Assessment Method. **RBT:L1, L2, L3**	**10 Hours**

Module-5	
Dos And Don'ts Of Software Process Improvement : Measuring Process Maturity, Measuring Process Capability, Staged Versus Continuous Debating Religion, Measuring Levels Is Not Enough, Establishing The Alignment Principle , Take Time Getting Faster, Keep it Simple Or Face Decomplexification, Measuring The Value Of Process Improvement , Measuring Process Compliance , Celebrate The Journey Not Just The Destination. **Using Function Point Metrics to Measure Software Process Improvement: Software** Process Improvement Sequences, Process Improvement Economies, Measuring Process Improvement at Activity Levels **RBT:L1, L2, L3**	**10 Hours**
Course outcomes:	
Upon completion of the course, students shall be able to • Identify and apply various software metrics, which determines the quality level of software • Identify and evaluate the quality level of internal and external attributes of the software product • Compare and Pick out the right reliability model for evaluating the software • Evaluate the reliability of any given software product • Design new metrics and reliability models for evaluating the quality level of the software based on the requirement	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Stephen H Khan: Metrics and Models in Software Quality Engineering, Pearson 2nd edition 2013.	
Reference Books: 1. Norman E-Fentor and Share Lawrence Pflieger." Software Metrics". International Thomson Computer Press, 1997. 2. S.A.Kelkar,"Software quality and Testing, PHI Learing, Pvt, Ltd., New Delhi 2012. 3. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc, 2008. 4. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education(Singapore) Pte Ltd, 2003 5. Philip B Crosby, " Quality is Free: The Art of Making Quality Certain ", Mass Market, 1992.	

INFORMATION RETRIEVAL
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	**18SSE243**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define Information Retrieval with pertinence to modeling, query operations and indexing
- Explain machine learning techniques for text classification and clustering
- Contrast various applications of Information Retrieval giving emphasis to Multimedia IR, Web Search
- Interpret the concepts of queries specification judgment and search engines

Module -1	**Contact Hours**
Introduction: Motivation, Basic concepts, Past, present, and future, The retrieval process. **Modeling: Introduction, A taxonomy of information retrieval models, Retrieval:** Adhoc and filtering, A formal characterization of IR models, Classic information retrieval, Alternative set theoretic models, Alternative algebraic models, Alternative probabilistic models, Structured text retrieval models, Models for browsing. **RBT:L1, L2, L3**	**10 Hours**
Module -2	
Retrieval Evaluation: Introduction, Retrieval performance evaluation, Reference collections. **Query Languages:** Introduction, keyword-based querying, Pattern matching, Structural queries, Query protocols. **Query Operations:** Introduction, User relevance feedback, Automatic local analysis, Automatic global analysis. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Text and Multimedia Languages and Properties: Introduction, Metadata, Text, Markup languages, Multimedia. **Text Operations:** Introduction, Document preprocessing, Document clustering, Text compression, Comparing text compression techniques. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
User Interfaces and Visualization: Introduction, Human-Computer interaction, The information access process, Starting pints, Query specification, Context, Using relevance judgments, Interface support for the search process. **Searching the Web:** Introduction, Challenges, Characterizing the web, Search engines, Browsing, Meta searchers, Finding the needle in the haystack, Searching using hyperlinks. **RBT:L1, L2, L3**	**10 Hours**
Module-5	

Indexing and Searching: Introduction; Inverted Files; Other indices for text; Boolean queries; Sequential searching; Pattern matching; Structural queries; Compression. **Parallel and Distributed IR:** Introduction, Parallel IR, Distributed IR. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

- Upon completion of the course, the students will be able to
- Build an Information Retrieval system using the available tools
- Identify and design the various components of an Information Retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
- Analyze the Web content structure
- Design an efficient search engine

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson, 1999.

Reference Books:

1. David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2004

ADVANCED ALGORITHMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18SCS22/ **18SSE244**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define the graph search algorithms.
- Explain network flow and linear programming problems.
- Interpret hill climbing and dynamic programming design techniques.
- Develop recursive backtracking algorithms.
- Define NP completeness and randomized algorithms

Module -1	**Contact Hours**
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods. **RBT:L1, L2, L3**	**10Hours**
Module -2	
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization **RBT:L1, L2, L3**	**10 Hours**
Module-4	
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

CLOUD COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI151 / 18SCE14 / 18SCN31 / 18SCS23 / 18SIT22 **/ 18SSE251**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and Cloud, models and Services.
- Compare and contrast programming for cloud and their applications
- Explain virtuaization, Task Scheduling algorithms.
- Apply ZooKeeper, Map-Reduce concept to applications.

