Syllabus: ***M.Tech. in Computer Science and Engineering***

Semester - I					
Course Code	**Subject**	**Scheme / Mode**			**Credits**
		L	**T**	**P**	
RCC- PCT-MCSE-101	Mathematical Foundations of Computer Science	3	0	0	3
RCC-PCT-MCSE-102	Advanced Algorithms	3	0	0	3
RCC-PET-MCSE-103	**Elective I (PET):** a) Soft Computing Techniques b) Advanced DBMS and Data Warehousing c) Graphics and Multimedia	3	0	0	3
RCC-PET-MCSE-104	**Elective II (PET):** a) Distributed Systems b) Big Data Analytics c) Internet of Things	3	0	0	3
RCC-PROJ-MCSE-105	Research Methodology and IPR	2	0	0	2
RCC- PCL-MCSE-191	Advanced Programming Lab	0	0	4	2
RCC-PEL-MCSE-192	**Elective III (PEL):** a) Distributed Systems Lab b) Big Data Analytics Lab c) Internet of Things Lab	0	0	4	2
RCC-AU-MCSE-181	Techniques and Languages for Research Paper Writing.	4	0	0	0
Total		**18**	**0**	**8**	**18**

Semester - II					
Course Code	**Subject**	**Scheme / Mode**			**Credits**
		L	**T**	**P**	
RCC-PCT-MCSE-201	Data Science	3	0	0	3
RCC-PCT-MCSE-202	Machine Learning	3	0	0	3
RCC-PET-MCSE-203	**Elective IV (PET):** a) Cloud Computing b) Pattern Recognition c) Principles of Computer Security d) High Performance Computing	3	0	0	3
RCC-PET-MCSE-204	**Elective V (PET):** a) Digital Image Processing b) NLP	3	0	0	3
RCC-PCL-MCSE-291	Machine Learning with Python Lab	0	0	4	2
RCC-PEL-MCSE-292	**Elective VI (PEL):** a) Digital Image Processing Lab b) NLP Lab	0	0	4	2
RCC- PROJ MCSE-281	Minor Project & Seminar	0	0	4	2
RCC-AU- MCSE-281	Soft Skill and Personality Development	2	0	0	0
Total		**14**	**0**	**12**	**18**

Semester - III					
Course Code	**Subject**	**Scheme / Mode**			**Credits**
		L	**T**	**P**	
RCC-PET-MCSE-301	**Elective IV (PET):** a) Deep Learning b) Block Chain c) MOOCS-1(NPTEL/SWAYAM) 12 Week Program related to course structure subject to approval of the HOD of the Department.	3	0	0	3
RCC-OET-MCSE-301	**Elective V (OET):** a) MOOCS-2(NPTEL/SWAYAM) 12 Week Program related to course on Engineering/Management/Mathematics subject to approval of the HOD of the Department b) Quantum Information Processing	3	0	0	3
RCC-PROJ-MCSE-381	Industrial Project/Training(Min 4 weeks duration)	0	0	8	2
RCC- PROJ-MCSE-382	General Viva-Voce				2
RCC- PROJ-MCSE-383	Dissertation I + Defense of Dissertation I	0	0	12	6
Total		**6**	**0**	**20**	**16**

Semester-IV					
Course Code	**Subject**	**Scheme / Mode**			**Credits**
		L	**T**	**P**	
RCC-PROJ-MCSE-481	Dissertation-II + Defense of Dissertation II	0 0	0 0	32	16
Total				**32**	**16**
Grand Total					**68**

Course Name	Mathematical Foundations of Computer Science	**Course Code**	**RCC- PCT- MCSE-101**
Semester	1st Semester	**Program Name**	M.Tech in CSE
L:T:P	3 :0 : 0	**Total Hours**	36

Course Pre-requisite:

1. B.Tech./M.Sc (Computer Science & Engineering) level mathematics.

CO Number	**Statement**	**Knowledge Level**
RCC- PCT- MCSE-101.CO1	**Understand** the advance graph theory for networking like Tree, Planar graphs, Graph colouring, Matching and Marriage Problems etc.	Understanding (K2)
RCC- PCT- MCSE-101.CO2	**Demonstrate** the utility of Graph theory in Computer Science Applications	Applying(K3)
RCC- PCT- MCSE-101.CO3	**Understand** the basic notions of discrete & continuous probability and statistics.	Understanding (K2)
RCC- PCT- MCSE-101.CO4	**Apply** probability and statistics to construct mathematical models as well as their solutions.	Applying(K3)
RCC- PCT- MCSE-101.CO5	**Formulate** mathematical models and their solution methods using optimization theory	Creating(K6)
RCC- PCT- MCSE-101.CO6	**Analyze** future events as well as long-term behavior of modeling systems with statistical inference methods.	Analyzing(K4)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	**Advance Graph Theory:** Trees and its properties, Minimal spanning tree, Rooted trees and Binary trees, Planar graphs, Euler's formula, Statement of Kuratowski's theorem, Dual of planer graph, Graph colouring, Chromatic number, Statement of Four-color theorem, Chromatic Polynomials, Independence number and Clique number, Matching and Marriage Problems, Hall's Marriage Theorem.	8	CO1 & CO2
2	**Probability & Statistics:** Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, Variance, Conditional expectation, Applications of the univariate and	10	CO3 & CO4

	multivariate, Central Limit Theorem, Probabilistic inequalities, Random samples, Sampling distributions of estimators, Methods of Moments and Maximum Likelihood.		
3	**Optimization Theory:** Fundamentals of optimization theory, Optimization problems, Classification of Optimization problems, Optimization techniques, Applications of optimization, Formulation of Linear Programming Problem (LPP) and Non-Linear Programming Problem (NLPP), Local and Global optima, Concave and Convex functions, Unconstrained and Constrained NLPP, Modelling using optimisation problems and its solution.	10	CO5
4	**Stochastic process:** Statistical inference, Introduction to multivariate statistical models, Regression and classification problems, Principal components analysis, The problem of over fitting model assessment. Random variables, Random processes, Random Walk, Brownian motion, Markov process, queues: (M/M/1) : (/FIFO), (M/M/1) : (N/FIFO).	8	CO6

