**JSS MAHAVIDYAPEETHA**
**JSS SCIENCE & TECHNOLOGY UNIVERSITY**

## Sri Jayachamarajendra College of Engineering
## Mysuru-570006.

**Department of Information Science & Engineering**

# Master of Technology
## In
## Software Engineering

## SCHEME & SYLLABUS

**I to IV semesters**

**2017-2018**

# Scheme of Teaching and Examination

## MTech in Software Engineering

### First Semester MTech (SE) 2017-2018

| SL. No. | Subject Code | Course Title | Teaching Department | Credits | | | | Contact Hours | Marks | | | Exam Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| 1. | SSE110 | Software Project Planning and Management | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 2. | SSE120 | Formal Methods in Software Engineering | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 3. | SSE130 | Machine Learning | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4a. | SSE141 | Distributed Computing | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4b. | SSE142 | Multimedia Computing | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4c. | SSE143 | Advanced Algorithms | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5a. | SSE151 | Numerical Linear Algebra | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5b. | SSE152 | Web Services | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5c. | SSE153 | Cyber Security | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 6. | SSE160 | Minor Project – I | IS&E | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - |
| 7. | SSE170 | Seminar – I | IS&E | 0 | 1.5 | 0 | 1.5 | 3 | 50 | - | 50 | - |
| Total | | | | 20 | 3.5 | 4.5 | 28 | 36 | 350 | 250 | 600 | - |

# Scheme of Teaching and Examination

## MTech in Software Engineering

### Second Semester MTech (SE) 2017-2018

| SL. No. | Subject Code | Course Title | Teaching Department | Credits | | | | Contact Hours | Marks | | | Exam Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| 1. | SSE210 | Software Quality Assurance | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 2. | SSE220 | Big Data Analytics | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 3. | SSE230 | Internet Of Things | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4a. | SSE241 | Computational Intelligence | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4b. | SSE242 | Computational Linguistics | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 4c. | SSE243 | Bioinformatics | IS&E | 4 | 1 | 0 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5a. | SSE251 | Advanced Data Mining Techniques | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5b. | SSE252 | Mobile Adhoc Networks | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 5c. | SSE253 | Agile Technologies | IS&E | 4 | 0 | 1 | 5.0 | 6 | 50 | 50 | 100 | 3 |
| 6. | SSE260 | Minor Project – II | IS&E | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - |
| 7. | SSE270 | Seminar – II | IS&E | 0 | 1.5 | 0 | 1.5 | 3 | 50 | - | 50 | - |
| Total | | | | 20 | 3.5 | 4.5 | 28 | 36 | 350 | 250 | 600 | - |

# Scheme of Teaching and Examination

## MTech in Software Engineering

### Third Semester MTech (SE) 2017-2018

| Sl.No. | Subject Code | Course title | Teaching Department | Credits | | | | Contact Hours | Marks | | | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| **1** | SSE31T | Practical Training in Industry/Exploration in Research | IS&E | -- | -- | 4 | 4 | - | 100 | - | 100 | - |
| **2** | SSE32P | Project Work (Phase – I) | IS&E | -- | -- | 10 | 14 | - | 100 | - | 100 | - |
| | | | | **Total Credits** | | | **18** | | **Total Marks** | | **200** | |

# Scheme of Teaching and Examination

## MTech in Software Engineering

### Fourth Semester MTech (SE) 2017-2018

| Sl.No. | Subject Code | Course title | Teaching Department | Credits | | | | Contact Hours | Marks | | | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| **1** | SSE41P | Project Work (Phase –II) | IS&E | -- | -- | 26 | 26 | - | 100 | 200 | 300 | - |
| | | | | **Total Credits** | | | **26** | **-** | **Total Marks** | | **300** | - |

## SSE110 SOFTWARE PROJECT PLANNING AND MANAGEMENT

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Rapid Software Development** **10 Hours**

Agile methods; Extreme programming; Rapid application development. Software Reuse: Reuse landscape; Design patterns; Generator-based reuse; Application frameworks; Application system reuse. Component-Based Software Engineering: Components and component models; Component-Based Software Engineering Process. 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.