Module 1	**Contact Hours**
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing. **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.	**10 Hours**

RBT:L1, L2, L3	
Module 5	
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Compare the strengths and limitations of cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Apply suitable virtualization concept. • Choose the appropriate cloud player • Address the core issues of cloud computing such as security, privacy and interoperability • Design Cloud Services • Set a private cloud	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.	
Reference Books: 1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. 2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.	

SOFTWARE AGENTS **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2018 -2019)** **SEMESTER - II**			
Subject Code	18LNI252 / **18SSE252**	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to • Explain the principles and fundamentals of designing agents			

• Define the architecture design of different agents. • Demonstrate design of the agents • Illustrate user interaction with agents • Discover the role of agents in assisting the users in day to day activities	
Module -1	**Teaching Hours**
An introduction to Software Agents Why Software Agents? Simplifying Computing, Barriers to Intelligent Interoperability, Incorporating Agents as Resource Managers, Overcoming user Interface Problems, Toward Agent-Enabled System Architectures. Agents: From Direct Manipulation to Delegation Introduction, Intelligent Interfaces, Digital Butlers, Personal Filters, Digital sisters-in-Law, Artificial Intelligence, Decentralization, Why Linking works, The Theatrical Metaphor, Conclusion: Direct Manipulation and Digital Butlers, Acknowledgements. Interfaces Agents Metaphors with Character Introduction, Objections to Agents, In Defense of Anthropomorphism, Key Characteristics of Interface Agents, Agency, Responsiveness, Competence, Accessibility, Design and Dramatic Character, An R & D Agenda **RBT:L1, L2, L3**	**10 Hours**
Module -2	
Designing Agents as if People Mattered: What does "Agents" Mean?, Adaptive Functionality: Three Design Issues, The Agent Metaphor: Reactions and Expectations The Agent Conceptual Model. Direct Manipulation versus Agents: Paths to Predict able, Controllable, and Comprehensible Interfaces: Introduction, General Concerns About Intelligent Interfaces, Learning From History, What Is an Agent?, Looking at the Components, Realizing a New Vision, Tree Maps, Dynamic Queries, Back to a Scientific Approach, Acknowledgements. Agents for Information Sharing and Coordination: A History and some Reflections: Information, Lens: An Intelligent Tool for Managing Electronic Messages, Semiformal Systems an d Radical Tailorability, Oval: A Radically Tailorable Tool for Information Management and Cooperative Work, Examples of Application and Agents in Oval, Conclusions: An Addendum: The Relationship between Oval and Objects Lens **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Agents that Reduce Work and Information Overload Introduction, Approaches to Building Agents, Training a Personal Digital Assistant, Some Example of Existing Agents, Electronic Mail Agents, Meeting Scheduling Agent, News Filtering Agent, Entertainment Selection Agent, Discussion, Acknowledgements Software Agents for Cooperative Learning: Computer-Supported Cooperative Learning, Examples of Software Agents for Cooperative Learning, Examples of Software Agents for Cooperative Learning, Developing an Example, Discussion and Perspectives. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
An Overview of Agent-Oriented Programming: Agent-Oriented Programming: Software with Mental State, Two Scenarios, On the Mental state of agents, Generic Agent Interpreter, AGENT-0: A Simple Language and its Interpreter, KQML as an Agent Communication Language: The approach of knowledge sharing effort(KSE), The Solution of the knowledge sharing efforts, knowledge Query Manipulation Language (KQML),Implementation, Application of KQML , Other Communication Language, The Approach of Knowledge-Sharing Effect,(KSE),The Solutions of the Sharing Effect. **RBT:L1, L2, L3**	**10 Hours**

