

POST GRADUATE DEGREE COURSE
M.TECH
IN
COMPUTER SCIENCE AND TECHNOLOGY
[W.E.F. 2020-21]

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING
ENGINEERING AND TECHNOLOGY PROGRAM
GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE
AND P.G. COURSES (A)
VISAKHAPATNAM-530 045

GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE & P.G. COURSES (A)
RUSHIKONDA, VISAKHAPATANAM - 530045.

ENGINEERING & TECHNOLOGY PROGRAM
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M. Tech in Computer Science and Technology
Semester I [First year]

Curriculum

Sl. No	Type of Course	Periods / Week	Max. Marks				Total	Credits
		Theory	Theory	Lab	Ext.	Int.		
1	Program Core	Mathematical Foundations of Computer Science	3	0	70	30	100	3
2	Program Core	Advanced Data Structures	3	0	70	30	100	3
3	Program Elective	Elective-I	3	0	70	30	100	3
4	Program Elective	Elective-II	3	0	70	30	100	3
5	Mandatory Course	Research Methodology and IPR	2	0	70	30	100	2
6	Audit Course	Audit Course	2	0	70	30	100	0
7	Laboratory Course	Advanced Data Structures Lab	0	4	50	50	100	2
8	Laboratory Course	Elective-II Lab	0	4	50	50	100	2
Total			16	8	520	280	800	18

Elective-I: Artificial Intelligence/Embedded Systems/Wireless Sensor Networks/
Computer Graphics

Elective II: NoSQL/Cryptography and Network Security/Big Data Analytics

Audit Course:

1. English for Research Paper Writing
2. Pedagogy Training
3. Disaster Management
4. Sanskrit for Technical Knowledge
5. Value Education
6. Constitution of India
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

Semester II [First year] Curriculum

Sl. No	Type of Course	Periods / Week	Max. Marks				Total	Credits
		Theory	Theory	Lab	Ext.	Int.		
1	Program Core	Advanced Software Engineering	3	0	70	30	100	3
2	Program Core	Soft Computing	3	0	70	30	100	3
3	Program Elective	Elective-III	3	0	70	30	100	3
4	Program Elective	Elective-IV	3	0	70	30	100	3
5	Audit Course	Audit Course	2	0	70	30	100	0
6	Laboratory Course	Software Engineering Lab	0	4	50	50	100	2
7	Laboratory Course	Soft Computing Lab	0	4	50	50	100	2
8	Laboratory Course	Mini Project with Seminar	0	4	-	100	100	2
Total			14	12	450	350	800	18

Elective-III: Knowledge Discovery/Internet of Things/Data Science

Elective-IV: Cyber Security & Digital Forensics/Cloud Computing/Natural Language Processing

Semester III [Second year] Curriculum

Sl No.	Course Type	Name of the subject	Periods/week		Max. Marks		Total	Credits
			Theory	Lab	Ext.	Int.		
1	Program Elective	Elective-V	3	-	70	30	100	3
2	Open Elective	Open Elective	3	-	70	30	100	3
3	Dissertation-I / Industrial project			-	100	-	100	10
	Total		6	-	240	60	300	16

Elective-V: Machine Learning/Recommender Systems/Image Processing

Open Elective: Business Analytics/Python Programming/IoT Fundamentals and Applications

Semester IV [Second year] Curriculum

Sl No	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
1	Dissertation - II	-	-	100	-	100	16
	Total	-	-	100	-	100	16

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**ENGINEERING & TECHNOLOGY PROGRAM
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**M. Tech in Computer Science and Technology
Semester I [First year] Curriculum**

Sl. No	Type of Course	Periods/week	Max. Marks				Total	Credits
		Theory	Theory	Lab	Ext.	Int.		
1	Program Core	Mathematical Foundations of Computer Science	3	0	70	30	100	3
2	Program Core	Advanced Data Structures	3	0	70	30	100	3
3	Program Elective	Elective-I	3	0	70	30	100	3
4	Program Elective	Elective-II	3	0	70	30	100	3
5	Mandatory Course	Research Methodology and IPR	2	0	70	30	100	2
6	Audit Course	Audit Course	2	0	70	30	100	0
7	Laboratory Course	Advanced Data Structures Lab	0	4	50	50	100	2
8	Laboratory Course	Elective-II Lab	0	4	50	50	100	2
Total			16	8	520	280	800	18

Elective-I: Artificial Intelligence/Embedded Systems/Wireless Sensor Networks/
Computer Graphics

Elective II: NoSQL Databases/Cryptography and Network Security/Big Data Analytics

CODE	MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand the Propositional logic and first order logic and graph theory.
2. To understand the concepts of Number theory.
3. To study various concepts of finite automata and languages.

COURSE OUTCOMES:

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

1. Apply the knowledge of Propositional logic and first order logic to solve problems using sets, relations, functions and discrete structures
2. Solve problems on Graph Theory.
3. Solve problems using number theory concepts.
4. Construct minimized finite Automata for a given regular expression or Non-Deterministic finite automata.
5. Convert context free grammar for push down automata and understand the concepts of Turing machine.

UNIT-I

Introduction: Sets, Relations, Functions, Fundamentals of Logic, Quantified propositions, mathematical Induction, Combinations and Permutations, Enumerations, Recurrence Relations, Generating Functions, Binary Relations, Lattices.

UNIT-II

Graph Theory: Directed Graphs, Graphs, Spanning Trees, Planar Graphs, Euler Circuits, Hamiltonian Graphs, Graph Coloring.

