JSS MAHAVIDYAPEETHA

JSS SCIENCE AND TECHNOLOGY UNIVERSITY

Mysuru-570006.

Department of Information Science & Engineering

Master of Technology

In

Software Engineering

SCHEME & SYLLABUS

I to IV semesters

2019

Scheme of Teaching and Examination

MTech in Software Engineering

First Semester MTech(SE)

SL. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks		
				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
2.	SSE120	Agile Technologies	IS&E	4	1	0	5.0	6	50	50	100
3.	SSE130	Machine Learning	IS&E	4	0	1	5.0	6	50	50	100
4a.	SSE141	Distributed Computing	IS&E	4	0	1	5.0	6	50	50	100
4b.	SSE142	Multimedia Computing	IS&E	4	0	1	5.0	6	50	50	100
4c.	SSE143	Advanced Algorithms	IS&E	4	0	1	5.0	6	50	50	100
5a.	SSE151	Linear Algebra and Applications	IS&E	4	0	1	5.0	6	50	50	100
5b.	SSE152	Web Services	IS&E	4	0	1	5.0	6	50	50	100
5c.	SSE153	Cyber Security	IS&E	4	0	1	5.0	6	50	50	100
6.	SSE160	Minor Project – 1	IS&E	0	0	3.0	3.0	6	100	-	100
		Total		20	2.0	6.0	28	36	350	250	600

Scheme of Teaching and Examination

MTech in Software Engineering

Second Semester MTech (SE)

SL. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks		
				L	T	P	Total		CIE	SEE	Total
1.	SSE210	Software Quality Assurance	IS&E	4	1	0	5.0	6	50	50	100
2.	SSE220	Big Data Analytics	IS&E	4	1	0	5.0	6	50	50	100
3.	SSE230	Internet Of Things	IS&E	4	0	1	5.0	6	50	50	100
4a.	SSE241	Computational Intelligence	IS&E	4	0	1	5.0	6	50	50	100
4b.	SSE242	Computational Linguistics	IS&E	4	0	1	5.0	6	50	50	100
4c.	SSE243	Bioinformatics	IS&E	4	0	1	5.0	6	50	50	100
5a.	SSE251	Advanced Data Mining Techniques	IS&E	4	0	1	5.0	6	50	50	100
5b.	SSE252	Mobile Adhoc Networks	IS&E	4	0	1	5.0	6	50	50	100
5c.	SSE253	Formal Methods in Software Engineering	IS&E	4	0	1	5.0	6	50	50	100
6.	SSE260	Minor Project – 2	IS&E	0	0	3.0	3.0	6	100	-	100
		Total		20	2.0	6.0	28	36	350	250	600

Scheme of Teaching and Examination

MTech in Software Engineering

Third Semester MTech (SE)

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	10	-	100	-	100	-
				Total Credits			**14**		**Total Marks**		**200**	

Scheme of Teaching and Examination

MTech in Software Engineering

Fourth Semester MTech (SE)

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	--	--	18	18	-	100	200	300	-
				Total Credits			18		Total Marks		300	

SSE110 SOFTWARE PROJECT PLANNING AND MANAGEMENT

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

Lab hours/week: 02

Course Outcomes:

After completing this course, the students would be able to:

CO 1: Apply project management practices to the launch of new programs, initiatives, products, services, and events relative to the needs of stakeholders.
CO 2: Develop strategies to calculate risk factors involved in IT projects.
CO 3: Apply schedule and cost techniques to compute an estimate of a project.
CO 4: Identify metrics for managing quality assurance, quality planning and quality control.
CO 5: Evaluate software development methods for a variety of software projects.

Process Models **10 Hours**

Process Models: Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process, Agile development. **Project management concepts:** The management spectrum, people, product, process, project, W^5HH principle. **Process and project metrics:** Metrics in the Process and Project Domains, Software measurement, Metrics for software quality, integrating metrics within the software process, Metrics for small organizations, Establishing a software metrics program.

Risk Management **10 Hours**

Risk Management: Proactive versus reactive risk, Software risks, Risk identification, Risk projection, Risk refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan. **Software Process Improvement:** Introduction, SPI Process, CMMI, The people CMM, Other SPI Frameworks, SPI Return on Investment.

Estimation for Software Projects **10 Hours**

Estimation for software projects: Observations on Estimation, The Project Planning Process, Software Scope and Feasibility, Resources, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized estimation techniques, Make/Buy decision.
Project Scheduling: Basic concepts, Project scheduling, Defining the task set for software project, Defining a task network, scheduling, Earned value analysis.