Module-5	
Agent for Information Gathering: Agent Organization, The Knowledge of an Agent, The Domain Model of an Agent, Modeling other Agent, communication language and protocol, query processing, an information goal, information source selection, generating a query access plan, interleaving planning and execution , semantic query optimization, learning, caching retrieved data, related work, discursion, acknowledgement. Mobile Agents: Enabling Mobile Agents, Programming Mobile Agents, Using Mobile Agents. **RBT:L1, L2, L3**	**10 Hours**
Course outcomes:	
The students should be able to: • Identify and explore the advantages of agents and design the architecture for an agent • Analyze the agent in details in a view for the implementation • Analyze communicative actions with agents. • Analyze typical agents using a tool for different types of applications.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Jeffrey M. Bradshaw: Software Agents, PHI (MIT Press) 2012.	
Reference Books: 1. Lin Padgham and Michael Winikoff, "Developing In telligent Agent Systems: A Practical Guide", John Wiley & sons Publication, 2004. 2. Steven F. RailsBack and Volker Grimm, "Agent-Based and Individual Based modeling: A Practical Introduction", Princeton University Press, 2012. 3. Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002. 4. Frank Y. Shih, "Multimedia Secuirty, Watermarking, Steganography and Forensics", CRC Press	

TRUST MANAGEMENT IN E-COMMERCE **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2018 -2019)** **SEMESTER – II**			
Subject Code	18SFC244 / 18SSE253 / **18SSE253**	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
CREDITS – 04			
Course objectives: This course will enable students to			
• Explain fundamental principles of E-Commerce • Illustrate technologies & tools for E-Commerce with emphasis on Security • Identify best techniques & practices for different types of legacy & partner requirements			

• Handle & address risk management	
Module 1	**Teaching Hours**
Introduction to E-Commerce: Network and E-Commerce, Types of E-Commerce. Ecommerce Business Models: B2C, B2B, C2C, P2P and M-commerce business models. Ecommerce Payment systems: Types of payment system, Credit card E-Commerce transactions, B2C E-Commerce Digital payment systems, B2B payment system. **RBT:L1, L2, L3**	**8 Hours**
Module 2	
Security and Encryption: E-Commerce Security Environment, Security threats in Ecommerce environment, Policies, Procedures and Laws. **RBT:L1, L2, L3**	**8 Hours**
Module 3	
Inter-organizational trust in E-Commerce: Need, Trading partner trust, Perceived benefits and risks of E-Commerce, Technology trust mechanism in E-Commerce, Perspectives of organizational, economic and political theories of inter-organizational trust, Conceptual model of inter-organizational trust in E-Commerce participation. **RBT:L1, L2, L3**	**8 Hours**
Module 4	
Introduction to trusted computing platform: Overview, Usage Scenarios, Key components of trusted platform, Trust mechanisms in a trusted platform. **RBT:L1, L2, L3**	**8 Hours**
Module 5	
Trusted platforms for organizations and individuals: Trust models and the E-Commerce domain. **RBT:L1, L2, L3**	**8 Hours**
Course Outcomes	
The students should be able to: • Explain the types of E-Commerce, E-Commerce business models and E-commerce payment systems. • Illustrate the Policies, Procedures and Laws and Security threats in E-Commerce environment. • Analysis and explain the issues, risks and challenges in inter-organisational trust in E-Commerce • Explain the Key components and Trust mechanisms of trusted computing platform. • Describe the Trusted platforms for organizations and individuals	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books 1. Kenneth C. Laudon and Carol Guercio Trave, Study Guide to E-Commerce Business Technology Society, Pearson Education, 2005. 2. Pauline Ratnasingam, Inter-Organizational Trust for Business-to-Business E- Commerce,IRM Press, 2005.	
Reference Books: 1. Siani Pearson, et al, Trusted Computing Platforms: TCPA Technology in Context, Prentice Hall PTR, 2002.	

TRENDS IN ARTIFICIAL INTELLIGENCE AND SOFT COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18SCS252 / 18SIT323 / 18SSE254 / **18SSE254**	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Describe Artificial Intelligence its utility and intelligent agents
- Describe a problem as a state space
- Use and implement search techniques
- Use knowledge representation techniques for problem solving
- Solve AI problems using symbolic reasoning and game theory
- Describe and apply neural networks
- Describe and apply Fuzzy systems to various problem domains
- Describe and apply GA to different problem domains