UNIT-III

Introduction to Number theory, Divisibility, modular arithmetic (addition modulo and multiplication modulo); Statements and applications of Euler and Fermat Theorems, Primitive Roots, Discrete Logarithms, Primality Test, Finding Large primes.

UNIT-IV

Introduction To Finite Automata: Alphabets and languages- Deterministic Finite Automata – Non- deterministic Finite Automata – Equivalence of Deterministic and Non-Finite Automata – Languages Accepted by Finite Automata, Finite Automata and Regular Expressions – Properties of Regular sets & Regular Languages and their applications.

UNIT-V

Context Free Languages: Context – Free Grammar Regular Languages and Context-Free Grammar. Pushdown Automata – Pushdown Automata and Context-Free Grammar – Properties of Context-Free Languages – pushdown automata and Equivalence with Context Free Grammars, Introduction to Turing Machine.

Text Books:

1. Discrete Mathematics & Its Applications with Combinatorics and Graph Theory by Kenneth H Rosen, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani & JD Ullman—Pearson education- III edition.

Reference Books:

1. Discrete Mathematics for Computer Scientists & Mathematicians by Joe L. Mott, Abraham Kandel, Theodore P. Baker, Prentice-Hall, India.
2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI.

CODE	ADVANCED DATA STRUCTURES	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. The student should be able to choose appropriate data structures, understand the Them, and use them to design algorithms for a specific problem.
2. To understand the concepts of data structures stacks, queues, trees and graphs and apply them in building efficient algorithms.
3. To familiarize students with text processing and dynamic programming.
4. To construct algorithms for simple geometrical problems.

COURSE OUTCOMES:

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

1. Understand the implementation of data structures and dictionaries.
2. Prepare Skip Lists and its related operations and implement hashing techniques.
3. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
4. Develop algorithms for text processing applications.
5. Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT-I

Introduction to Data Structures: Stacks, Queues, Single Linked list, double linked list, Circular linked lists. **Dictionaries:** Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

UNIT-II

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing. **Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT-III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees.

UNIT-IV

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT-V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.

Text Books:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, 2nd Edition, Pearson, 2004.
2. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, *Computational Geometry: Algorithms and Applications*, 3rd edition, Springer, 2008

Reference Books:

1. M T Goodrich, Roberto Tamassia, *Algorithm Design*, John Wiley, 2002, ISBN: 978 - 1 - 118 - 29027 - 9.
2. Thomas H. Cormen , Charles E. Leiserson , Ronald L. Rivest , Clifford Stein., *Introduction to Algorithms*, MIT Press, 2001.
3. Narasimha karumanchi, *Data Structures and algorithms made easy*, 5th Edition 2017.

CODE	ELECTIVE-I ARTIFICIAL INTELLIGENCE	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To learn about AI problem, Production Systems and their characteristics.
2. To understand the importance of Knowledge Representation, Symbolic Logic for solving AI problems.
3. To Understand to Uncertainty concepts in reasoning, Expert Systems and Natural Language Processing.

COURSE OUTCOMES:

At the end of the Course the student is able to:

1. Understand AI problem characteristics, state space approach for solving AI problem and Heuristic Search Techniques.
2. Discuss various Knowledge Representation techniques and Symbolic Logic.
3. Apply the Concepts of Reasoning under uncertainty on AI Problems and Design the Fuzzy Systems.
4. Applying Knowledge Acquisition and Validation Techniques to develop Expert Systems.
5. Understand and Apply NLP techniques in various AI Applications.

UNIT-I

Introduction: Artificial Intelligence, AI Problems, AI Techniques, the Level of the Model, Criteria for Success. Defining the Problem as a State Space Search, Problem Characteristics, Production Systems, Search: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, A*Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

UNIT-II

Knowledge Representation: Procedural Vs Declarative Knowledge, Representations & Approaches to Knowledge Representation, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms; **Symbolic Logic:** Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction;

Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, CYC.

UNIT-III

Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Model and Temporal Logics; Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory. Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems, Membership Function, Fuzzification and Defuzzification, Fuzzy System Modeling.

UNIT-IV

Experts Systems: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells, Fuzzy Expert systems.

UNIT-V

Natural Language Processing: Role of Knowledge in Language Understanding, Approaches Natural Language Understanding, Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning: Components of a Planning System, Goal Stack Planning, Hierarchical Planning, Reactive Systems.

Text Books:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence, Elaine Rich and Knight, Mcgraw-Hill Publications

Reference Books:

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI
2. Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss.G, MIT Press.
3. Artificial Intelligence: A modern Approach, Russell and Norvig, Printice Hall
4. Neural Networks, Fuzzy Logic and Genetic Algorirthms, S.Rajasekharan, G.A.Vijayalakshmi Pai

CODE	ELECTIVE-I EMBEDDED SYSTEMS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal:30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.

COURSE OUTCOMES:

At the end of the Course the student is able to:

1. Acquainted to Embedded Systems and their classification.
2. Expected to understand the selection procedure of Processors in the Embedded domain.
3. Familiarize Design Procedure for Embedded Firmware.
4. Expected to visualize the role of Real time Operating Systems in Embedded Systems
5. Expected to evaluate the Correlation between task synchronization and latency issues

UNIT-I

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT-V

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Book:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference Books:

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

CODE	ELECTIVE-I WIRELESS SENSOR NETWORKS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand wireless networks principles.
2. To understand the functional aspects, operating system prototypes, and energy consumption in WSN.
3. To analyze the wireless sensor networks performance.
4. To understand the routing techniques in WSN.
5. To understand synchronization and security concepts of WAN.