**Risk Management** **10 Hours**

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.

**Software Requirements gathering** **10 Hours**

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 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.

**Project management in the testing phase** **10 Hours**

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.

**Globalization issues in project management** **10 Hours**

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?

**Text Book:**

1. Roger S Pressman, Software Engineering – A practitioner Approach Tata McGraw Hill 6th edition 2010

**Reference Books:**

1. Ramesh Gopalaswamy: “Managing Global Projects ", Tata McGraw Hill, 2013.
2. Watts Humphrey, “Managing the Software Process “, Pearson Education, New Delhi, 2000
3. PankajJalote, “Software Project Management in practice”, Pearson Education, New Delhi, 2002.

## SSE120 FORMAL METHODS IN SOFTWARE ENGINEERING

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction** **10 Hours**

**How to Write Correct Software the First Time?:** Express Precisely: The Precondition, The Postcondition, The Principles of Top-Down Refinement, Example.
**How to Prove a Program Correct: Programs Without Loops:** Program Correctness, The Weakest Precondition wp(S, Q), Finding the wp(S, Q), The Assignment Axiom, A Sequence of Assignments: The Composition Rule, SPARK Experiments.

**Program Correctness** **10 Hours**

**How to Prove a Program Correct: Iterative Programs?:** When not possible to Verify All Paths: Programs with Loops, From the Particular to the General: Mathematical Induction, Loop Invariants, Where do Invariants Come From: Goal Invariant, Supporting the Proof: Using the Proof Checker, Does the Loop Terminate? Variants.
**Prepare Test for Any Implementation: Black-Box Testing:**
Testing Principles, Functionality Testing, Special Values, Fixed Points, Special Classes, Boundary Analysis, Partition Testing, An Example, Random Testing.

**Program Representation** **10 Hours**

**Intermediate Program Representation:** Introduction, Program Parse and Syntax Trees, Program Control Flowgraph, Labeled Flowgraphs, Deriving the Flowgraph, Paths in Flowgraphs.
**Program Dependencies:** Dominators and Attractors, Control Dependency: Structured Control, Control Dependency: Arbitrary Control, Computing Control Dependency, Data and General Dependency.

**Program Analysis** **10 Hours**

**Decisison About a Program Without Its Execution: Static Analysis:** Control Flow Anomalies,
Data Flow Anomalies , Undefined-Referenced (UR) Anomaly: The Use of Uninitialized Variable, Redundant Statement (RS) Anomaly, Loop Analysis'Modeling Procedure Calls, Signature Anomalies, Descriptive Static Analysis, Control Flow Queries, Data flow and Dependency Queries, Structural Testing Queries, System (Program) and Visibility Queries, Events on Program Paths.

**Program Debugging** **10 Hours**

**How to indentify a Bug in the Program? Structural Program Testing:** Introduction, Code Coverage Criteria , Testing Scenario, Faults and Errors , Fault Detection Power of Code Coverage Testing.
**Dynamic Program Analysis**: Introduction, Operational Semantics: States and Computations, Dynamic Analysis Concepts, An Application: Dynamic Program Slicing, An Application: Handling Dynamic Data Structures.

**Text Book**

1. Janusz Laski and William Stanley: “Software Verification and Analysis An Integrated Hands on Approach", Springer, 2009.

**Reference Book:**

1. Jean-Francois Monin, “Understanding Formal Methods”, Springer-Verlag London Ltd, 2003

## SSE130 MACHINE LEARNING

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction & Bayesian Decision Theory** **10 Hours**

What Is Machine Learning?, Challenges, Examples of Machine Learning Applications, Present Research Avenues, Introduction to Bayesian Decision Theory, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules

**Dimensionality Reduction** **10 Hours**

Introduction, Feature Generation, Feature Selection, Principal Component Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Locality Preserving Projections (LPP) and it's variants, Locality Preserving Indexing and its variants.