Module 1	**Teaching Hours**
Role of AI in Engineering, AI in daily life, Intelligence and AI, Different Task Domains of AI, History and Early Works of AI, History of AI, Programming Methods, Limitaions of Ai, Agent, Performance Evaluation, Task environment of an Agent, Agents Classification, Agent Architecture Logic Programming, Logic Representation, Propositional Logic, Predicate Logic and Predicate Calculus, Horn Clauses, Well formd Formula, Computable functions and predicate, Quantifiers, Universe of discourse, Applications of Predicate Logic, Unification,Resolution, Conjuctive Normal Form, conversion to normal form or clausal form **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Fundamental Problem of Logic: Logic Inadequacy: FundamentaProblem of Logic-Monotonicity wuith "Flying Penguin" example, General disadvantage of monotonicity property in logic , logic in search space problem, logic in decidability and Incompleteness, Logic in Uncertainty Modelling, Knowledge representation: Knowledge, Need to represent knowledge, Knowledge representation with mapping scheme, properties of a good knowledge base system, Knowledge representation issues, AND-OR graphs, Types of knowledge, Knowledge representation schemes, , semantic nets, Frames, conceptual graphs, conceptual dependence theory, script, weak and strong slot filler. Reasoning: Types of Reasoning, Methods of reasoning, Application of Reasoning, Forward	**10 Hours**

and Backward Reasoning **RBT:L1, L2, L3**	
Module 3	
Search Techniques: Search, Representation techniques, Categories of Search, Disadvantage of state space search, Issues in design of search programs, General Search examples, Classification of search diagram representation, Hill climbing method and Hill climbing search ,Simulates Annealing, Best-First Search, Branch and Bound Search, A* search Game Playing: Two player games, Minmax Search, Complexity of Minmax algorithm, Alpha-Beta Pruning Planning: Necessity of planning, Components of Planning, Planning Agents, Plan-gererating schemes, Algorithm for planning, Planning Representation with STRIPS, BlOCKS WORLD, difficulties with planning **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Fuzzy Sets and Uncertainties: Fuzzy set and fuzzy logic, set and fuzzy operators, , Extended fuzzy operations, Fuzzy relations, Properties of fuzzy relations, Fuzzy system and design, Linguistic hedges, Syntax for IF and Then rules, , Types of fuzzy rule based system, Fuzzy linguistic controller, Fuzzy Inference, Graphical techniques of Inference, How, Fuzzy logic is used, Fuzzification, De-fuzzification. Unique features of Fuzzy Logic, Application of Fuzzy Logic, Fuzzy logic uncertainty and probability, Advantages and Limitations of Fuzzy logic and Fuzzy Systems **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Advancement of AI: Expert System, Expert System structure, Knowledge acquisition, Knowledge representation, Inference control mechanism, User interface, Expert System Shell, Knowledge Representation, Inference Mechanism, Developer Interface and User Interface, Characteristics of Expert system, Advantages of an expert system, Production System, Artificial Neural Networks, : Characteristics of Neural Networks, Architecture of neural networks, Types of neural networks, Application of neural networks. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms. • Apply AI technique to current applications. • Apply Problem solving, knowledge representation, reasoning, and learning techniques to solve real world problems • Design and build expert systems for various application domains. • Apply Soft Computing techniques such as neural networks, fuzzy logic to solve problems in various application domains	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 3. Anindita Das Battacharjee, Artificial Intelligence and Softcomputing for Beginners, Shroff Publishers, 2nd edition	
Reference Books:	

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms by S. Rajasekaran, G. A. Vijayalakshmi Pai, PHI publication
4. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

SOFT COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	**18SSE31**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain key aspects of soft computing.
- Identify the components and building block hypothesis of Genetic algorithm.
- Analyze Neuro Fuzzy modeling and control.
- Evaluate machine learning through Support vector machines.

Module 1	**Contact Hours**
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model. **RBT:L1, L2**	**10 Hours**
Module 2	
Perceptron Network: Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models). **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions. **RBT:L1, L2, L3**	
Module 4	
Defuzzification: Fuzzy decision making, and applications.	**10 Hours**

RBT:L1, L2, L3	
Module 5	
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications. **RBT:L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Implement machine learning through neural networks. • Design Genetic Algorithm to solve the optimization problem. • Develop a Fuzzy expert system. • Model Neuro Fuzzy system for clustering and classification.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, ISBN 13: 788126527410, 2011	
Reference Books: 1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.	

INTERNET OF THINGS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18LNI22 / 18SCE23 / 18SCN14 / 18SCS14 / **18SSE321**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and explain basic issues, policy and challenges in the IoT
- Illustrate Mechanism and Key Technologies in IoT
- Explain the Standard of the IoT
- Explain resources in the IoT and deploy of resources into business
- Demonstrate data analytics for IoT

Module -1	**Contact Hours**
What is The Internet of Things? Overview and Motivations, Examples of Apllications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation.Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Apjplication Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications. **RBT:L1, L2, L3**	**10 Hours**
Module -2	
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

At the end of this course the students will be able to:

- Develop schemes for the applications of IOT in real time scenarios
- Manage the Internet resources
- Model the Internet of things to business
- Understand the practical knowledge through different case studies
- Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015

Reference Books:

1. Michael Miller,” The Internet of Things”, First Edition, Pearson, 2015.
2. Claire Rowland,Elizabeth Goodman et.al.,” Designing Connected Products”, First Edition,O’Reilly, 2015.