COURSE OUTCOMES:

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

1. Understand and analyze the various architectures of wireless sensor network.
2. Explain about operating system for wireless sensor networks.
3. Discuss simulation tools for wireless sensor networks.
4. Analyze the communication protocols.
5. Understand the security principles in wireless sensor networks.

UNIT-I

Fundamentals Of Wireless Sensor Networks: Introduction to wireless sensor networks, challenges of wireless sensor Networks, Single node architecture, network architecture, sensor network scenario, network Design principles of wireless sensor networks.

UNIT-II

Operating Systems And Power Management: Operating Systems: functional and nonfunctional aspects, prototypes, Tiny OS, Contiki, LiteOS, SOS. Power management in wireless sensor networks.

UNIT-III

Simulation and Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet).

UNIT-IV

Protocols: Communication protocols: MAC protocols and Network layer protocols: Flooding and gossiping, data centric routing, proactive routing, On-Demand routing, Hierarchical routing, location-based routing.

UNIT-V

Synchronization And Security: Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks , Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, Zig Bee Security.

Text Books:

1. H. Karl and A. Willig, “*Protocols and Architectures for Wireless Sensor Networks*”, 1st edition, John Wiley & Sons, India, 2012.
2. Waltenegus Dargie, Christian Poellabauer, “*Fundamentals of Wireless Sensor Networks: Theory and Practice*”, 2nd edition, Wiley publications, 2010.

Reference Books:

1. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “*Wireless Sensor Networks*”, Springer Verlag, 1st Indian reprint, 2010.
2. F. Zhao and L. Guibas, “*Wireless Sensor Networks: An Information Processing Approach*”, Morgan Kaufmann, 1st Indian reprint, 2013.
3. Mohammad S. Obaidat, SudipMisra, “*Principles of Wireless Sensor Networks*”, Cambridge, 2014.

CODE	ELECTIVE-I COMPUTER GRAPHICS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications and techniques.
2. To learn the basics of Geometric Transformations and projections.
3. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

COURSE OUTCOMES:

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

1. Understand basics of computer graphics, applications and overview of graphics systems.
2. Discuss various graphics drawing algorithms and techniques.
3. Explain two dimensional and three dimensional transformations.
4. Discuss graphics pipeline and clipping operations.
5. Understand 3D Graphics display methods and animation techniques.

UNIT-I

Introduction: Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Overview of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software.

UNIT-II

Output primitives: Points and Lines, Line and Curve Attributes, Color and Gray scale levels, Anti aliasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.

UNIT-III

Two Dimensional Transformations: Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations. **Three Dimensional Transformations & Projections:** Translation, Rotation, Scaling, Other Transformations,

Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.

UNIT-IV

Viewing Pipeline and Clipping operations: Viewing Pipeline, Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations-Point Clipping, Line Clipping, Polygon Clipping, Curve Clipping, Text and Exterior Clipping.

UNIT-V

Three Dimensional Concepts and Object representations: 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces, **Color Models and Basics of Computer Animation:** Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY&HSV Color models. Design of animation Sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

Text Books:

1. Computer Graphics, Donald Hearn & M.Pauline Baker, Pearson Education, New Delhi.
2. Computer Graphics by Dr. Rajiv Chopra.

Reference Books:

- 1.1.Procedural Elementsfor Computer Graphics, DavidF. Rogers,TataMc GrawHill Book Company,New Delhi,2003
- 2.ComputerGraphics:Principles&PracticeinC,J.D.Foley,S.KFeiner,AVanDamF.HJohnPearso nEducation,2004
3. Computer Graphics using Open GL,Franscis S HillJr, PearsonEducation, 2004.
4. Computer Vision and Image Processing: A Practical Approach using CVIP tools, S. E.Umbaugh, Prentice Hall,1998.

CODE	ELECTIVE-II NoSQL Databases	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand database applications and analyze queries in relational data.
2. To understand NoSQL and MongoDB applications.
4. To understand the replication and Sharding and examine the queries against various aggregate structure.
4. To Understand NoSQL Key values using Riak, transactions and query features.
5. To learn developing Web Application with NOSQL and NOSQL Administration.

COURSE OUTCOMES:

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

1. Understand about Database Management System.
2. Understand the concept of NoSQL using MongoDB
3. Analyze various Query features on NoSQL
4. Understand and examine the relationship among data and its operations using MongoDB.
5. Develop Web applications with NoSQL and its administration

UNIT-I

Introduction to Management: History of Database Systems. Database System Applications, database System VS file System. Data Models: ER Model, Relational Model and Other Models. Database Languages: DDL, DML. Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical database Design – Introduction to Views – Destroying /altering Tables and Views. Introduction of Object Database Systems, Structured Data types, operations on structured data, Encapsulation and ADTS, Inheritance.

UNIT-II

Introduction To Nosql: Overview and History of NoSQL, Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points. Comparison of relational databases to new NoSQL stores.
Introduction to MongoDB: MongoDB, Cassandra use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases.

UNIT-III

Data and Distribution Models: Replication and Sharding, Map-Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. NoSQL Key/Value databases using MongoDB, Document Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Web Analytics or Real-Time Analytics, Queries against Varying Aggregate Structure.

UNIT-IV

Key-value Databases: NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.

UNIT-V

Developing Web Application with NOSQL and NOSQL Administration: Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP, NOSQL Database Administration. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Introduction to Graph Databases, features.

TextBooks:

1. Raghuramakrishnan and Johannes Gehrke, "*Database Management Systems*", 3rd Edition, TMH, 2006.
2. Sadalage, P. & Fowler, M., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. (1st Ed.). Upper Saddle River, NJ: Pearson Education, In, 2012.