Text Books:

1. Operations Research: An Introduction by H. A. Taha.10th Edition
2. Graph Theory by N. Deo, 7th Edition
3. Probability and Statistics by S. Sen, S. K. De and A. Banerjee, 5th Edition
4. Stochastic Processes by Sheldon M. Ross, 2nd Edition

Reference Books:

1. Operations Research: Introduction to Management Science by Swarup Kanti, Gupta P K, Mohan Man. Publisher: Sultan Chand & Sons.
2. Operations Research by S. Kalavathy
3. Graph Theory by R. Diestel, Springer-Verlag.
4. Probability and Statistical Inference by D. Bhattacharya and S Roychowdhury

Course Name	Advanced Algorithms	**Course Code**	**RCC- PCT- MCSE-102**
Semester	1st Semester	**Program Name**	M.Tech in CSE
L:T:P	3 :0 : 0	**Total Hours**	36

Course Pre-requisite:

1. Data Structure and Algorithms
2. Design & Analysis of Algorithm

CO Number	**Statement**	**Knowledge Level**
RCC- PCT- MCSE-102.CO1	**Understanding** the complexity analysis of various sorting algorithms using asymptotic notation.	Understanding (K2)
RCC- PCT- MCSE-102.CO2	**Solve** the applications by using algorithm designing techniques like Dynamic Programming, Greedy Method, Branch and Bound, Backtracking.	Applying(K3)
RCC- PCT- MCSE-102.CO3	**Analyze** the network flow strategies and their solutions.	Analyzing(K4)
RCC- PCT- MCSE-102.CO4	**Demonstrate** the various methods of performing traversal and amortized algorithms analysis	Applying(K3)
RCC- PCT- MCSE-102.CO5	**Explain** the types of complexity classes of problems.	Understanding (K2)
RCC- PCT- MCSE-102.CO6	**Design** of randomized and approximation algorithms and their applications.	Creating(K6)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	**Complexity Analysis and Complexity Analysis for Sorting and Searching Algorithm :-** Growth of functions, Asymptotic Notations, Recurrences, Solution of recurrence relations by substitution method, Recursion Tree method, Master Theorem, Best case, worst case and average case analysis algorithms: Merge sort, quick sort and Heap Sort.	6	CO1
2	**Algorithm designing techniques**: **Dynamic Programming**: Application- Travelling Salesperson Problem, Knapsack problem, Single source and All Pair shortest path Algorithms. **Greedy Techniques**: Fractional Knapsack, Prims and Kruskal Algorithms. **Backtracking:** N-Queen Problems, Graph Colouring Problem, Hamiltonian Circuits. **Branch & Bound**: 8 & 15 puzzle problems **Graph Traversal techniques**: BFS & DFS	10	CO2 &CO4

3	**Network Flow**: Maximum Flow problem, Ford-Fulkerson algorithm, Max flow min cut theorem, augmenting paths, applications to bipartite matching problem and disjoint paths in directed and undirected graphs. **Amortized Algorithm**: Aggregate Analysis, Accounting method, Potential method. Etc.	6	CO3 & CO4
4	**Complexity Classes**: Tractable & intractable problems, NP-Hard and NP-complete problems, Cook's Theorem, NP-completeness reductions. **Approximation Algorithms**: Polynomial Time and fully polynomial time approximation schemes, Probabilistic Complexity classes, Probabilistic Proof theory and certificates **Randomized Algorithms**: Finger Printing, Pattern matching, Graph Problems, Algebric methods, Probabilistic Primality testing, D-randomization.	8	CO5 & CO6

Text Books:

1. Ellis Horowitz, Sartaz Sahani, and Sanguthevar Rajasekaran Fundamentals of Computer Algorithms, 2nd Edition.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition.
3. Sara Baase and Allen Van Gelder. Computer Algorithms: Introduction to Design and Analysis, Pearson education (Singapore) Pvt. Ltd, New Delhi 2007, Publisher Pearson, 3rd Edition.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, Algorithms, TataMcGraw-Hill, 1st Edition.
2. Alfred V. Aho, JohnE. Hopcroft, Jeffrey D. Ullma. The Design and Analysis of Computer Algorithms, Pearson Education (Singapore) 2006.

Course Name	Soft Computing Techniques	Course Code	RCC-PET-MCSE-103(a)
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	3:0:0	**Total Hours**	36 Hrs

Course Pre-requisite:

1. Mathematical concepts on statistics and, probability.
2. Discrete Mathematics, Image processing for application and verification.

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-PET-MCSE-103(a).CO1	**Understand** the concepts of Machine intelligence along with its difference from Computational Intelligence.	Understanding (K2)
RCC-PET-MCSE-103(a).CO2	**Demonstrate** fuzzy logic and neural network as well as it's application to real life problems.	Applying (K3)
RCC-PET-MCSE-103(a).CO3	**Understand** Classification and clustering techniques and its applications.	Understanding (K2)
RCC-PET-MCSE-103(a).CO4	**Design** the advanced neural network models and its applications.	Creating (K6)
RCC-PET-MCSE-103(a).CO5	**Perform** various operations of genetic algorithms.	Applying (K3)
RCC-PET-MCSE-103(a).CO6	**Comprehend** various techniques to build model for various applications.	Understanding (K2)

Detailed Syllabus:

Module #	Contents	Contact Hours	CO Linked
1	Evolution of Soft Computing- Soft Computing paradigm, Machine learning Basics. **Fuzzy Logic:** Fuzzy sets and Fuzzy logic, Fuzzy sets versus crisp sets, membership function, Membership Value Assignment technique, operations on fuzzy sets, linguistic variable, Fuzzy relations—Cartesian product, Operations on relations; Extension principle, Defuzzification methods (Max membership principle, Centroid method, Weighted average method). Composition operation (T-norm, Tconorm) , Fuzzy if then rules. Type2 Fuzzification, Fuzzy Rule-Based Systems.	10	CO1& CO2
2	**Artificial Neural Networks:**		CO2 & CO3

	Basic concept of neural networks, Mathematical model, implementation of logical AND, OR, XOR functions. Typical architectures: single layer, multilayer, Common activation functions; Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron. Classification techniques: Supervised, unsupervised & reinforced.	12	
3	**Deep learning:** Why Deep Learning? Architecture of Convolutional Networks, Recurrent Nets, Deep Learning Use Cases.	2	CO4
4	**Genetic Algorithms:** Evolutionary Algorithms: Genetic Algorithm (GA), role of GA in optimization, Selection of initial population, Cross over, Mutation, Inversion, Deletion, convergence of Genetic Algorithm.	8	CO5
5	**Hybrid Systems**: Neuro Fuzzy Systems, Fuzzy Logic-Based Neural Networks.	4	CO6

Text Books:

1. S. Rajasekaran & G. A. V. Pai , Neural Networks, Fuzzy logic, and Genetic Algorithms, PHI.
2. Pravir Chawdhry, Rajkumar Roy, Raj Pant, Soft Computing in Engineering Design and Manufacturing, Springer.

Reference Books:

1. Haykin, Neural Networks, Pearson Education, 2nd edition, 2001.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
3. Deep Learning: From Logical Calculus to Artificial Intelligence (Undergraduate Topics in Computer Science) Sandro Skansi.

Course Name	Advanced DBMS and Data Warehousing	Course Code	RCC-PET-MCSE-103(b)
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	3:0:0	**Total Hours**	36 Hrs

Course Pre-requisite:

1. Data processing and file structure.
2. Database management system

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-PET-MCSE-103(b).CO1	**Understand** the distributed database system and its architectural overview for representation of data.	Understanding (K2)
RCC-PET-MCSE-103(b).CO2	**Understand** the distributed query management of Database system.	Understanding (K2)
RCC-PET-MCSE-103(b).CO3	**Determine** the query cost of database management.	Evaluating (K5)
RCC-PET-MCSE-103(b).CO4	**Evaluate** knowledge from the database system.	Evaluating (K5)
RCC-PET-MCSE-103(b).CO5	**Analyse** the similarity and dissimilarity of data.	Analyzing (K4)
RCC-PET-MCSE-103(b).CO6	**Synthesize** the statistical modelling of Market data analysis.	Evaluating (K5)

Detailed Syllabus:

Module #	Contents	Contact Hours	CO Linked
1	Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Complicating factors, Problem areas, DDBMS Architecture Models- Autonomy, Distribution, Heterogeneity DDBMS Architecture –Client/Server, Peer to peer, MDBS.	6	CO1
2	Optimization of distributed queries, centralised query optimisation, join Ordering, Distributed query processing algorithms.	5	CO2
3	Query processing, Distributed Query processing, Query Optimization techniques, Transformation of Relational Expressions, Equivalence Rules, Catalog Information for Cost Estimation, Cost-based optimization.	7	CO3
4	Knowledge discovery in databases (KDD), knowledge		CO4

	extraction, data/pattern analysis, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity, Outlier detection, Boxplot, Quantile Plot, Scatter Plot analysis.	7	
5	Proximity Measure for Numeric Attributes of data: Maximum Likelihood Estimate, Euclidean distance, Manhattan distance, Minkowski distance, Supremum distance. Cosine Similarity of Two Vectors.	4	CO5
6	Data Warehousing and OLAP, OLTP, Schematic Representation, Design of Data warehouse models, Knowledge discovery: Market basket analysis, Apriori algorithm, FP Growth algorithm	7	CO3 & CO6

Text Books:

1. Leon & Leon, Essentials of DBMS, McGraw Hill Education (1 January 2008).
2. Henry F. Korth and Silberschatz Abraham, Database System Concepts, Mc.Graw Hill.

Reference Books:

1. Saeed K. Rahimi, Frank S. Haug, Distributed Database Management Systems: A Practical Approach, Willey.

Course Name	Graphics and Multimedia	Course Code	RCC-PET-MCSE-103(c)
Semester	1st	Program Name	M.Tech in CSE
L:T:P	3:0:0	Total Hours	36 Hrs

Course Pre-requisite:

1. Programming and Data Structures
2. Designing and Analysis of Algorithms

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-PET-MCSE-103(c).CO1	**Understanding** the fundamental concepts of computer graphics and multimedia, including color models, basic algorithms, and hardware components.	Understanding (K2)
RCC-PET-MCSE-103(c).CO2	**Analyze** various algorithms for 2D and 3D graphics, including line drawing, circle generation, and transformations with their efficiency in different scenarios.	Analyzing (K4)
RCC-PET-MCSE-103(c).CO3	**Develop** the construction of 2D and 3D graphics applications by demonstrating the ability to apply transformation techniques, viewing pipelines, and clipping algorithms.	Creating (K6)
RCC-PET-MCSE-103(c).CO4	**Examine** the advanced computer graphics techniques such as curve representation, hidden surface removal, and shading models by **evaluating** their suitability for different applications.	Evaluating (K5)
RCC-PET-MCSE-103(c).CO5	**Design** multimedia content by integrating various elements (images, audio, video) and assess the effectiveness of different compression and storage techniques in multimedia systems.	Creating (K6)
RCC-PET-MCSE-103(c).CO6	**Develop** hypermedia projects by combining computer graphics and multimedia elements, and critically evaluate the user interface and overall system design.	Creating (K6)

Detailed Syllabus:

Module #	Contents	Contact Hours	CO Linked
1	**Introduction to Computer Graphics and Graphics Systems** (8L): Overview of Computer Graphics, Scan Conversion, Line	10	CO1 & CO2

	drawing algorithms: DDA, Bresenham's, Circle generation: Midpoint circle algorithm, Ellipse generation: Midpoint ellipse algorithm, Polygon filling: Scan line, boundary fill algorithms.		
2	**2D and 3D Transformation and Viewing**: 2D Transformation and Viewing, Basic transformations: translation, rotation, scaling, Matrix representations and homogeneous coordinates Viewing pipeline, window to viewport transformation, Clipping: Cohen-Sutherland, Liang-Barsky line clipping, 3D Transformation and Viewing, 3D transformations: translation, rotation, scaling, Parallel and perspective projections, 3D viewing pipeline, 3D clipping.	9	CO2 & CO3
3	**Curves, Surfaces, and Advanced Techniques**: Curves and Surfaces, Curve representation and design,Bézier curves, B-spline curves, Hidden Surfaces and Lines, Z-buffer algorithm, Back-face detection, BSP tree method, Painter's algorithm, Scan-line algorithm.	10	CO3 & CO4
4	**Multimedia Fundamentals**: Introduction to Multimedia, Concepts, uses, hypertext, and hypermedia, Image standards and processing, Video standards and compression, Audio standards and processing, Digital audio: sampling, compression	3	CO1 & CO5
5	**Multimedia System Design and File Handling:** Multimedia System Design: Multimedia basics and applications, Compression and decompression techniques.	2	CO1 & CO5
6	**Hypermedia**: Hypermedia: Multimedia authoring and user interface, Animation: types, techniques, key-frame animation.	2	CO6

Text Books:

1. Computer Graphics: Principles and Practice by John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, and Kurt Akeley.
2. Introduction to computer graphics and multimedia by Anirban Mukherjee and Arup Chattopadhyay, N. Delhi Vikas 2007, 2nd Edition
3. Fundamentals of Computer Graphics by Peter Shirley, Michael Ashikhmin, Steve Marschner, and others.
4. Multimedia: Computing, Communications, and Applications" by Ralf Steinmetz and Klara Nahrstedt.
5. Multimedia Systems Design" by Prabhat K. Andleigh and Kiran Thakrar.

Reference Books:

1. Introduction to Computer Graphics and the Vulkan API by Kenwright.

2. Mathematical Elements for Computer Graphics by David F. Rogers and J. Alan Adams.
3. Real-Time Rendering" by Tomas Akenine-Möller, Eric Haines, and Naty Hoffman

Course Name	Distributed Systems	**Course Code**	RCC- PET-MCSE-104(a)
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	3 : 0 : 0	**Total Hours**	36

Course Pre-requisite:

1. Operating System

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC -PET-MCSE-104(a).CO1	**Understand** the Evolution and Issues of Distributed system	Understanding(K2)
RCC-PET- MCSE-104(a).CO2	**Understand** the concepts of Inter process communication in Distributed Environment	Understanding(K2)
RCC-PET- MCSE-104(a).CO3	**Demonstrate** the concepts of Remote Procedure Call in Distributed Environment	Applying(K3)
RCC-PET- MCSE-104(a).CO4	**Analyze** the concept of Distributed shared memory	Analyzing(K4)
RCC-PET-MCSE-104(a).CO5	**Understand** the concept of Distributed process management	Understanding(K2)
RCC-PET- MCSE-104(a).CO6	**Design** the concept of Distributed file system	Creating(K6)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	Introduction to Distributed Computing Systems: Evolution of distributed computing systems, Distributed computing systems models, issues in the design of distributed operating systems.	6	CO1
2	Inter-process Communication in Distributed Systems: Message passing, synchronization, buffering, failure handling, group communication.	6	CO2
3	Remote Procedure Calls: Remote Procedure Call (RPC) models, transparency of RPC, RPC messages, Marshalling arguments and results, exception handling, lightweight RPC.	6	CO3
4	Distributed Shared Memory:General architecture of Distributed Shared Memory (DSM), granularity, replacement strategies, thrashing.	6	CO4
5	Distributed Process Management: Synchronization – clock synchronization, event ordering, mutual exclusion; election algorithm, process migration,	6	CO5

	threads.		
6	Distributed File System: File accessing models, file-sharing semantics, file-caching semantic, case-study: Network file systems.	6	CO6

Text Books:

1. Distributed Operating Systems, Concept and Design, P.K. Sinha, Prentice Hall of India, 1st edition
2. Distributed Systems, Coulouris, Pearson Education 5th edition
3. Vijay K. Garg, Elements of Distributed Computing Wiley, 1st edition

Reference Books:

1. Distributed Operating Systems, Tannenbaum, Pearson Education
2. Distributed Systems, Jie Wu, CRC Press
3. Distributed Computing: Fundamentals, Simulations and Advanced Topics, Hagit Attiya, Jennifer Welch, McGraw-Hill

Course Name	Big Data Analytics	**Course Code**	RCC-PET-MCSE-104(b)
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	3 : 0 : 0	**Total Hours**	36

Course Pre-requisite:

1. Advanced Programming Knowledge
2. Basic knowledge of DBMS

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PET-MCSE-104(b).CO1	**Understand** the scope of big data in industry and research.	Understanding(K2)
RCC-PET-MCSE-104(b).CO2	**Demonstrate** the architecture and functionality of unstructured data.	Applying(K3)
RCC-PET-MCSE-104(b).CO3	**Analyze** the architecture of NOSQL unstructured database.	Analyzing(K4)
RCC-PET-MCSE-104(b).CO4	**Demonstrate** the Hadoop framework, Hadoop Distributed File System and Mapreduce.	Applying(K3)
RCC-PET-MCSE-104(b).CO5	**Understand** the techniques for HADOOP programming workflow.	Understanding(K2)
RCC-PET-MCSE-104(b).CO6	**Design** spark programming with different programming languages and graph algorithms	Creating(K6)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	Understanding Big Data: Concepts and terminology, Big Data Characteristics, Different types of Data, Identifying unstructured data characteristics, Big data application in business analytics, marketing, web analytics, credit risk management, healthcare etc.	2	CO1 & CO2
2	Introduction to NoSQL, aggregate data models, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, CAP theorem, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations, Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts,	16	CO3 & CO4