MANAGING BIG DATA
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18LNI251 / 18SCE21 / 18SCN252 / 18SCS21 / 18SFC331 / 18SIT31 / **18SSE322**	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Deal with Big data using Hadoop and SPARK technologies
- Explain basic concepts of Map and Reduce
- Explain basic concepts of Hadoop Distributed File System
- Develop map-reduce analytics using Hadoop and related tools

Module -1	**Teaching Hours**
Meet Hadoop: Data!, Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals MapReduce A Weather Dataset: Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming **The Hadoop Distributed Filesystem** The Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, Hadoop Filesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow: Anatomy of a File Read, Anatomy of a File Write. **RBT:L1, L2, L3**	**10 Hours**
Module -2	
YARN Anatomy of a YARN Application Run: Resource Requests, Application Lifespan, Building YARN Applications, YARN Compared to MapReduce, Scheduling in YARN: The FIFO Scheduler, The Capacity Scheduler, The Fair Scheduler, Delay Scheduling, Dominant Resource Fairness **Hadoop I/O** Data Integrity, Data Integrity in HDFS, LocalFileSystem, ChecksumFileSystem, Compression, Codecs, Compression and Input Splits, Using Compression in MapReduce, Serialization, The Writable Interface, Writable Classes, Implementing a Custom Writable, Serialization Frameworks, File-Based Data Structures: SequenceFile **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Developing a MapReduce Application The Configuration API, Combining Resources, Variable Expansion, Setting Up the Development Environment, Managing Configuration, GenericOptionsParser, Tool, and ToolRunner, Writing a Unit Test with MRUnit: Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Tuning a Job, Profiling Tasks, MapReduce Workflows: Decomposing a Problem into MapReduce Jobs, JobControl,	**10 Hours**

Apache Oozie **How MapReduce Works** Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures: Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort: The Map Side, The Reduce Side, Configuration Tuning, Task Execution: The Task Execution Environment, Speculative Execution, Output Committers **RBT:L1, L2, L3**	
Module-4	
MapReduce Types and Formats: MapReduce Types, Input Formats: Input Splits and Record,s Text Input, Binary Input, Multiple Inputs, Database Input (and Output) Output Formats: Text Output, Binary Output, Multiple Outputs, Lazy Output, Database Output, **Flume** Installing Flume, An Example,Transactions and Reliability, Batching, The HDFS Sink, Partitioning and Interceptors, File Formats, Fan Out, Delivery Guarantees, Replicating and Multiplexing Selectors, Distribution: Agent Tiers, Delivery Guarantees, Sink Groups, Integrating Flume with Applications, Component Catalog **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Pig Installing and Running Pig, Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example: Generating Examples, Comparison with Databases, Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Data Processing Operators: Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data. **Spark** An Example: Spark Applications, Jobs, Stages and Tasks, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution, Executors and Cluster Managers: Spark on YARN **RBT:L1, L2, L3**	**10 Hours**
Course outcomes:	
The students shall able to: • Understand managing big data using Hadoop and SPARK technologies • Explain HDFS and MapReduce concepts • Install, configure, and run Hadoop and HDFS. • Perform map-reduce analytics using Hadoop and related tools • Explain SPARK concepts	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.	
Reference Books: 1. Matei Zaharia and Bill Chambers, SPARK: The Definitive Guide, Oreilly, 2018 2. S. D'Souza and Steve Hoffman, Apache Flume: Distributed Log Collection for Hadoop, Oreilly. 2014	

AGILE TECHNOLOGIES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SCE324 / 18SCS242 / 18SIT331 / **18SSE323**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain iterative, incremental development process leads to faster delivery of more useful software
- Evaluate essence of agile development methods
- Illustrate the principles and practices of extreme programming
- Show the roles of prototyping in the software process
- Explain the Mastering Agility

Module -1	**Contact Hours**
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **RBT:L1, L2, L3**	**10 Hours**
Module -2	
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is	**10 Hours**

for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery **RBT:L1, L2, L3**	

Course outcomes:

Students should be able to

- Define XP Lifecycle, XP Concepts, Adopting XP
- Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Demonstrate concepts to Eliminate Waste

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007.