Reference Books:

1. Gauravvaish, Getting started with NoSQL , PACKT publishing, ISBN: 978184969488.

CODE	ELECTIVE-II CRYPTOGRAPHY AND NETWORK SECURITY	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam:70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To introduce several issues in network security- its need and importance, taxonomy and terminology.
2. To learn various cryptographic techniques.
3. To understand Internet security protocols and standards.
4. To design security applications in the field of Information technology.

COURSE OUTCOMES:

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

1. Classify network security attacks, services, mechanisms and classical encryption techniques.
2. Apply symmetric key cryptographic techniques to ensure privacy of data in transit.
3. Apply symmetric key cryptographic techniques to ensure privacy of data in transit.
4. Describe symmetric keys distribution techniques and public key Infrastructure (PKI) and transport layer security.
5. Understand cryptographic protocols for email security, intrusion detection techniques, firewalls and malicious software.

UNIT-I

Overview: Computer Security Concepts, the OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security, **Classical Encryption Techniques:** Symmetric Cipher Models, Substitution Techniques, Transposition techniques, Stenography.

UNIT-II

Mathematics of symmetric key cryptography: Algebraic structures – Modular arithmetic, Euclid's algorithm, Congruence and matrices, Stream Ciphers and Block Ciphers, the Data Encryption Standard (DES), A DES Example, the Strength of DES. AES(Advanced Encryption Standard), IDEA, **Block Cipher Operations:** Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode.

UNIT-III

Mathematics of asymmetric key cryptography: Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Exponentiation and discrete logarithm. **Asymmetric key ciphers:** Public-Key Cryptography and Principles, RSA Algorithm. Diffie-Hellman Key Exchange, Elliptic curve Cryptography.

UNIT-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Secure Hash Algorithm (SHA-512). **Digital Signatures:** Digital Signatures, NIST Digital Signature Algorithm. Distribution of public Keys, X.509 Certificates, Public-Key Infrastructure. **User Authentication:** Remote User-Authentication Principles, Kerberos. **Transport-Level Security:** Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security.

UNIT-V

Electronic Mail Security: Pretty Good Privacy, S/MIME. **Malicious Software:** Types of Viruses, Virus Countermeasures, Worms, Distributed Denial Of Service Attacks. **Intruders:** Intruders, Intrusion Detection, Password Management. **Firewalls:** Need of Firewalls, Firewall Characteristics, Types of Firewalls, Configurations.

Text Book:

Cryptography and Network Security Principles and Practice, William Stallings, Seventh Edition, Pearson Education.

Reference Books:

1. Computer Security - Principles and Practice, 4th Edition by William Stallings, Pearson Education.
2. Cryptography and Network Security, Atul Kahate, 4th Edition, Tata McGraw Hill Publications.
3. Cryptography and Network Security Behrouz A Forouzan, Second Edition, Tata McGraw Hill Pub Company Ltd, New Delhi.

CODE	ELECTIVE-II BIG DATA ANALYTICS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To familiarize big data for business intelligence.
2. To familiarize No SQL for big data management.
3. To explore the concepts of Map, Reduce and related tools for real time implementation and analysis.

COURSE OUTCOMES:

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

1. Describe big data and use cases from selected business domains.
2. Explain NoSQL big data management.
3. Install, configure, and run Hadoop and HDFS.
4. Perform map-reduce analytics using Hadoop.
5. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

UNIT-I

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT-II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT-III

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

UNIT-IV

MapReduce 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, Map Reduce types, input formats, output formats

UNIT-V

Hbase, data model and implementations, Hbase clients, Hbase examples, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Text Books:

1. "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Michael Minelli, Michelle Chambers, and Ambiga Dhiraj. Wiley, 2013.
2. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", P. J. Sadalage and M. Fowler. Addison-Wesley Professional, 2012.
3. Hadoop: The Definitive Guide, 4th Edition, Tom White, O'Reilly.
4. Cassandra – The Definitive Guide, 3e: Distributed Data at Web Scale, Jeff Carpenter ,Eben Hewitt , O'Reilly; 3rd edition.

Reference Books:

1. Big Data and Analytics, Subhashini Chellappan, Seema Acharya, Wiley, 2ed.
2. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, Apress, e-book of 2012.

CODE	RESEARCH METHODOLOGY AND IPR	
Instruction: 2 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 30 Marks	External Exam: 70 Marks	Total: Marks

COURSE OBJECTIVES:

1. To familiarize with Research Problem characteristics.
2. To illustrate effective Literature Studies.
3. To demonstrate various types of Copy right Process, Patenting techniques.
4. To explain the concepts of Patent Rights and New Developments of IPR.

COURSE OUTCOMES:

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

1. Understand research problem formulation.
2. Analyze research related information and Follow research ethics.
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V

New Developments in IPR: Administration of Patent System. New developments in IPR, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

Reference Books:

1. Mayall, "Industrial Design", McGraw Hill, 1992.
2. Niebel, "Product Design", McGraw Hill, 1974.
3. Asimov, "Introduction to Design", Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

CODE	ADVANCED DATA STRUCTURES LAB	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

To implement programs using data structures Stacks, Queues, Lists, hashing, trees, and graphs, and string matching algorithms.