Quality concepts **10 Hours**

Quality concepts: Software quality, Quality dilemma, Achieving Software Quality, **Software Quality assurance:** Elements of Software Quality Assurance, SQA Processes and Product Characteristics, SQA Tasks, Goals, and Metrics, Formal

Approaches to SQA, Statistical Software Quality Assurance, Software reliability, The ISO 9000 Quality Standards, The SQA plan.

Software Configuration Management: Software Configuration Management, The SCM Repository, The SCM process, Configuration Management for Web and MobileApps.

Software Testing Strategies **10 Hours**

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps,

Test Strategies for MobileApps, Validation Testing, System testing, Debugging.

Formal Modelling and Verification: The Cleanroom Strategy, Functional Specification, cleanroom design, cleanroom testing, Rethinking Formal Methods, Formal Methods Concepts

Text Book:

1. Roger S. Pressman and Bruce R. Maxim, “Software Engineering A PRACTITIONER’S APPROACH ", Tata McGraw Hill, 8th edition, 2015.

Reference Books:

1.Watts Humphrey, “Managing the Software Process “, Pearson Education, New Delhi, 2000

2.PankajJalote, “Software Project Management in Practice by PankajJalote”, Pearson Education, 2017.

Swayam: https://swayam.gov.in/nd1_noc19_cs70/preview

SSE120 AGILE TECHNOLOGIES

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

Course Outcomes:

After completing this course, the students would be able to:
CO1:Identify the agile methods suitable for software development.
CO2: Apply appropriate agile models and principles for software development.
CO3: Analyze the impact of agile technologies on software development.

Introduction **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

SSE130 MACHINE LEARNING

Total Teaching hours: 50 **No of credits: 5**

Course Outcomes:

After completing this course, student should be able to:
CO1: Understand the basic principles of Learning theories
CO2: Understand the principles of dimensionality reduction and feature selection techniques
CO3: Understand and Develop a wide variety of supervised learning algorithms
CO4: To become familiar with various clustering algorithms
CO5: To learn methodology and tools to apply machine learning algorithms to Software Engineering

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 its variants, Locality Preserving Indexing and its variants.

Supervised Learning **10 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 **10 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,*EthemAlpaydin,*** Second Edition, PHI Learning Publisher, 2013 edition.
2. **Pattern Recognition,*SergiosTheodoridis and KonstantinosKoutroumbas,*** Fourth Edition, Academic Press Publisher, 2014.

Reference Materials:

1. **Machine Learning,*Tom M. Mitchell,***McGrawHil Publishers, 1997.
2. **Machine Learning Applications in Software Engineering, *Du Zhang and Jeffrey J. P. Tsai,*** World Scientific Publishers, 2005.

SSE141 DISTRIBUTED COMPUTING

Total Teaching hours: 50 **No. of credits: 05**

Course Outcomes (CO):

On successful completion of the course, students should be able to:

CO1: Explain the design issues and communication in distributed system
CO2: Analyze the underlying principles of clock synchronization, mutual exclusion and election algorithms.
CO3: Apply process/processor scheduling algorithms in distributed and real time systems
CO4: Analyze the concepts of distributed file systems.
CO5: Illustrate shared memory concepts in distributed systems.

Introduction to distributed systems **10 Hours**

Distributed systems, goals, hardware/ software concepts, design issues. Communications in distributed systems, layered protocols, ATM networks, Client- server models, RPC, group communications

Synchronization in distributed systems: **10 Hours**

Clock synchronization, mutual exclusion, election algorithms, atomic transaction, deadlocks in distributed systems.

Processes and Processors in distributed systems. **10 Hours**

Threads, system models, processor allocation, scheduling in distributed systems, fault tolerances, real time distributed system

Distributed file systems **10 Hours**

Design, implementation, trends in distributed file system.

Distributed shared memory **10 Hours**
Introduction, shared memory, consistency models, page based distributed shared memory, shared variable distributed shared memory, object based distributed shared memory.

Text Book:

1. Distributed Operating System, Andrew Tannenbaum, Pearson, 2008

Reference Book:

1. Distributed Systems: Concepts and Design, 5/e, George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Addison-Wesley, 2011.