**Supervised Learning** **12 Hours**

Learning a Class from Examples, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithms, Decision Tree Induction, Nearest Neighbors, Bayesian Classifier, Artificial Neural Networks, Model Over fitting, Performance Evaluation of classifiers.

**Clustering** **10 Hours**

Basic Concepts, Proximity Measures, Sequential Algorithms, Hierarchical Algorithms, Schemes based on Functional Optimization, Clustering Algorithms based on Graph Theory, Cluster Validity.

**Machine Learning Applications in Software Engineering** **8 Hours**

The challenges, Related Issues, Learning Approaches, SE tasks for ML Applications, State of the Practice in ML & SE, Present Status, Applying ML algorithms to SE Tasks.

**Text Books:**

1. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, PHI Learning Publisher, 2013 edition.
2. Pattern Recognition, Sergios Theodoridis and Konstantinos Koutroumbas, Fourth Edition, Academic Press Publisher, 2014.

**Reference Books:**

1. Machine Learning, Tom M. Mitchell, Mc Graw Hil Publishers, 1997.
2. Machine Learning Applications in Software Engineering, Du Zhang and Jeffrey J. P. Tsai, World

Scientific Publishers, 2005.
3. Pattern Recognition and Machine Learning, Christopher M. Bishop, Spriger Publishers, 2011.
4. Related Research Articles

## SSE141 DISTRIBUTED COMPUTING

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus:**

**Concepts in Distributed Systems** **10 Hours**

Introduction, Distributed computing models, Software concepts, Design issues in distributed systems, Client-server model. Network Communication: LAN and WAN technologies, OSI Model and Internet protocols, ATM, Protocols for Distributed systems. Interprocess Communication: Message Passing and its features, IPC message format, IPC synchronization, Buffering, multi datagram messaging, process addressing techniques, failure handling, Formal Models for message passing systems.

**Remote Communication** **10 Hours**

Introduction, RPC basics, RPC implementation, RPC Communication and Other issues, Sun RPC, RMI basics, RMI Implementation, Java RMI.

**Synchronization** **10 Hours**

Clock synchronization, Logical clocks, Global state, Mutual exclusion, Election algorithms: Bully algorithm, Ring algorithm, Leader election in rings, anonymous rings, Asynchronous rings, synchronous rings, election in wireless networks, Deadlocks in Distributed systems, Deadlocks in Message communication

**Distributed System Management** **10 Hours**

Resource management, Task management approach, Load balancing approach, Load sharing approach, Process Management, Process migration, threads, fault tolerance

**Distributed Shared Memory** **10 Hours**

Concepts, Hardware DSM, Design issues in DSM systems, Implementation issues, Heterogeneous and other DSM systems. Naming: Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS

**Text book:**

1. Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair Fifth Edition, published by Addison Wesley.

**Reference Books:**

1. Distributed Computing, Fundamentals, Simulations and Advanced topics, Hagit Attiya and Jennifer Welch, Wiley India.
2. Advanced Operating Systems, M. Singhal, N.G. Shivarathri, McGraw Hill
3. Distributed Operating Systems, A.S. Tanenbaum, Prentice Hall

## SSE142 MULTIMEDIA COMPUTING

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction** **10 Hours**

Introduction - Multimedia applications – architecture and issues for distributed multimedia systems – multimedia skills – digital audio representations and processing – video technology.

**Information and Entropy** **10 Hours**

Characteristics of entropy ,Noiseless and Memory less coding, Shannon fano and Huffman coding .Multimedia data compression II:Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

**Audio ,Digital Video and Image Compression** **10 Hours**

MIDI Vs digital audio – audio file formats - video compression techniques – standardization of algorithms – JPEG image compression and Its variants.

**Multimedia Standards** **10 Hours**

Multimedia Standards, Mpeg 1, Mpeg -2 Mpeg 4 Mpeg 7 ITU –T ,Multimedia Communications over ATM Networks & IP Network, Mobile Networks & Broad Casting

**Multimedia Information System** **10 Hours**

Operating system support for continuous media applications – middleware system service architecture – multimedia device, presentation services and user interface – multimedia file systems and information model.