COURSE OUTCOMES:

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

1. Implement various types of linear and non-linear data structures.
2. Implement different hashing techniques.
3. Implement basic and advanced binary search trees.
4. Implement various types of pattern matching algorithms.
5. Implement the concepts of KD-tree

List of Programs:

1. Write a program to implement stack operations using linked list.
2. Write a program to implement circular queue operations using arrays.
3. Write a program to implement the following operations on singly linked list
 - a) Creation of a linked list
 - b) Insert a node into linked list
 - c) Delete a node from linked list
4. Write a program to implement the following operations on doubly linked list
 - a) Creation of a linked list
 - b) Insert a node in to linked list
 - c) Delete a node from linked list
5. Write a program to implement the following.
 - a) Linear probing
 - b) Quadratic probing
 - c) Double hashing.
6. Write a program to implement the following in binary search tree
 - a) Creation
 - b) Insertion
 - c) Deletion.
7. Write a program to implement AVL trees
 - a) Creation
 - b) Insertion
 - c) Deletion
8. Write a program to create a Red-black tree for the given elements
9. Write a program to create a splay tree for the given elements
10. Write a program to implement Boyer-Moore pattern matching algorithm
11. Write a program to implement KMP pattern matching algorithm
12. Write a program to create a Kd tree for the given element.

13. Write a program to construct a binomial heap for the given elements.
14. Write a program to construct a leftist tree for the given elements.

Reference Books:

1. Data Structures and Algorithms in java, 3rd edition, A.Drozdek, Cengage Learning.
2. Data Structures with Java, J.R.Hubbard, 2nd edition, Schaum's Outlines, TMH.
3. Data Structures and algorithms in Java, 2nd Edition, R.Lafore, Pearson Education.
4. Data Structures using Java, D.S.Malik and P.S. Nair, Cengage Learning.
5. Data structures, Algorithms and Applications in java, 2nd Edition, S.Sahani, Universities Press.
6. Design and Analysis of Algorithms, P.H.Dave and H.B.Dave, Pearson education.
7. Data Structures and java collections frame work, W.J.Collins, McGraw Hill.
- 8 Java: the complete reference, 7th All editon, Herbert Schildt, TMH
9. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education / Java: How to Program P.J.Deitel and H.M.Deitel , 8th edition, PHI.

CODE	DATABASES LAB	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To learn NoSQL with MongoDB.
2. To practice queries, CRUD, schema design, data aggregation and more.
3. To write code, build real-world projects in a work-like environment.

COURSE OUTCOMES:

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

1. Learn basic MongoDB functions and its implementation.
2. Implement various types of operations in MongoDB.
3. Implement the concepts of limit records and sort records.
4. Implement Indexing, Advanced Indexing and Hashing using MongoDB.
5. Analyze and apply aggregation and Map Reduction in MongoDB.

List of Programs:

1. Installation of MongoDB on Windows & Linux.
2. Implementation of mongo Shell, Create database and display the database.
3. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection.
4. Implementation of Where Clause, AND,OR operations in MongoDB.
5. Implementation of MongoDB count() cursor method.
6. Execute Aggregation Pipeline and its operations.
7. Execute Limit Records and Sort Records operation in MongoDB.
8. Implementation of Aggregation and Map Reduce functions in MongoDB.
9. Implementations of Indexing, Advanced Indexing using MongoDB.
10. Implementations of Hashing using MongoDB.
11. Practice with ' McDonalds ' collection data for document oriented database.Import restaurants collection and apply some queries to get specified output.
12. Create a backup for an entire server to back up a Database with Mongo dump.
13. Establish a connection with a database or access any tabular data source using Java Driver, Python Driver, PHP Driver to do the following operations.
 - a) Send various MongoDB statements.
 - b) Retrieve and process the results received from the database.

CODE	ELECTIVE-II LAB: CRYPTOGRAPHY AND NETWORK SECURITY	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To implement the essential cipher techniques.
2. To develop various symmetric/asymmetric and key exchange algorithms.

COURSE OUTCOMES:

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

- 1: **Construct** new security applications by experimenting the cipher techniques.
- 2: **Apply** various cryptographic authentication techniques.
- 3: **Design** symmetric and asymmetric cryptographic protocols for secure data transmission.

MODULE-I

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using Ceaser cipher.
4. Write a Java program to perform encryption and decryption using Transposition cipher.
5. Write a Java program to perform encryption and decryption using Hill cipher.
6. Write a C/JAVA program to encrypt a text using Cipher Block Chaining.

MODULE-II

1. Write a C/JAVA program to implement to implement DES.
2. Write Java program to implement RSA algorithm.
3. Write a Java program to implement Rijndael algorithm.
4. Write a C/JAVA program to implement display the points of an elliptic curve.
5. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
6. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

References:

1. Computer Security - Principles and Practice, 4th Edition by William Stallings, Pearson Education.
2. Cryptography and Network Security, Atul Kahate, 4th Edition, Tata McGraw Hill Publications.
3. Cryptography and Network Security Behrouz A Frorouzan, Second Edition, Tata McGraw Hill Pub Company Ltd, New Delhi.

CODE	ELECTIVE-II LAB: BIG DATA ANALYTICS	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To familiarize with various Hadoop Tools.
2. To familiarize with Map Reduce operations.

COURSE OUTCOMES:

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

1. Demonstrate Installing & Configuring Hadoop in Pseudo Distributed Mode.
2. Apply MapReduce to solve the various research problems in Big data management.
3. Demonstrate installing, configuration and performing various operations through Pig Latin and Hive.

Exercises

1. Setup and install Hadoop in Pseudo-Distributed Mode.
2. Monitoring Hadoop and Hadoop CLI operations.
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
4. Write a Map Reduce program that mines weather data to find the max and min temperature for each year in NCDC data set.
5. Install and run Apache Pig in Ubuntu.
6. Explore basic Data Processing operators in Pig.
7. Take a dataset and Write Pig Latin program to sort, group, join, project, and filter the data.
8. Write Pig Latin script to count the number of occurrences of each word in an input text file.
9. Install and run HIVE in Ubuntu so as to work with Hadoop.
10. Explore Hive with its basic commands: create, alter, and drop databases, tables, views, functions and indexes.
11. Analyze Movie Lens data using Hive.