	Hadoop I/O, data integrity, compression, serialization, file-based data structures.		
3	Map Reduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats, Pipelining MapReduce jobs.	9	CO5
4	Overview of Spark – Hadoop Overview of Spark – Hadoop vs. Spark – Cluster Design –Cluster Management – performance, Application Programming interface (API): Spark Context, Resilient Distributed Datasets, Creating RDD, RDD Operations, and Saving RDD -Lazy Operation – Spark Jobs. Writing Spark Application - Spark Programming in Scala, Python, R, Java – Application, Execution, GraphX overview –Creating Graph – Graph Algorithms.	9	CO6

Text Books:

1. Distributed Operating Systems, Concept and Design, P.K. Sinha, Prentice Hall of India, 1st edition
2. Distributed Systems, Coulouris, Pearson Education 5th edition
3. Vijay K. Garg, Elements of Distributed Computing Wiley, 1st edition

Reference Books:

1. Distributed Operating Systems, Tannenbaum, Pearson Education
2. Distributed Systems, Jie Wu, CRC Press
3. Distributed Computing: Fundamentals, Simulations and Advanced Topics, Hagit Attiya, Jennifer Welch, McGraw-Hill

Course Name	Internet of Things	**Course Code**	RCC-PET-MCSE-104(c)
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	3 : 0 : 0	**Total Hours**	36

Course Pre-requisite:

1. Basics of Computer Network
2. Basic of Electronics

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PET-MCSE-104(c).CO1	**Understand** the basics of IoT, detailed architecture,	Understanding(K2)
RCC-PET-MCSE-104(c).CO2	**Implement** appropriate sensors and embedded devices for data acquisition.	Applying(K3)
RCC-PET-MCSE-104(c).CO3	**Discuss** about IoT communication protocol	Understanding(K2)
RCC-MCSE-PET-104(c).CO4	**Experiment** the various development board for IoT communications.	Applying(K3)
RCC-PET-MCSE-104(c).CO5	**Demonstrate** the IoT data processing and interfacing different cloud API communication.	Applying(K3)
RCC-PET-MCSE-104(c).CO6	**Examine** about the IoT security and authentication.	Analyzing(K4)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	Definition and History of Internet of Things (IoT), IoT applications and use cases, IoT architecture and components, IoT market trends and future prospects. Types of IoT devices and sensors, Sensor characteristics and selection criteria, Interfacing sensors with microcontrollers, Real-world sensor applications.	6	CO1& CO2
2	Overview of IoT communication protocols - HTTP, MQTT, CoAP, LoRaWAN, Zigbee, Comparison of communication protocols, Practical implementation of MQTT and HTTP. IoT network architecture (PAN, LAN, WAN), IPv6 and IoT, Network topologies and protocols. Introduction to microcontrollers (Arduino, Raspberry Pi, ESP8266/ ESP32), Basic programming for microcontrollers, Interfacing IoT devices with microcontrollers. Data collection and storage in IoT.	12	CO2 & CO3

3	Data preprocessing and analysis, Cloud computing for IoT, Overview of IoT platforms (AWS IoT, Google Cloud IoT, Microsoft Azure IoT).	9	CO3, CO4&CO6
4	Security challenges in IoT, Authentication and authorization, Data encryption and privacy, Secure communication protocols. Overview of IoT standards and regulation protocols, Regulatory requirements for IoT, Standardization bodies and frameworks, Case studies on IoT standardization.	9	CO4, CO5&CO6

Text Books:

1. Internet of Things: AHands On Approach by Arshdeep Bahga and Vijay Madisetti
2. Internet of Things: Principles and Paradigms edited by Rajkumar Buyya and Amir Vahid Dastjerdi
3. Internet of Things: Architecture and Design Principles (A Practical Approach) by Raj Kamal, 2nd Edition, McGraw Hill.

Reference Books:

1. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally, Publisher - John Wiley & Sons Inc, Edition
2. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher
3. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry by Maciej Kranz

Course Name	Research Methodology and IP	**Course Code**	**RCC- PROJ- MCSE-105**
Semester	1st Semester	**Program Name**	M.Tech in CSE
L:T:P	2 :0 : 0	**Total Hours**	24

Course Pre-requisite:

1. Basic foundations of Mathematics.
2. Basic skill sets to understand and the proper skill set to address a Research Based Problem.

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PROJ- MCSE-105.CO1	**Understand** the significance of the research problem and the importance of literature review in formulating a research problem	Understanding (K2)
RCC- PROJ- MCSE-105.CO2	**Develop** various research designs required to solve any research problem	Creating(K6)
RCC- PROJ- MCSE-105.CO3	**Describe** how to collect and analyze data, from processing, sampling and developing single data analysis techniques.	Understanding (K2)
RCC- PROJ- MCSE-105.CO4	**Examine** the art of writing a proper unplagarised research report.	Analyzing(K4)
RCC- PROJ- MCSE-105.CO5	**Design** a comprehensive skill set to understand the importance of IPRs such as patents, copyrights, trademarks of a research work.	Creating(K6)
RCC- PROJ- MCSE-105.CO6	**Understand** the necessary ethics as well as national/international laws to understand before filing an IPR.	Understanding(K2)

Detailed Syllabus:

Module #	**Contents**	**Contact Hours**	**CO Linked**
1	An introduction to Research Methodology: Significance of Research methodology, Criteria of Good Research, Research Process decision, planning, conducting, Classification of Research Methods; Reflective Thinking, Necessity of a Research work, Importance of Literature Review.	6	CO1
2	Research Design: Meaning of Research Design, Need for Research Design, Important Concepts Relating to Research Design, Different Research Designs, Different sampling design, Measurement and scaling techniques involved in research design.	6	CO2