Text Books:

1. Adam Drozdek Elements of Data Compression Thomson Learning
2. Tay Vaughan, "Multimedia - Making it work", Tata Mc Graw Hill Edition, 5th edition

Reference Book:

1. Ze-Nian Li & Mark S. Drew, "*Fundamentals of Multimedia*", Prentice-Hall India, 2012

## SSE143 ADVANCED ALGORITHMS

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Analysis Techniques** **10 Hours**

Growth of functions – Asymptotic notations, Standard notations and common functions; Recurrences and solution of recurrence equations – Substitution method, Recurrence-tree method, Master method; Amortized analysis – Aggregate, Accounting, Potential methods.

**Graph Algorithms/Internet Algorithms** **10 Hours**

Bellman-ford algorithm, Single source shortest path in a DAG, Johnson's algorithm for sparse graphs, Flow networks and Ford-Fulkerson method, Maximum bipartite matching.
Search engines, Ranking web pages, Hashing, Cashing, content delivery and consistent hashing.

**Number Theoretic Algorithms** **10 Hours**

Elementary notations, GCD, Modular arithmetic, Solving modular equations, Chinese remainder theorem, Powers of an element, RSA cryptosystem, Primality testing, Integer factorization.

**String Matching Algorithms** **10 Hours**

Naïve string matching, Robin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm, Boyer-Moore algorithm.

**Probabilistic and Randomized Algorithms** **10 Hours**

Probabilistic algorithms, Randomizing and deterministic algorithms, Monte-Carlo and Las-Vegas algorithms, Probabilistic numeric algorithms.

**Text Book:**

1. T H Cormen, C E Leiserson, R L Rivest, C Stein: Introduction to Algorithms, 3rd edition, PHI, 2010.
2. A Kenneth, Berman, Jerome L Paul: Algorithms, Cengage Learning, 2002.

**Reference Book:**

1. Ellis horowitz, Sartaj Sahni, S Rajasekharan: fundamentals of Computer Algorithms, 2nd edition, University Press, 2007.

## SSE151 NUMERICAL LINEAR ALGEBRA

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction** **10 Hours**

Fundamentals: Matrix –Vector Multiplication, Orthogonal Vectors & Matrices, Norms, The Singular Value Decomposition, More on the SVD.
QR Factorization & Least Squares: Projectors, QR Factorization, Gram – Schmidt Orthogonalization, MATLAB, Householder Triangularization, Least Squares Problems.

**Conditioning & Stability** **10 Hours**

Conditioning & Condition Numbers, Floating Point Arithmetic, Stability, More on Stability, Stability of Householder Triangularization, Stability of Back Substitution, Conditioning of Least Squares Problems, Stability of Least Squares Algorithms.

**Systems of Equations** **10 Hours**

Gaussian Elimination, Pivoting, Stability of Gaussian Elimination, Cholesky Factorization.

**Eigenvalues** **10 Hours**

Eigenvalue Problems, Overview of Eignvalue Algorithms, Reduction to Hessenberg or Tridiagonal form, Rayleigh Quotient, Inverse Iteration, QR Algorithm without Shifts, QR Algorithm with Shifts, Other Eigenvalue Algorithms, Computing SVD.

**Iterative Methods** **10 Hours**

Overview of Iterative Methods, The Arnoldi Iteration, How Arnoldi Locates Eigenvalues, GMRES, The Lanczos Iteration, From Lanczosto Gauss Quadrature, Conjugate Gradients, Biorthogonalization Methods, Preconditioning.

**Text Book:**

1. Numerical Linear Algebra, Llyod N Trefethen & Davis Bau III, SIAM.

**Reference Book:**

1. Numerical Linear Algebra, William Layton and Myron Sussman, University of Pittsburgh Pittsburgh, Pennsylvania, ISBN 978-1-312-32985-0

## SSE152 WEB SERVICES

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Overview** **10 Hours**

Distributed Information system-Design of information system, Architecture of information system, Communication in a information system. Understanding middleware, RPC and related middleware, TP monitors, object brokers, Message-oriented middleware.