Reference Books:

1. Hadoop: The Definitive Guide, Tom White, O'Reilly, 4th Edition.
2. Big Data and Analytics, Subhashini Chellappan, Seema Acharya, Wiley, 2ed.

**GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE & P.G. COURSES (A)
RUSHIKONDA, VISAKHAPATANAM - 530045.**

ENGINEERING & TECHNOLOGY PROGRAM

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M. Tech in Computer Science and Technology

Semester II [First year] Curriculum

Sl. No	Type of Course	Periods/week	Max. Marks				Total	Credits
		Theory	Theory	Lab	Ext.	Int.		
1	Program Core	Advanced Software Engineering	3	0	70	30	100	3
2	Program Core	Soft Computing	3	0	70	30	100	3
3	Program Elective	Elective-III	3	0	70	30	100	3
4	Program Elective	Elective-IV	3	0	70	30	100	3
5	Audit Course	Audit Course	2	0	70	30	100	0
6	Laboratory Course	Software Engineering Lab	0	4	50	50	100	2
7	Laboratory Course	Soft Computing Lab	0	4	50	50	100	2
8	Laboratory Course	Mini Project with Seminar	0	4	-	100	100	2
Total			14	12	450	350	800	18

Elective-III: Knowledge Discovery/Internet of Things/Data Science

Elective-IV: Cyber Security & Digital Forensics/Cloud Computing/Natural Language Processing

CODE	ADVANCED SOFTWARE ENGINEERING	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand the concepts of Software Engineering and Design Principle Issues.
2. To understand the concepts Software Design and Testing.
3. To study various UML Diagrams.

COURSE OUTCOMES:

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

1. Understand the concepts of Basics of Software Engineering.
2. Understand the working of Software Architecture.
3. Understand the design principles of software.
4. Apply the testing strategies on the products.
5. Apply the knowledge of UML in developing the product diagrams.

UNIT-I

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models, Overview of Quality Standards like ISO 9001, SEI – CMM. Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.

UNIT-II

Software Architecture: Role of Software Architecture, Architecture views, Component and Connector view: Components, Connectors, Architecture style for C and C view: pipe and filter, shared data style, client server style, Evaluating Architecture. Software Project Planning: Size Estimation like lines of Code & Function Count, Cost Estimation Models, Static single & Multivariable Models, COCOMO, COCOMO-II, Putnam resource allocation model, Risk Management.

UNIT-III

Software Design: Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design. Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation. Software Metrics: Software measurements: What & Why, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics.

UNIT-IV

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Regression Testing, Testing Tools & Standards. Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Calendar time Component.

UNIT-V

An Overview of UML, Use Case Diagrams , Class Diagrams, Interaction Diagrams , State Machine Diagrams , Activity Diagrams , Modeling Concepts , Systems, Models, and Views , Data Types, Abstract Data Types, and Instances , Classes, Abstract Classes, and Objects , Event Classes, Events, and Messages , Object-Oriented Modeling , Falsification and Prototyping , A Deeper View into UML, Use Case Diagrams , Class Diagrams , Interaction Diagrams , State Machine Diagrams, Activity Diagrams , Diagram Organization , Diagram Extensions

Text Books:

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International, 2001.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, 5th Ed., McGraw Hill Int. Ed., 2001.
3. P. Jalote, “An Integrated approach to Software Engineering”, Springer Publications, 2005.
4. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

Reference Books:

1. R. Fairley, “Software Engineering Concepts”, Tata McGraw Hill, 1997.
2. Yogesh Singh, “Software Testing”, Cambridge University Press, New York, 2012.
3. Stephen R. Schach, “Classical & Object Oriented Software Engineering”, IRWIN, 1996.
4. James Peter, W. Pedrycz, “Software Engineering”, John Wiley & Sons., 1999
5. I. Sommerville, “Software Engineering”, Addison. Wesley, 1999

CODE	SOFT COMPUTING	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide student a hand-on experience on MATLAB to implement various strategies.

COURSE OUTCOMES:

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

1. Identify and describe soft computing techniques and their roles in building intelligent Machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering Problems.
3. Design Neural Networks for various applications and Advances in Neural networks.
4. Apply genetic algorithms and Deep Learning to combinatorial optimization problems.
5. Compute solutions by various soft computing approaches for a given problem using Python and MATLAB.

UNIT-I

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT-II

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-III

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT-IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

DEEP LEARNING: Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

UNIT-V

MATLAB/PYTHON LIB: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Text Books:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, Eiji Mizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall,1995.
3. MATLAB Toolkit Manual.

CODE	ELECTIVE-III KNOWLEDGE DISCOVERY	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal:30 Marks	External Exam:70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand KDD process and analyze data mining systems.
2. To learn the significance of pre-processing in data mining.
3. To learn various classification techniques.
4. To learn apply and analyze classification rules.
5. To learn prediction using neural networks.

COURSE OUTCOMES:

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

1. Understand various knowledge representation methods.
2. Apply various data pre-processing techniques.
3. Apply rules for classification and prediction.
4. Evaluate and compare solutions by various clustering algorithms.
5. Apply neural networks for prediction.

UNIT-I

INTRODUCTION KDD AND DATA MINING: Introduction KDD and Data Mining - The KDD Process, Data Mining within the Complete Decision Support System, KDD and DM Research Opportunities and Challenges, KDD & DM Trends. Data Cleansing: Applying Data Cleansing.