3	Data collection:- Processing and Analysis of Data, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Some Fundamental Definitions, Important Sampling Distributions, Central Limit Theorem, Testing of Hypotheses-I (Parametric or Standard Tests of Hypotheses), chi-square Test, Analysis of Variance and Covariance, Interpretation and Report Writing, Meaning of Interpretation, Why Interpretation, Technique of Interpretation.	6	CO3& CO4
4	Introduction to IPR (Intellectual Property Rights): Introduction to Intellectual Property: Definition and Concept of Intellectual Property (IP); Types of Intellectual Property: Patents, Trademarks, Copyright, Trade Secrets, Industrial Design, Geographical Indications, Overview of International IPR Laws and Treaties, Importance of IPR in Business and Innovation, IPR and its Role in Economic Development Overview of Patents: Application Process, Patentability Criteria, Patent Infringement; Copyright: Authorship, Registration, and Protection; Trademarks: Branding, Registration, and Infringement; Geographical Indication: Importance, Registration, and Legal Protection; IP Management Techniques.	6	CO5&CO6

Text Books:

5. Research Methodology Paperback – 1 September 2019 by C.R. Kothari (Author), Gaurav Garg (Author)
6. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by John W. Creswell
7. Research Methodology: A Step-by-Step Guide for Scientists" by Anthony J. T. Wood.
8. Fundamentals of Statistics in Engineering, By: SrijibBhusan Bagchi, Srijibendu Bagchi & Tapati Bagchi , Publisher: Shroff Publishers & Distributors Pvt. Ltd.

Reference Books:

1. Research Methodology: A Step-by-Step Guide for Beginners Ranjit Kumar, by Sage Publishers,4th Edition.
2. The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams, 4th edition

Course Name	Advanced Programming Lab	**Course Code**	RCC- PCL-MCSE-191
Semester	1st	**Program Name**	MTech in CSE
L:T:P	0:0:4	**Total Hours**	48

Course Pre-requisite:

1. The Concept of basic python programming like loops, decision making etc necessary.
2. The concept of python data-structure (string, list, tuple,dictionary,set) for working with advanced python related module.

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PCL MCSE-191.CO1	**Develop** the idea of object-oriented programming like class, object, constructor, inheritance and exception handling in python.	Creating(K6)
RCC- PCL MCSE-191.CO2	**Create** new modules with the intention of importing other modules and packages to address various problems.	Creating(K6)
RCC- PCL MCSE-191.CO3	**Solve** real life problems using numpy and pandas library functions.	Applying (K3)
RCC- PCL MCSE-191CO4	**Analyze** the different data structure using python collection and implement data visualizations using matplotlib/seaborn.	Analyzing (K4)
RCC- PCL MCSE-191.CO5	**Evaluate** the regular expression for validation and parsing from complex structure documents and concept of web scrapping.	Evaluating(K5)
RCC- PCL MCSE-191.CO6	**Design** a project that would be appropriate for covering advanced Python expertise.	Creating (K6)

Detailed Syllabus:

Module #	**Module Name**	**Experiment Topics**	**No of Labs Required**	**CO Linked**
1	Exception Handling	1. Study about Python Exception Handling and Knowledge about User defined exception(s)with implementations. 2. Study about Python Object Oriented Programming like Creating Classes, Methods and objects with implementations using constructors and attributes.	2	CO1
2	OOPS	1. Study about Object Oriented Programming Advanced method like Using Class Attributes and	1	CO1

		Static Methods, Understanding Object Encapsulation, Private Attributes and Methods with implementations.		
3	NUMPY	1. Study of Python Modules in Programs, then implementation of custom modules and importing that custom module in program. 2. Study about Python Numpy Library basic and implements of vectors and matrices using python numpy. 3. Implement the complex matrix manipulations using advanced numpy in Python.	3	CO2 & CO3
4	PANDAS	1. Study and implements about Pandas and Data Structures – Series and data-frames with Filter Concept. 2. Study and implementation of Grouping, Merging, Joining using pandas	2	CO3
5	Data Visualization	1. Study about Python Data Visualization Matplotlib/Seaborn and implement different graph plot like Scatter plot,Line plot, Bar chart,Histogram,Box plot in python. 2. Study about Python CollectionModule and implements different collections like Counters,OrderedDict,DefaultDict,ChainMap,NamedTuple, DeQue,UserDict,UserList and UserString.	2	CO4
6	Regular Expression and Web Scrapping	1. Study about Python Regular Expression and metacharacters concept. Implements the different regular expression for extracting information from text. 2. Study about Web Scrapping and implements webscrapping using“Beautiful Soup” module.	2	CO5

Text Books:

1. Python Data Science Handbook by Jake VanderPlas,O'Reilly Media, Inc.
2. Python for Data Science: 2 Books in 1. A Practical Beginner's Guide to learn Python Programming, introducing into Data Analytics, Machine learning, Web Development, with Hands-on Projects by Erick Thompson
3. Mastering matplotlib: A practical guide that takes you beyond the basics of matplotlib and gives solutions to plot complex data By Duncan M. McGreggor

Reference Books:

1. Fluent Python: Clear, Concise, and Effective Programming, Second Edition (Grayscale Indian Edition) by Luciano Ramalho
2. Hands-on Matplotlib: Learn Plotting and Visualizations with Python3 by Ashwin Pajankar
3. Web Scraping with Python, 2nd Edition by Ryan Mitchell

Course Name	Distributed Systems Lab	**Course Code**	**RCC- PEL-MCSE-192(a)**
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	0:0:4	**Total Hours**	48

Course Pre-requisite:

3. Proficient in C.
4. Proficient in Core Java.

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PEL-MCSE - 192(a).CO1	**Understand** the design principles and foundations on which the Internet and other distributed systems are based with the architectures for distributed systems	Understanding (K2)
RCC- PEL-MCSE - 192(a).CO2	**Use** a variety of distributed methods for load balancing, voting, deadlock detection, concurrency control, and clock synchronization.	Applying(K3)
RCC- PEL-MCSE - 192(a).CO3	**Analyze** fault tolerance and recovery in distributed systems and algorithms for the same.	Analyzing(K4)
RCC- PEL-MCSE - 192(a).CO4	**Analyze** the design and functioning of existing distributed systems and file systems.	Analyzing(K4)
RCC- PEL-MCSE - 192(a).CO5	**Implement** the client server using RPC, RMI and multithreaded way.	Evaluating(K5)
RCC- PEL-MCSE - 192(a).CO6	**Implement** different distributed algorithms over current distributed platforms	Evaluating(K5)

Detailed Syllabus:

Module #	**Module Name**	**Experiment Topics**	**No of Labs Required**	**CO Linked**
1	Mutual Exclusion	Study of Non token based algorithm for Mutual Exclusion.	2	CO1&CO2
2	Lamport Logical Clock	Study of determining the Order of event's(Lamport Logical Clock) in Distributed Systems	2	CO2
3	Distributed Deadlock Detection	Study of Distributed Deadlock Detection Algorithm (Edge Chasing Algorithm).	2	CO2
4	Distributed Locking	Study on Distributed Locking Algorithm.	2	CO3
5	Remote Method	Study on the objects in one system to access and invoke methods on objects in another system	2	CO5

	Invocation	(Remote Method Invocation).		
6	Remote Procedure Call	Study on process to process communication(Remote Procedure Call)	2	CO5&CO6

Text Books:

1. MukeshSinghal and Niranjan G. Shivaratri, Advanced Concepts in Operating Systems" ISBN 0-07-057572-X, McGraw Hill.
2. Programming Distributed Systems By Mae Milano

Reference Books:

1. R1: Distributed Systems 4th edition by Maarten van Steen & A.S Tanenbaum

Course Name	Big Data Analytics Laboratory	**Course Code**	**RCC- PEL-MCSE -192(b)**
Semester	1st	**Program Name**	MTech in CSE
L:T:P	0:0:4	**Total Hours**	48

Course Pre-requisite:

1. Basic knowledge of programming concepts.
2. Familiarity with Linux/Unix operating systems.
3. Introduction to database systems/RDBMS.
4. Basic data structures & JAVA.

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PEL-MCSE -192(b).CO1	**Understand** the architecture and functionality of Hadoop, including its distributed file system (HDFS).	Understanding(K2)
RCC- PEL-MCSE -192(b).CO2	**Use** the HDFS functions and Linux commands to administer and communicate with the Hadoop file system.	Applying(K3)
RCC- PEL-MCSE -192(b).CO3	**Explain** the Mapreduce programming model and its application in processing large datasets.	Applying(K3)
RCC- PEL-MCSE -192(b).CO4	**Implement** basic Mapreduce programs to perform data analysis and processing tasks	Applying(K3)
RCC- PEL-MCSE -192(b).CO5	**Understand** the architecture and components of Apache Spark and its advantages over Hadoop Mapreduce	Understanding(K2)
RCC- PEL-MCSE -192(b).CO6	**Develop** data processing programs using Apache Spark to solve real-world big data problems	Creating(K6)

Detailed Syllabus:

Module #	**Module Name**	**Experiment Topics**	**No of Labs Required**	**CO Linked**
1	Ecosystem and HDFS	Study of Hadoop ecosystem and HDFS	2	CO1
2	HDFS Commands	Study of HDFS Commands on Linux	2	CO2
3	MapReduce Framework	Study of the MapReduce Framework	2	CO3
4	MapReduce Framework	Experiments using Map Reduce framework.	2	CO4

5	Data Analytics	Data Analytics using Apache Spark. (1)	2	CO5,
6	Data Analytics	Data Analytics using Apache Spark. (2)	2	CO6

Text Books:

1. Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale, 4th Edition Publisher: Shroff/O'Reilly
2. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence," Addison-Wesley Professional, 2012.

Reference Books:

1. NeerajMalhotra, Data Engineering Skills - Hadoop Shell: A Comprehensive Guide to HadoopFs Commands, Paperback – Import, 27 April 2018

Course Name	Internet of Things Lab	**Course Code**	**RCC- PEL-MCSE -192(c)**
Semester	1st	**Program Name**	M.Tech in CSE
L:T:P	0:0:4	**Total Hours**	48

Course Pre-requisite:

1. Basic Programming Knowledge
2. Basic Electronics

Course Outcome (CO)

CO Number	**Statement**	**Knowledge Level**
RCC- PEL-MCSE -192(c).CO1	**Understand** the components of IoT networking in relation to the OSI layer.	Understanding (K2)
RCC- PEL-MCSE -192(c).CO2	**Create** sensor systems based on the Internet of Things.	Creating (K6)
RCC- PEL-MCSE -192(c).CO3	**Use** IoT protocols and software.	Applying(K3)
RCC- PEL-MCSE -192(c).CO4	**Evaluate** the wireless technologies for IoT.	Evaluating(K5)
RCC- PEL-MCSE -192(c).CO5	**Recognize** the importance of IoT Trust and its variations.	Understanding(K5)
RCC- PEL-MCSE -192(c).CO6	**Develop** IoT solutions for real-life Problems	Creating(K6)

Detailed Syllabus:

Module #	**Module Name**	**Experiment Topics**	**No of Labs Required**	**CO Linked**
1	IoT Boards	Study and Survey various IoT Boards available in Market	2	CO1, CO2
2	IoT Platforms	Study and Survey various IoT Platforms available in Market	2	CO2
3	Interfacing Sensors and Actuators	Study and Implement interfacing Sensors and Actuators with Arduino	2	CO2, CO4
4	Interfacing Sensors and Actuators	Study and Implement interfacing Sensors and Actuators with Raspberry Pi	2	CO3, CO4
5	Servomotor Control	Implement Servomotor Control using Arduino/Raspberry Pi	1	CO5