**Introduction to Web services** **10 Hours**

The basics of Web Services; An example; Next generation of the Web; Interacting with Web Services; The technology of Web Services; XML for business collaboration: bXML; Web Services versus other technologies; Additional technologies.

**XML** **10 Hours**

An example; Instance and schema; Processing XML documents; Namespaces; Transformation; XML specifications and information.

**WSDL** **10 Hours**

Basics; WSDL elements; The extensible WSDL framework; Importing WSDL elements; WSDL-Related Namespaces; Extensions for binding to SOAP. SOAP: Example; The SOAP specifications; SOAP message processing; SOAP use of Namespaces; SOAP Multipart MIME; Attachments; SOAP I the context of existing systems;

**UDDI Registry** **10 Hours**

The UDDI organization; The concepts underlying UDDI; How UDDI works?
UDDI SOAP APIs; Usage scenarios; Using WSDL with UDDI; UDDI for private use; UDDI
Support for SOAP, Complex business relationships, and UNICODE. EBXML: Overview of web XML; ebXML specifications.

**Text Book:**

1. Web services: concept, architecture and applications, springer-Verlag, Gustavo Alonso, Fabio Casati, Harumi Kuno, vijay Machiraju
2. Eric Newcomer: Understanding Web Services XML, WSDL, SOAP, and UDDI, Pearson , 2002.

**Reference Books:**

1. Aaron E. Walsh: UDDI, SOAP, and WSDL – The Web Services Specification Reference Book, Prentice Hall PTR, 2000.
2. James McGovern et al: Java Web Services Architecture, Elsevier, 2003.
3. Relevant web Sites.

## SSE153 CYBER SECURITY

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Systems Vulnerability Scanning** **10 Hours**

Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet

**Network Defense tools** **10 Hours**

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System

**Web Application Tools** **10 Hours**

Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra

**Introduction to Cyber Crime and law** **10 Hours**

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

**Introduction to Cyber Crime Investigation** **10 Hours**

Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

**Text Books:**

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley

## SSE210 SOFTWARE QUALITY ASSURANCE

**Total Teaching Hours: 50** **No. of Credits: 05**

**Syllabus:**

**Software Quality** **10 Hours**

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.

**Software Tools** **10 Hours**

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.

**Software Testing** **10 Hours**

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

**Software Testing Methodologies** **10 Hours**

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.

**System Testing** **10 Hours**

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.

**Books:**

1. Stephen H Khan: Metrics and Models in Software Quality Engineering, Pearson 2nd edition 2013.ISBN: 978-81-203-1136-7
2. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2013.ISBN: 9670201785602
3. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008. ISBN 9780201515602
4. 4.Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, John Wiley & Sons, 2008 ISBN: 978-81-203-1351-4

## SSE220 BIG DATA ANALYTICS

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction & Perspective of Big Data** **10 Hours**

Overview of Big Data, History, Structuring Big Data, Types of Data, Elements of Big Data, Data analytics project life cycle, Problems & challenges in understanding Data Analytics, Web page categorization (In detail), Case studies on: Stock Market changes.
Application of Data Analytics in Digital market, Big Data benefit areas, Various Analytical approaches, Cross Channel Life cycle marketing, Use of Big Data in Social Networking, Use of Big Data in Business Intelligence, Use of Big Data in preventing Fraudulent activities, Use of Big Data in Retail Industry, Use of RFID Data in Retail, Big Data in Health Care, Predictive and Disruptive Analytics, Content delivery and market optimization.

**Big Data Technology** **10 Hours**

Exploring Big Data Stack, Virtualization, Virtualization Approaches, Distributed and parallel computing for Big Data, Introducing Hadoop, Hadoop Ecosystem, Hadoop Distributed File Systems(HDFS), Features of HDFS : Hadoop YARN, MAP Reduce, Features of Map Reduce, Working of Map Reduce, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, HBase, Features of HBase, Role of HBase in Big Data processing, Other tools of Hadoop (Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, OOZie), The cloud and Big Data, Cloud Deployment Models, Cloud Delivery Models, Cloud providers in Big Data Market.