SSE142 MULTIMEDIA COMPUTING

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

After the completion of the course students should be able to:
CO1: Understand common multimedia data formats, protocols, and compression techniques of digital images, video and audio content.
CO2: Able to analyze the various Multimedia Algorithms
CO3: Understand the technical details of JPEG and MPEG families of standards.
CO4: Able to understand the working principles of Multimedia Information Systems

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, EmbeddedZerotree 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 McGraw 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**

Course Outcomes:

On successful completion of the course, students should be able to:
CO1: Analyze the asymptotic performance and amortized running time of algorithms.
CO2: Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.
CO3: Apply the algorithms and design techniques to solve Number Theoretic and String Matching problem.
CO4: Analyze Probabilistic and Randomized algorithms.
CO5: Apply efficient algorithms in common engineering design situations

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 Books:

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, SartajSahni, S Rajasekharan: fundamentals of Computer Algorithms, 2nd edition, University Press, 2007.

SSE151 LINEAR ALGEBRA AND APPLICATIONS

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

Course Outcomes:

On successful completion of the course, students should be able to:
CO1: Solve linear equations through matrix representation.
CO2: Identify the vector space and subspace.
CO3: Test for orthogonality and apply Eigen vectors to solve differential equations.
CO4: Justify linear inequalities in the vector subspace.
CO5: Apply methods to solve different linear equations.

Introduction **10 Hours**

Introduction, The Geometry of Linear Equations, An Example of Gaussian Elimination, Matrix Notation and Matrix Multiplication, Triangular Factors and Row Exchanges, Inverses and Transposes, Special Matrices and Applications.

Vector Space **10 Hours**

Vector Spaces and Subspaces, Solving $Ax = 0$ and $Ax = b$, 3 Linear Independence, Basis, and Dimension, The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations, Review Exercises.

Orthogonality **10 Hours**

Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections and Least Squares, Orthogonal Bases and Gram-Schmidt, The Fast Fourier Transform.

Computations with Matrices **10 Hours**

Introduction, Matrix Norm and Condition Number, Computation of, Iterative Methods for $Ax = b$.

Linear Algebra and Game Theory **10 Hours**

Linear Inequalities, The Simplex Method, The Dual Problem, Network, Game Theory .

Text Book:

Linear Algebra and Its Applications by Gilbert Strang, 2016 Edition,Wellesley-Cambridge Press and SIAM,ISBN: 978-09802327-7-6.

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**

Course Outcomes:

After completing this course, the students would be able to:
CO1: Explain the architecture of XML and Web Services
CO2: Illustrate the working of Web Service Description Language document ,UDDI
CO3: Develop services using WSDL and Universal Description Discovery Interfaces.

XML TECHNOLOGY FAMILY **10Hrs**

XML – benefits – Advantages of XML over HTML – EDL –Databases – XML based standards – DTD –XML Schemas – X- Files – XML processing – DOM – SAXpresentation
technologies – XSL – XFORMS – XHTML – voice XML – Transformation – XSLT – XLINK – XPATH –XQ

ARCHITECTING WEB SERVICES **10 Hrs**

Business motivations for web services – B2B – B2C- Technical motivations – limitations of CORBA and COM – Service – oriented Architecture (SOA) – Architecting webservices – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer– process view – life in the runtime

WEB SERVICES BUILDING BLOCK **10 Hrs**

Transport protocols for web services – messaging with web services – protocols – SOAP– describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI- Web service inspection – Ad-Hoc Discovery – Securing web services.

IMPLEMENTING XML IN E-BUSINESS **10Hrs**

B2B - B2C Applications – Different types of B2B interaction – Components of ebusiness XML systems – ebXML – Rosetta Net Applied XML in vertical industry – Web services for mobile devices.

XML AND CONTENT MANAGEMENT **10Hrs**

Semantic Web – Role of Meta data in web content – Resource Description Framework– RDF schema – Architecture of semantic web – content management workflow –XLANG –WSFL.

Text Books:

1.Ronschmelzer et al, “XML and Web Services”, Pearson Education, 2002.
2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004.

Reference Books:

1. Frank P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
2. Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003.
3. Henry Bequet and MeerajKunnumpurath, “Beginning Java Web Services”, Apress, 2004.
4. Russ Basiura and Mike Batongbacal, “Professional ASP.NET Web Services”, Apress,2.ASP .NET Web Services”, Apress, 2003

SSE153 CYBER SECURITY

Total Teaching hours: 50 **No. of credits: 05**

Course Outcomes

On successful completion of the course, students should be able to:
CO1: Categorize different cybercrimes.
CO2: Evaluate the various cyber offences.
CO3: Elaborate challenges of cybercrime posed by mobile devices.
CO4: Identify different types attacks on mobile networks.
CO5: Appraise phishing in cybercrime and the Indian IT Act.