UNIT-II

HANDLING MISSING ATTRIBUTE VALUES: Handling Missing Attribute Values- Sequential Methods, Parallel Methods. Feature Extraction and Dimensional Reduction, Feature Selection, Discretization Methods, Outlier Detection.

UNIT-III

CLASSIFICATION TREES- DECISION TREES: Classification Trees- Decision Trees: Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm. Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation.

UNIT-IV

CLASSIFICATION RULES: Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency.

UNIT-V

ARTIFICIAL NEURAL NETWORKS: Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees. Artificial Neural Networks – Perceptron's, Multilayer Networks, The Back propagation Algorithm Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm.

Text Books:

1. Oded Maimon, Lior Rokach, *Data Mining and Knowledge Discovery Handbook*, Springer Science & Business Media, 10-Sep-2010.

Reference Books:

1. Ronen Feldman, James Sanger, *The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data*, Cambridge University Press, 2007

CODE	ELECTIVE-III INTERNET OF THINGS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To provide an overview of Internet of Things M2M and IoT designed methods.
2. To learn different hardware and physical end points in IoT Applications
3. To provide clear understanding about different other technologies for IoT system with case studies.

COURSE OUTCOMES:

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

1. Understand difference between IoT and M2M and their applications.
2. Familiarize and usage of Python in IoT system design methodology.
3. Identify the identify endpoints and their usage in the IoT application design.
4. Compare different cloud services for IoT systems.
5. Understand different IoT case studies and design IoT applications using tools.

UNIT-I

Introduction to Internet of Things : Physical Design of IoT ,Logical Design of IoT ,IoT Enabling Technologies, IoT Levels & Deployment Templates ,Domain Specific IoT Home Automation Cities , Environment , Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle. Introduction: M2M, Difference between IoT and M2M ,SDN and NFV for IoT Software Defined Networking ,Network Function Virtualization .

UNIT-II

IoT Platforms Design Methodology, Introduction, IoT Design Methodology: Case Study on IoT System for Weather Monitoring, Motivation for Using Python. IoT Systems - Logical Design using Python Introduction, Installing Python Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes , Python Packages of Interest for IoT.

UNIT-III

IoT Physical Devices & Endpoints : What is an IoT Device , Basic building blocks of an IoT Device , Exemplary Device: Raspberry Pi, About the Board ,Linux on Raspberry Pi ,Raspberry Pi Interfaces ,Serial ,SPI ,I2C Programming Raspberry Pi with Python , Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi , Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices pcDuino, Beagle Bone Black, Cubieboard .

UNIT-IV

IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT ,Xively Cloud for IoT , Python Web Application Framework - Django ,Designing a RESTful Web API , Amazon Web Services for IoT ,SkyNet IoT Messaging Platform , Data Analytics for IoT :Apache Hadoop ,Using Hadoop MapReduce for Batch Data Analysis ,Apache Oozie .

UNIT-V

Tools and Case Studies Illustrating IoT Design: Tools for IoT : Chef ,Chef Case Studies ,Puppet ,Puppet Case Study - Multi-tier Deployment ,NETCONF-YANG Case Studies ,IoT Code Generator Case Studies: Home Automation ,Cities, Environment ,Agriculture, Productivity Applications ,Structural Health Monitoring Case Study.

Text Books:

1. INTERNET OF THINGS – A Hands on Approach by Arshdeep Bahga, Vijay Madisetti, Universities Press (India) Private Limited

Referenc Books:

- 1.Smart Sensors and Systems, Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., SpringerInternational Publishing
- 2.INTERNET OF THINGS – Architecture and Design Principles by Raj Kamal, McGraw Hill Education India Pvt. Ltd
- 3.Internet of Things: Converging Technologies for Smart Environments and IntegratedEcosystems, Marina Ruggieri & Homayoun Nikookar, River Publishers Series inCommunications.
- 4.Internet of Things. IoT Infrastructures, Mandler, B., Barja, J., MitreCampista, M.E., Cagá_ová, D., Chaouchi, H., Zeadally, S.,Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Springer International Publishing.

CODE	ELECTIVE-III DATA SCIENCE	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To familiarize with basics of Data Science.
2. To learn various methods of classification.
3. To learn various methods of clustering.
4. To learn the concepts of time-series forecasting.
5. To understand outlier analysis.

COURSE OUTCOMES:

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

1. Describe about Data Science and its process.
2. Differentiate between the classification and regression methods.
3. Apply clustering and evaluate the methods.
4. Understand and analyze the text mining and time series forecasting applications.
5. Assess different feature selection methods and use in applications.

UNIT-I

Introduction: Data Science, Data Science Process: Process, Data, Data Preparation, Modeling. **Data Exploration:** Objectives, Types of data, Descriptive Statistics, Data Visualization, Roadmaps for data Exploration.

UNIT-II

Classification Methods: K-Nearest Neighbors, Decision Trees, Rule Induction, Naive Bayesian, Ensemble Learners. **Regression Methods:** Linear Regression, Logistic Regression.

UNIT-III

Clustering: k-means, DBSCAN, Self-Organizing Maps. **Model Evaluation:** Confusion Matrix, ROC and AUC, Lift Curves, Implementation.

UNIT-IV

Recommendation Engines: Concepts, Collaborative Filtering, Content Based Filtering, Hybrid Recommendation. **Time Series Forecasting:** Decomposition, Smoothing, Regression and Machine Learning Methods, Performance Evaluation.