**Mining Data Streams** **12 Hours**

The Stream Data Model, A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing, Sampling Data in a Stream, Filtering Streams, Estimating Moments, Dealing With Infinite Streams, Counting Ones in a Window, The Market Basket Analysis, A Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.

**Advanced Analytical Theory and Methods** **08 Hours**

Analytics on Text, Image, Video, Web, Social Network (A Case Studies on all the different types of Data), Time Series Analysis, NoSQL, Recommendation System: A Model, Content Based Recommendations, Collaborative Filtering, Dimensionality Reduction Problem, The NetFlix Problem.

**Large Scale Machine Learning** **10 Hours**

Introduction, Types of Machine Learning Algorithms, Machine Learning Architecture, Applications of Machine Learning, Supervised Machine Learning Algorithms (Problems on Classification): Bayseian

Networks, Learning from Nearest Neighbors, Decision Trees, Support Vector Machines, Neural Networks, Unsupervised Machine Learning Algorithms (Problems on Clustering): Hierarchical Clustering Techniques, Partitional Clustering techniques, Distance measures.

**Text Books:**

1. Big Data: Black Book, DT Editorial Services, Dream Tech Press Publishers, 2015.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, Second Edition, Cambridge University Press Publisher, 2015.

**Reference Books:**

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, 2015.
2. Selected Research Articles from Internet.

## SSE230 INTERNET OF THINGS

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**M2M to IoT** **10 Hours**

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. **M2M to IoT – A Market Perspective**– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

**M2M to IoT-An Architectural Overview** **10 Hours**

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

**IoT Architecture-State of the Art** **10 Hours**

Introduction, State of the art, **Architecture Reference Model-** Introduction, Reference Model and architecture, IoT reference Models.

**IoT Reference Architecture** **10 Hours**

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

**Industrial Automation** **10 Hours**

Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

**Textbook:**

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle**,** "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

**Reference Books:**

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

## SSE241 COMPUTATIONAL INTELLIGENCE

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus:**

**Introduction to Computational Intelligence** **8 Hours**

Representation and Reasoning, Ontology and Conceptualization, Intelligent Machines, Computational Intelligence Paradigms, Short History, Some Applications of Intelligence.

**Fuzzy Theory – I** **10 Hours**

Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

**Fuzzy Theory – II** **10 Hours**

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy Reasoning – Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

**Artificial Neural Networks** **12 Hours**

Introduction – Fundamental concept – Evolution of Neural Networks, Basic Models of Artificial Neural Networks Multilayer feed-forward networks, Recurrent Neural Networks, ART Neural Networks, RBF Networks, Probabilistic Neural Networks, Deep Learning Networks.

**Evolutionary Algorithms** **12 Hours**

Introduction, Optimization Problems and evolutionary Algorithms, Advanced techniques in evolutionary algorithms, Evolutionary Algorithms in designing neural networks, evolutionary algorithms vs fuzzy systems. Hybrid Intelligent Systems: Neural Expert Systems, Neuro-Fuzzy Systems, Evolutionary Neural Networks

**Text Book:**

1. Computational Intelligence: Methods and Techniques., Leszek Rutkowski, Springer Publisher, 2008.

**Reference Books:**

1. Computational Intelligence: An Introduction., Andries P. Engelbrecht, Wiley Publisher, Second Edition, 2007.
1. Fuzzy Logic with Engineering Applications, Timothy J.Ross, Wiley-Blackwell Publisher, Third Edition, 2010.
2. Principles of Soft Computing, S.N. Deepa and S.N. Sivanandam, Wiley Publishers, Second Edition, 2011.

## SSE242 COMPUTATIONAL LINGUISTICS

**Total Teaching Hours: 50** **No. of Credits: 05**

**Syllabus**

**Introduction** **10 Hours**

What is computational linguistics? Ambiguity and uncertainty in language, regular languages, and their limitations, finite-state automata, morphology.