Introduction **10 Hours**

Introduction to cybercrime, Cybercrime and information security, Who are Cybercriminals, Classification of Cybercrimes, Cybercrime: The Legal Perspectives, An Indian Perspective**,** Cybercrime and the Indian ITA 2000, A global perspective on cybercrimes, Cybercrime era: Survival mantra for the citizens.

Cyber offenses **10 Hours**

Introduction, How criminal plan the attacks, Social engineering, Cyber stalking, Cybercafe and cybercrimes, Botnets: The fuel for cybercrime, Attack vector, Cloud Computing.

Cyber crime: Mobile and Wireless devices **10 Hours**

Introduction, Proliferation of mobile and wireless devices, Trends in mobility, Security challenges posed by mobile devices, Registry setting for mobile devices, Authentication service security, Attacks on mobile/ cell phones, Mobile devices: security implications for organizations, Organization measures for handling mobile, Organizational security policies and measures in mobile computing era, Laptops.

Tools and method used in Cybercrime **10 Hours**

Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL injection, Buffer overflow, Attacks on wireless networks.

Phishing and identity theft **10 Hours**

Introduction, Phishing, Identity theft (id theft).

Cybercrimes and Cyber Security: The legal perspectives
Introduction, Cybercrime and the legal landscape around the world, Why do we need cyber laws: the Indian context, The Indian IT Act, Challenges to Indian law and cybercrime scenario in India, Consequences of not addressing the weakness in information technology act.

Text Books:

1. Cyber Security by Nina Godbole, SunitBelapure, Wiley India, 1st edition copyright 2011 reprint 2013.

Reference Books:

1. Computer Forensics and Cyber Crime An Introduction by Marjie T. Britz, Pearson
publication, 2nd edition.

Online Course:

- https://swayam.gov.in/nd2_nou19_cs08/preview

SSE210 SOFTWARE QUALITY ASSURANCE

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

Course Outcomes:

On successful completion of the course, students should be able to:
CO1:Utilize the concepts in software development life cycle.
CO2: Demonstrate their capability to adopt quality standards.
CO3: Assess the quality of software product.
CO4: Apply the concepts in preparing the quality plan & documents.
CO5: Interpret the different software testing methodologies, quality metrics and tools with illustrations.

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.

Text 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

Reference Books:

1. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008. ISBN 9780201515602
2. 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**

Course Outcomes (CO):

At the end of the course student will be able to:

CO1: Explain big data analytics and methods to create innovative analytics systems for big data

CO2:Discuss and Distinguish different big data techniques

CO3: Apply big data algorithms to solve complex big data problems

CO4: Analyze different data mining methods and Recommendationmethods to handle big data

CO5:Justify importance of various machine learning algorithms to solve big data problems

Syllabus

Introduction **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, computing the frequency of stock market change. Use of Big Data in Social Networking, Use of Big Data in preventing Fraudulent activities, Use of Big Data in Retail Industry.

Big Data Technology **10 Hours**

Exploring Big Data Stack, Virtualization, Virtualization Approaches, Distributed and parallel computingfor Big Data,The cloud and Big Data, Cloud Deployment Models, Cloud Delivery Models, Cloud providers in Big Data Market. 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),

Mining Data Streams **08 Hours**

The Stream Data Model, A Data-Stream-Management System, Examples of Stream Sources, StreamQueries, Issues in Stream Processing, Sampling Data in a Stream, Filtering Streams, Estimating Moments, Dealing With Infinite Streams, Counting Ones in a Window.

Frequent Itemsets and Recommendation Systems **12 Hours**

The Market Basket Analysis, A Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream. Recommendation System: A Model, Content Based Recommendations, Collaborative

Filtering, Dimensionality Reduction Problem, TheNetFlix Problem.

Large Scale Machine Learning **10 Hours**

Introduction, Types of Machine Learning Algorithms, Machine Learning Architecture, Applications ofMachine Learning, Supervised Machine Learning Algorithms: Learning from Nearest Neighbors, Support Vector Machines. Unsupervised Machine Learning Algorithms: Hierarchical Clustering Techniques, K-means Algorithms.

Text Books:

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

Reference Books:

1. Big Data Analytics withR and Hadoop,VigneshPrajapati,Packt Publishing, 2013
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, 2015.

SSE230 INTERNET OF THINGS

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

Course Outcomes:

The students should be able to:

CO1: Identify IoT protocol layers, levels and architecture.

CO2: Demonstrate IoT devices using Raspberry Pi and python Programming language.