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002.
2. Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

SUPPLY CHAIN MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SIT321 / **18SSE324**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define Model of SCM.
- Compare and contrast QRM, CPFR.
- Evaluate inventory Models and third party logistics.
- Explain revenue management

Module -1	**Contact Hours**
Introduction to Supply Chain Management : Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing. **RBT:L1, L2, L3**	**10 Hours**
Module -2	
Designing the supply chain network : Designing the distribution network – role of distribution – factors influencing distribution – design options – e-business and its impact – distribution networks in practice – network design in the supply chain – role of network – factors affecting the network design decisions – modeling for supply chain. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
Designing and Planning Transportation Networks.: Role of transportation - modes and their performance - transportation infrastructure and policies - design options and their trade-offs - Tailored transportation. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
Sourcing and Pricing: Sourcing – In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment, selection – design collaboration – procurement process – sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts. **RBT:L1, L2, L3**	**10 Hours**
Module-5	
Information Technology in the supply chain: IT Framework – customer relationship management – internal supply chain management – supplier relationship management – transaction management – future of IT. **RBT:L1, L2, L3**	**10 Hours**

Course outcomes:

The student shall be able to

- Discuss SCM Models,
- Formulate of QRM, CPFR.
- Implement various Inventory Models and third party logistics.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sunil Chopra and Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson/PHI, 3rd Edition, 2007.
2. Coyle, Bardi, Longley, The management of Business Logistics – A supply Chain Perspective, Thomson Press, 2006.
3. Supply Chain Management by Janat Shah Pearson Publication 2008.

Reference Books:

1. Donald J Bowersox, Dand J Closs, M Bixby Coluper, Supply Chain Logistics Management, TMH, Second Edition, 2008.
2. Wisner, Keong Leong and Keah-Choon Tan, Principles of Supply Chain Management A Balanced Approach, Thomson Press, 2005.
3. David Simchi-Levi et al, Designing and Managing the Supply Chain – Concepts, ISBN-13: 978-0072357561

WEB MINING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SCN334 / **18SSC331**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Compare and contrast different knowledge discovery issues in Web mining.
- Analyze the different algorithms commonly used by Web application.
- Apply the role played by Web mining in Information retrieval and extraction
- Demonstrate the documents structures and grouping,
- Use the probabilistic model for web mining
- Illustrate applications using Web mining

Module -1	**Contact Hours**
INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining . **INFRASTRUCTURE and WEB SEARCH** -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search. **RBT:L1, L2, L3**	**8 Hours**
Module -2	
INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction **RBT:L1, L2, L3**	**8 Hours**
Module – 3	
LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding's – Probabilistic Approaches to clustering – Collaborative Filtering, **SUPERVISED LEARNING**: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection. **RBT:L1, L2, L3**	**8 Hours**
Module-4	
LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, **SEMI SUPERVISEDLEARNING**-- Expectation Maximization, Labeling Hypertext Graphs and Co- training.	**8 Hours**

RBT:L1, L2, L3	
Module-5	
APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining. **RBT:L1, L2, L3**	**8 Hours**
Course outcomes:	
At the end of the course the student should be able to: • Identify the application areas for web content mining, web structure mining and webusage mining. • Design to retrieval the web data • Develop schemes to crawl the web data, organize and index • Cluster the documents for fast access • Develop algorithms used by web mining applications. • Select between different approaches and techniques of web mining	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Sholom Weiss, "Text Mining: Predictive Methods for Analyzing Unstructured Information", Springer, 2005 2. Soumen Chakrabarti, "Mining the Web: Discovery Knowledge from Hypertext Data," Elsevier Science 2003	
Reference Books: 1. Min Song, Yi-fang Brrok Wu, "Handbook of Research on Text and Web Mining Technologies", Vol I & II, Information Science Reference (IGI), 2009 2. K.P.Soman, ShyamDiwakar, V.Ajay, "Insight into Data Mining Theory and Practice ," Prentice Hall of India Private Ltd 2006 3. Anthony Scime, "Web Mining Applications and Techniques", Idea Group Publishing,2005 4. Margret H.Dunham "DATA MINING - Introductory and Advanced Concepts", PearsonEducation,2003.	