6	Weather Monitoring	Implement Weather Monitoring using Arduino/Raspberry Pi	1	CO5&CO6

Text Books:

1. SudipMisra,AnandarupMukherjee,ArijitRoy,IntroductiontoIoT,Cambridge University Press, First Edition
2. ArsheepBahga,VijayMadisetti,InternetofThings-AHands-onApproach,Orient Blackswan Private Limited - New Delhi, First Edition

Reference Books:

1. R1: CharlesBell, BeginningIoTProjects:Breadboard-lessElectronicProjects,Apress,2 October 2021.

Course Name	Technique and Language for Research Paper Writing	**Course Code**	**RCC-AU-MCSE-181**
Semester	1st	**Program Name**	MTech in (CSE)
L:T:P	3:0:0	**Total Hours**	36

Course Pre-requisite:

1. Rudimentary knowledge of modern English grammar
2. Technical report writing skill
3. Knowledge of any scripting language

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-AU-MCSE-181.CO1	**Recall** the importance of scientific research	Remembering(K1)
RCC-AU-MCSE-181.CO2	**Understand** the elements of an academic research paper with respect to the basic syntax and semantics of the LaTeX	Understanding(K2)
RCC-AU-MCSE-181.CO3	**Apply** the key language skills for academic writing	Applying(K3)
RCC-AU-MCSE-181.CO4	**Analyse** the steps needed to successfully complete a standard research paper	Analyzing (K4)
RCC-AU-MCSE-181.CO5	**Evaluate** for clarity, precision and relevance	Evaluating(K5)
RCC-AU-MCSE-181.CO6	**Create** a research paper on a chosen topic with required LaTeX libraries and tags.	Creating (K6)

Detailed Syllabus:

Module #	Contents	Contact Hours	CO Linked
1	**Introduction to Research:** Motivation to conduct research- importance of research in science and technology- meaning, purpose and significance of research paper writing-Introduction to Academic Writing - Language Proficiency Requirement- Objectivity- Clarity- Precision- Formal tone- Paragraph Development Assessment 1: Paragraph Writing	2	CO1
2	**Reading and Writing:** Reading Strategies like Skimming and Scanning – How to read a research paper - Identifying Arguments Assessment 2- Framing arguments Writing Titles and Subtitles– Abstracts – Key words- Introduction Assessment 3- Abstract Writing	6	CO2, CO3
	Planning and Preparation:		CO2,

3	Literature Review- Research Methodology- Results- Conclusion Assessment 4- Writing task	6	CO3, CO4
4	**Effective Revisions:** Restructuring paragraphs- Editing for Clarity and Coherence - Proofreading for Grammatical Precision – Spellings- Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices Assessment 5- Identifying standard citation styles	6	CO5
5	**Technical Elements of Research Paper:** Hypothesis- Randomization- Population- Literature Review- Sampling Types- Variable- Validity- Consent- Risk- Field Work- Pictorial Depiction- Index- Annexures-End Notes- Footnotes Assessment 6- Conducting case study Assessment 7- Writing a research paper based on a case study of topic of choice	4	CO6
6	**Introduction to LaTeX:** Overview of different LaTeX integrated development environment (IDE). Installation of TexStudio. Access of Online Overleaf. Basic concept of LaTeX script to create a simple document including header [title, author and date] and footer [institute name, page number] in the document. Assessment 1: Prepare a paragraph **LaTeX Templates:** Overview of LaTeX scripts and packages for writing Titles, Subtitles, Abstracts, Keywords, Introduction (section and subsection) using some LaTeX templates (IEEE, Springer etc.). Assessment 2: Prepare a document containing Titles, Subtitles, Abstract, keywords and Introduction using any template.	6	CO2, CO6
7	**Mathematics and Algorithms:** Overview of LaTeX scripts and packages for writing Mathematical equations, operation symbols, matrix, fraction, Equation references etc. and different Algorithm styles using algorithm / algorithmic / algorithm2e library. Assessment 3: Prepare a document containing Mathematical equations and Algorithms	2	CO2, CO6
8	**Figures, Tables, References and Citations:** Overview of LaTeX scripts and packages for introducing the concept of subgraph to include and format images / figures / graphs in different ways. Assessment 4: Prepare a document containing figures and sub-figures. **Tables :** Overview of LaTeX scripts and packages for designing and formatting tables in LaTeX.	6	CO2, CO6

	Assessment 5: Prepare a document containing tables in different formats. **References and Citations:** Overview of LaTeX scripts for writing citation in LaTeX using BibTeX, creating .bib file for reference database, and different bibliography styles. Assessment 6: Finally, write a research paper in LaTeX based on the previously given topic.		

Text Books:

1. Oshima, A. & Hogue, A. 2005. Writing Academic English, Addison-Wesley, New York
2. Swales, J. & C. Feak. 2012. Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press.
3. Wallwork, Adrian. 2015. English for Academic Research: Grammar, Usage and Style, Springer, New York
4. English for Writing Research Papers by Authors: Adrian Wallwork
5. Goldbort R (2006) Writing for Science, Yale University Press
6. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
7. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
8. A Guide to LaTeX, Helmut Kopka and Patrick W. Daly
9. Latex for beginners by Dr.R.Ramalakshmi, Publisher: JAYALAKSHMI PUBLICATIONS

Reference Books:

1. Bailey. S. 2015. Academic Writing: A Handbook for International Students. London and New York: Routledge.
2. Gail Craswell, Writing for Academic Success. Sage Publications. 2nd Edition
3. Creme, P. & amp; M. Lea. 2008. Writing at University: A guide for students. Open University Press.
4. LATEX - A Beginner Guide to Professional Documentation, S.Swapna Kumar