CO3: Design and demonstrate the various IoT solutions.

Introduction to Internet of things **8 Hours**

Physical design of IOT, Logical Design of IOT, IOT enabling technologies, IOT Levels & Deployment Templates, Domain Specific IOTs, Introduction: Home Automation, Cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle

IOT and M2M **10 Hours**

Introduction: M2M, Difference between IoT and M2M, SDN and NFV for IOT, IOT System Management with NETCONF-YANG, Need for IOT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

DEVELOPING INTENET OF THINGS **12 Hours**

Introduction, IoT Design Methodology, Case Study on IoT System For Weather Monitoring, Motivation for Using Python, lot Systems - Logical Design using Python: Introduction, Installing python, Python Data Types and Data structures, Control flow Functions, Modules, Packages, File Handling, Operations, Classes, Python Packages of Interest for IoT

IoT Physical Devices & End points **10 Hours**

What is an lot Device, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices, IoT Physical Services and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, python Web Appliction framework – Django, Designing a RESTful Web API, Amazon Web Services for IoT, SkyNetIoT Messaging platform

Applications of IoT **10 Hours**

Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications

Text Book:

1. ArshdeepBahga, Vijay Madisetti, ”Internet of Things : A Hands on Approach” Universities Press., 2015

Reference Books:

1. Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving
worldof M2M Communications”, Wiley, 2013
2. Michael Miller, The Internet of Things”, First E dition, Pearson, 2015.
3. Claire Rowland,Elizabeth Goodman et.al.,” Designing Connected Products”, FirstEdition,O’Reilly, 2015

SSE241 COMPUTATIONAL INTELLIGENCE

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

Course Outcomes:

After completing this course, the students would be able to:
CO1:Explain the fundamental theory and concepts of Intelligent Systems
CO2: Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules.
CO3: Apply various learning rules to train or design the neural networks.
CO4: Explain basics of an evolutionary computing paradigm and its application to optimization problems
CO5: Analyse how computational intelligence concepts are employed in various applications

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 **10 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**.,***LeszekRutkowski,*** Springer Publisher, 2008.

Reference Books:

1. **Computational Intelligence: An Introduction.,*Andries P. Engelbrecht,*** Wiley Publisher, Second Edition, 2007.
2. **Fuzzy Logic with Engineering Applications, *Timothy J.Ross*,**Wiley-Blackwell Publisher, Third Edition, 2010.
3. **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**

Course outcomes

On successful completion of the course, students should be able to:

CO1: Apply linguistic rules using finite state transducers for language processing.
CO2: Demonstrate parsers in computational linguistics.
CO3: Create natural language processing applications.
CO4:Discuss clustering of text data in natural language processing applications.
CO5: Illustrate machine translation system using machine learning algorithms.

Introduction **10 Hours**

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

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

Computational Discourse **10 Hours**

Discourse segmentation, Text coherence, reference resolution, reference phenomena, Features for pronominal anaphora resolution, Algorithms for anaphora resolution, coreference resolution, evaluation of coreference resolution.

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 Books:

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 HinrichSchütze, Foundations of Statistical Natural Language Processing, MIT Press. Cambridge, MA: May 1999.

SSE243 BIOINFORMATICS

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

Course Outcome :

On successful completion of the course students will have the ability to:

CO1 : Explain Bioinformatics, biological databases and data models.
CO2: Obtain sequence data from biological databases and compare different formats.
CO3 : Analyze and evaluate methods of sequence alignment, utilize similarity finding tools to compare sequence data.
CO4 : Design applications using bioinformatics algorithms for gene finding, predictions and genome studies.
CO5 : Engage in independent study to analyze and interpret protein structure using biostatistics & biological tools and compare different methods and strategies of structure prediction.

Introduction and NCBI Data Model **8 Hours**

Introduction to Bioinformatics, Goal, Scope, Applications, Limitations, New Themes, Introduction to Database, Types of Databases, Biological Databases, Pitfalls of Biological Databases. Introduction to NCBI data model, PUBs: Publications or Perish, SEQ-Ids: What's in a Name? BIOSEQs: Sequences, BIOSEQ-SETs: Collections of Sequences, SEQ-ANNOT: Annotating the Sequence,SEQ-DESCR: Describing the Sequence, Using the Model.

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 **10 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 Prediction 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 Common 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. JinXiong (2006) Essential Bioinformatics, Cambridge University Press,
2. Baxevanis A. D. and B. F. Francis Ouellette, (2001) Bioinformatics a practical guide to the analysis of genes and proteins. Second edition, John Wiley and Sons.
3. An Introduction to Bioinformatics Algorithms, Neil C Jones and Pavel A Pevzner, MIT Press, 2004.