**Context Free Grammars** **10 Hours**

Constituency, CFG definition, use and limitations. Chomsky Normal Form. Top-down parsing, bottom-up parsing, and the problems with each. The desirability of combining evidence from both directions

**Programming in Python** **10 Hours**

An introduction to programming from square one. Why Python? Variables, numbers, strings, arrays, dictionaries, conditionals, iteration. The NLTK (Natural Language Toolkit).

**Word Sense Disambiguation and Clustering** **10 Hours**

Homonomy, polysemy, different meanings, the power of context. Language neighbourhood as a vector. Agglomerative clustering. Clustering by expectation maximization. Using clustering to discover different word senses. Semi-supervised document classification.

**Machine Translation** **10 Hours**

Probabilistic models for machine translation system, alignment, translation, language generation. machine translation evaluation.

**Text Book**

1. Daniel Jurafsky and James H. SPEECH and LANGUAGE PROCESSING: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Second Edition.
2. Chris Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press. Cambridge, MA: May 1999.

**Reference Books:**

1. Allen, James. 1995. – Natural Language Understanding. Benjamin/Cummings, 2ed.Bharathi, A Vineet Chaitanya and Rajeev Sangal. 1995.
2. Natural Language Processing- A Pananian Perspective. Prentice Hll India, Eastern Economy.
3. Eugene Cherniak: Statistical Language Learning, MIT Press, 1993.

## SSE243 BIOINFORMATICS

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Introduction, Scope and Importance** **8 Hours**

Important contributions, Aims and Tasks of Bioinformatics, Applications of Bioinformatics, Challenges and Opportunities, Introduction to NCBI data model, Various file formats for biological sequences, The Data: Storage and Retrieval , Basic Principles, The Data, Data Quality, Data Representation.

**Bioinformatics Database** **10 Hours**

Importance of Databases, Characteristics and Categories of Bioinformatics Database, Navigating Databases, Biological Databases, Primary Sequence Databases, Composite Sequence Databases, Secondary Databases, Nucleic Acid Sequence Databases, Structure Databases: File Formats, Protein Structure, PDB, MMDB, CATH, Other Database Enzyme, MEROPS, BRENDA, Pathway databases, Bibliographic Databases, Specialized Genomic Resources, Analysis Packages.

**Sequence Align Methods** **12 Hours**

Sequence Analysis of Biological Data, Significance of Sequence Alignment, Pairwise Sequence Alignment Methods, Use of Scoring Matrices and Gap Penalties in Sequence Alignments, Multiple Sequence Alignment Methods - Tools and Application of multiple sequence alignment, Gene Predictions Strategies, Protein Prediction Strategies, Phylogenetic Trees and Multiple Alignments.

**Bioinformatics Algorithms** **12 Hours**

Biological Algorithms versus Computer Algorithms, Exhaustive Search, Mapping Algorithms, Motif Finding Problem, Search Trees, Finding a Median String, Greedy Approach to Motif Finding, DNA Sequence comparison - Manhattan Tourist Problem - Edit Distance and Alignments - Longest Commons Subsequences - Global Sequence Alignment - Scoring Alignment - Local Sequence Alignment – Alignment with Gap Penalties - Multiple Alignment, DNA Sequencing, Shortest Superstring Problem, DNA arrays as an alternative sequencing techniques.

**Biostatistics & Tools** **10 Hours**

Handling Univariate and Bivariate Data, Measures of Central Tendency, Measures of Dispersion, Skewness & Kurtosis, Correlation and Regression.
Local Alignment Search Tool (BLAST), Purpose of BLAST, BLAST Analysis, Purpose of BLAST II, Scoring Metrics, PAM, BLOSUM, Working of BLAST, Introduction to HMMER.

**Text Books:**

1. Bioinformatics - Concepts, Skills, and Applications, S.C. Rastogi, Namita Mendiratta, Parag Rastogi, Second Edition, CBS Publishers, 2003.
2. An Introduction to Bioinformatics Algorithms, Neil C Jones and Pavel A Pevzner, MIT Press, 2004.