ADVANCES IN OPERATING SYSTEMS **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2018 -2019)** **SEMESTER – III**			
Subject Code	18SCS12 / **18SSE332**	IA Marks	40

Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define the fundamentals of Operating Systems.
- Explain distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- Illustrate distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- Identify the components and management aspects of Real time, Mobile operating Systems

Module 1	**Teaching Hours**
Operating System Overview, Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues. **RBT:L1, L2, L3**	**10 Hours**
Module 2	
Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management, Summary **RBT:L1, L2, L3**	**10 Hours**
Module 3	
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock **RBT:L1, L2, L3**	**10 Hours**
Module 4	
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits. **RBT:L1, L2, L3**	**10 Hours**
Module 5	
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management,Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management. The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization,Traps,Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager Kernel local procedure calls and IPC, The native API, subsystems. **RBT:L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of

Distributed operating system

- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating system
- Modify existing open source kernels in terms of functionality or features used

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

DATABASE SECURITY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SCE332 / 18SFC252 / **18SSE333**	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS – 04

Course objectives: This course will enable students to

- Fundamental security concepts and architectures that serve as building blocks to database security
- Concepts of user account management and administration, including security risks
- To use current database management system to design and configure the user and data permissions
- Operational components necessary to maximize database security using various security models

Module 1	**Teaching Hours**
Introduction: Introduction to Databases, Security Problems in Databases Security Controls Conclusions. Security Models 1: Introduction, Access Matrix Model, Take-Grant Model, Acten Model, PN Model, Hartson and Hsiao's Model, Fernandez's Model, Bussolati and Martella's Model for Distributed databases. **RBT:L1, L2, L3**	**8 Hours**

Module 2

Security Models 2: Bell and LaPadula's Model, Biba's Model, Dion's Model, Sea View Model, Jajodia and Sandhu's Model, The Lattice Model for the Flow Control conclusion. Security Mechanisms: Introduction, User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms, Isolation, Security Functionalities in Some Operating Systems, Trusted Computer System, Evaluation Criteria. **RBT:L1, L2, L3**	**8 Hours**
Module 3	
Security Software Design: Introduction, A Methodological Approach to Security, Software Design, Secure Operating System Design, Secure DBMS Design, Security Packages, Database Security Design. **RBT:L1, L2, L3**	**8 Hours**
Module 4	
Statistical Database Protection & Intrusion Detection Systems: Introduction, Statistics, Concepts and Definitions, Types of Attacks, Inference Controls, evaluation Criteria for Control Comparison, Introduction IDES System, RETISS System, ASES System Discovery. **RBT:L1, L2, L3**	**8 Hours**
Module 5	
Models For The Protection Of New Generation Database Systems 1: Introduction, A Model for the Protection of Frame Based Systems, A Model for the Protection of Object-Oriented Systems, SORION Model for the Protection of Object-Oriented Databases. Models For The Protection Of New Generation Database Systems 2: A Model for the Protection of New Generation Database Systems, the Orion Model, Jajodia and Kogan's Model, A Model for the Protection of Active Databases Conclusions. **RBT:L1, L2, L3**	**8 Hours**
Course Outcomes	
The students should be able to: • Carry out a risk analysis for a large database • Implement identification and authentication procedures, fine-grained access control and data encryption techniques • Set up accounts with privileges and roles • Audit accounts and the database system	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books 1. Database Security and Auditing, Hassan A. Afyoun i, India Edition, CENGAGE Learning, 2009. 2. Database Security, Castano, Second edition, Pearson Education.	
Reference Books: 1. Database security by Alfred Basta, Melissa Zgola , CENGAGE learning..	

MACHINE LEARNING TECHNIQUES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	18LNI322 / 18SCE321 / 18SCN324 / 18SCS31 / 18SFC254 / 18SIT322 / **18SSE334**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain basic concepts of learning and decision trees.
- Compare and contrast neural networks and genetic algorithms
- Apply the Bayesian techniques and instant based learning
- Examine analytical learning and reinforced learning

Module -1	**Contact Hours**
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search **RBT:L1, L2, L3**	**10Hours**
Module -2	
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **RBT:L1, L2, L3**	**10 Hours**
Module – 3	
BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **RBT:L1, L2, L3**	**10 Hours**
Module-4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **RBT:L1, L2, L3**	**10 Hours**
Module-5	
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **RBT:L1, L2, L3**	**10 Hours**
Course outcomes:	
On Completion of the course, the students will be able to	

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.