Reference Books:

1. Bioinformatics - Concepts, Skills, and Applications, S.C. Rastogi, NamitaMendiratta, ParagRastogi, Second Edition, CBS Publishers, 2003.
2. Bioinformatics: Databases, Tools, And Algorithms.,OrpitaBosu, Simminder Kaur Thukral, Oxford University Press Publisher, 2007.
3. Fundamentals of Mathematical Statistics., S.C. Gupta and V.K. Kapoor, Eleventh Edition, Sultan Chand & Sons Publishers, 2007.

Online Courses:

1. NPTEL:https://nptel.ac.in/courses/102106065/

SSE251 ADVANCED DATA MINING TECHNIQUES

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

Course Outcomes:

After completion of this course, students should be able to :
CO1: Explain the various data preparation and streaming data mining techniques.
CO2: Evaluate the advanced concepts of data mining tools & techniques.
CO3: Apply mining data stream concepts to develop applications.
CO4: Apply association rules to design to develop a decision system.
CO5: Understand the recent research trends in Data Mining.

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, Multi-relational 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 Item-set Generation, Compact Representation of Frequent Itemsets, FP-Growth Algorithms, Handling Categorical and Continuous Attributes, Handling a Concept Hierarchy, Sequential Patterns, Subgraph Patterns, Infrequent Patterns, Counting Frequent Items in a Stream.

Data Mining Methods as Tools **12 Hour**

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, MichelineKamber, Jian Pei*, Third Edition, Morgan Kauffmann Publishers, 2011.

2. Advanced Data Mining Techniques, *David L. Olson, DursunDelen,* 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**

Course Outcomes

On successful completion of the course, students should be able to:

CO1: Identify the characteristics of wireless and mobility models.
CO2: Analyze and provide solutions for issues related to MAC and network protocols
CO3: Implement the related end-to-end delivery, security and cross layer designs.

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 Control 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 and 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 designing- 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 perspective. Integration of adhoc with Mobile IP networks.

Text Books:

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, Mobileadhoc 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 FORMAL METHODS IN SOFTWARE ENGINEERING

Total Teaching hours: 50 **No of credits: 5**

Course Outcomes:

After completion of course student should be able to
CO1:Explain the need for formal methods
CO2:Apply discrete structures for proving the correctness of the program
CO3:Demonstrate the various software specifications

Introduction **10 Hrs**

Motivation, Some Industrial Applications, What Is a Formal Method?, From Software Engineering to Formal Methods, On Weaknesses of Formal Methods, A Survey of Formal Methods, Sketch of a Formal Specification, Is There a Solution?, Program Development

Formal Logic **10 Hrs**

Some Applications of Logic, Antecedents. The Different Branches of Logic, Mathematical Reminders, Well-founded Relations and Ordinal, Fixed Points, More about Computability. Hoare Logic, Introducing Assertions in Programs, Verification Using Hoare Logic, Program Calculus, Scope of These Techniques.

Classical logic **10 Hrs**

Propositional Logic, First-order Predicate Logic, Significant Examples, On Total Functions, Many-sorted Logics, Second-order and Higher-order Logics, Model Theory

Set-theoretic specification **12 Hrs**

The Z Notation., VDM, The B Method, Typical Features, Zermelo-Fraenkel Axiomatic System, Induction, Sets, Abstract Data Types and Polymorphism, Properties of ZF and ZFC. Behavioral Specifications, Unity, Transition Systems, CCS, a Calculus of Communicating Systems, The Synchronous Approach on Reactive Systems, Temporal Logic, TLA, Verification Tools.

Deduction Systems **08 Hrs**

Hilbert Systems, Natural Deduction, The Sequent Calculus, Applications to Automated Theorem Proving, Beyond First-order Logic, Dijkstra-Scholten's System, A Word About Rewriting Systems, Results on Completeness and Decidability. Using Type Theory: The Calculus of Inductive Constructions, More on Type Theory, a Program Correct by Construction, On Undefined Expressions

Text Book:

1. Michael G. Hinchey, Understanding Formal Methods, Springer 2003

Reference Books:

1. Gerard O'Regan Concise Guide to Formal Methods: Theory, Springer 2017
2. Paul Boca, Jonathan P. Bowen, Jawed Siddiqi, Formal Methods: State of the Art and New Directions, Springer, 2009