**Reference Books:**

1. Bioinformatics: Databases, Tools, And Algorithms., Orpita Bosu, Simminder Kaur Thukral , Oxford University Press Publisher, 2007.
2. Fundamentals of Mathematical Statistics., S.C. Gupta and V.K. Kapoor, Eleventh Edition, Sultan Chand & Sons Publishers, 2007.
3. Internet Resources

## SSE251 ADVANCED DATA MINING TECHNIQUES

**Total Teaching Hours: 50** **No. of Credits: 05**

**Syllabus**

**Introduction** **10 Hours**

**The Data Mining Process:** Basic Data Types, The Major Building Blocks: A Bird's Eye View, Scalability Issues and the Streaming Scenario, A Stroll through some Application Scenarios, Data Preparation, Feature Extraction and Portability, **Data Cleaning:** Data Reduction and Transformation, **Similarity and Distances:** Multidimensional Data, Text Similarity Measures, Temporal Similarity Measures, Graph Similarity Measures, Supervised Similarity Functions

**Mining Data Stream** **10 Hours**

Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis, Multirelational Data Mining, Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

**Advanced Concepts in Association Analysis** **8 Hours**

Frequent Itemset Generation, Compact Representation of Frequent Itemsets, FP- Growth Algorithms, Handling Categorical and Continuous Attributes, Handling a Concept Hierarchy, Sequntial Patterns, Subgraph Patterns, Infrequent Patterns, Counting Frequent Items in a Stream .

**Data Mining Methods as Tools** **12 Hours**

Memory-Based Reasoning Methods, Fuzzy Sets in Data Mining, Rough Sets, Support Vector Machines, Genetic Algorithm Support to Data Mining, Performance Evaluation for Predictive Modeling.

**Applications and Research Trends in Data Mining** **10 Hours**

Data Mining Applications (Financial Data Analysis, Retail Industry, Telecommunication Industry, Biological Data Analysis, Other Scientific Applications, Intrusion Detection), Data Mining System Products and Research Prototypes, Statistical Data Mining, Visual and Audio Data Mining, Data Mining and Collaborative Filtering, Data Mining, Privacy, and Data Security, Trends in Data Mining, Present Research Avenues.

**Text Books:**

1. Data Mining: Concepts and Techniques, *Jiawei Han, Micheline Kamber, Jian Pei Professor*, Third Edition, Morgan Kauffmann Publishers, 2011.
2. Advanced Data Mining Techniques, *David L. Olson, Dursun Delen*, Springer Publisher, 2008

**Reference Books:**

1. Data Mining: The Textbook, *Charu C. Aggarwal,* First Edition ,Springer Publisher, 2016.
2. Data Mining: Introductory and Advanced Topics, *Dunham,* First Edition, Pearson Education India Publisher, 2006

## SSE252 MOBILE ADHOC NETWORKS

**Total Teaching Hours: 50** **No. of Credits: 05**

**Syllabus**

**Introduction** **10 Hours**

Introduction to adhoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models:- Indoor and out door models.

**Medium Access Protocols Mac Protocols** **10 Hours**

Design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

**Network Protocols Routing Protocols** **10 Hours**

Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

**End-End Delivery And Security Transport Layer** **10 Hours**

Issues in desiging- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

**Cross Layer Design And Integration Of Adhoc For 4g Cross Layer Design** **10 Hours**

Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary prespective. Intergration of adhoc with Mobile IP networks.

**Text Book:**

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 17th edition, Pearson Education. 2014
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

**Reference Books:**

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.

3. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends.

## SSE253 AGILE TECHNOLOGIES

**Total Teaching Hours: 50** **No. of Credits : 05**

**Syllabus**

**Why Agile?** **10 Hours**

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.

**Understanding XP** **10 Hours**

The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility.

**Practicing XP** **10 Hours**

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.

**Mastering Agility** **10 Hours**

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.

**Deliver Value** **10 Hours**

Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery.

**Text Book:**

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