UNIT-V

Anomaly Detection: Concepts, Distance and Density based Outlier Detection, Local Outlier Factor. **Feature Selection:** Classifying Feature Selection Methods, PCA, and Information Theory based Filtering; Chi-Square based Filtering, Wrapper type feature selection.

Text Books:

1. Vijay Kotu, BalaDeshpande, *Data Science Concepts and Practice*, Second Edition, Morgan Kaufmann Publishers, An imprint of Elsevier, 2019.

Reference Book:

1. Cathy O'Neil and Rachel Schutt. *Doing Data Science, Straight Talk From The Frontline*. O'Reilly 2014.

CODE	ELECTIVE-IV CYBER SECURITY AND DIGITAL FORENSICS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam:70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To understand underlying principles and many of the techniques associated with the digital forensic practices and cybercrimes.
2. To explore practical knowledge about ethical hacking Methodology.
3. To develop an excellent understanding of current cyber security issues (Computer Security Incident) and analysed the ways that exploits in securities.
4. To apply digital forensic knowledge to use computer forensic tools and investigation report writing.

COURSE OUTCOMES:

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

1. Gain the knowledge on effective use of computer, data and internet securely.
2. Understand concepts and ethics of cyber security and cyber laws.
3. Acquire the knowledge on various web architectures, vulnerabilities, penetration testing, attacks and security of web applications
4. Illustrate the methods for Forensic Technologies, evidence collection, Evidentiary Reporting and information risk management
5. Analyze and respond to the cyber incidents.

UNIT-I

Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks-Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

UNIT-II

Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

UNIT-III

Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, Defining a web application test scope and process, Defining types of penetration testing. **Web Application Security:** Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues.

UNIT-IV

Forensics & Network Assurance: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection. **Information Risk Management:** Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case.

UNIT-V

Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman.
2. CISSP Study Guide, 6th Edition by James M. Stewart.
3. Title: Cyber Forensics by Dejei & S.Murugan, OXFORD University Press.

Reference Book:

1. Introduction to Information Security and Cyber Laws (English, Paperback, Tripathi Surya Prakash).

CODE	ELECTIVE-IV CLOUD COMPUTING	
Instruction: 3 Periods /week, Univ. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

- 1.To learn the basic Cloud types, services and cloud virtualization.
- 2.To learn cloud management and infrastructure.
- 3.To learn service architectures and different cloud applications.

COURSE OUTCOMES:

Able to

1. Understand Cloud Architecture, Characteristics and Services.
2. Familiarize concept of Virtualization and its role in different platforms.
3. Identify security aspects of each cloud model and Cloud management
4. Visualize the role of service oriented architectures in cloud.
5. Develop different cloud applications.

UNIT-I

Introduction, Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models, Service models, Cloud Reference model, Characteristics of Cloud Computing, Benefits and advantages of Cloud Computing. Cloud Architecture: A brief introduction on Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients; Services and Applications by Type: IaaS, PaaS, SaaS, IDaaS and CaaS.

UNIT-II

Use of Platforms in Cloud Computing Concepts of Abstraction and Virtualization: Virtualization technologies, Load Balancing and Virtualization, Hypervisors, Machine Imaging, Porting of applications in the Cloud; Concepts of Platform as a Service; Use of PaaS Application frameworks; Use of Google, Amazon and Microsoft Web Services.

UNIT-III

Cloud Infrastructure and Management: Features of network management systems, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle); Cloud Security: Cloud security concerns, Security boundary, Security service boundary, Overview of security mapping, Security of data, Identity management.

UNIT-IV

Concepts of Services and Applications Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs.

UNIT-V

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs; Cloud-based Storage: Cloud storage definition – Manned and Unmanned; Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail.

Text Books:

1. Cloud Computing Bible by B. Sosinsky, Wiley India
2. Mastering Cloud Computing by R. Buyya, C. Vecchiola and S. T. Selvi, McGraw Hill.

ReferenceBooks:

1. Cloud computing: A practical approach by Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill Edition.
- 2.Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paperback edition,2013.
3. Cloud Computing by Miller, Pearson
4. Building applications in cloud: Concept, Patterns and Projects by Moyer, Pearson
5. Cloud Computing: Concepts, Technology & Architecture, Erl T, Mahmood Z and Martinez J W, Prentice Hall (2014).
6. Cloud Computing Theory and Practice, Marinescu D C, Morgan Kaufmann (2014).

CODE	ELECTIVE-IV NATURAL LANGUAGE PROCESSING	
Instruction: 3 Periods /week, Univ. Exam: 3 Hours	Credits: 3	
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To analyze the internal structure of a word of the natural language.
2. To apply N-grams rules to identify word patterns and probability of word count in language processing.
3. To learn context free grammar and parsing algorithms.
4. To learn the concepts of syntax driven semantic analysis.
5. To learn automatic machine translation procedure.

COURSE OBJECTIVES:

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

1. Gain knowledge in automated Natural Language Generation and Machine Translation.
2. Provide the student with knowledge of various levels of analysis involved in NLP.
3. Understand the applications of NLP.
4. The semantic analysis of natural language.
5. Understand language generation and discourse analysis.

UNIT-I

OVERVIEW AND MORPHOLOGY: Introduction – Models -and Algorithms - -Regular Expressions Basic Regular Expression Patterns – Finite State Automata Understand the wireless sensor network principles. Morphology -Inflectional Morphology - Derivational Morphology. Finite-State Morphological Parsing - Porter Stemmer.

UNIT-II

WORD LEVEL AND SYNTACTIC ANALYSIS: N-grams Models of Syntax - Counting Words - Unsmoothed N-grams .Smoothing- Back-off Deleted Interpolation – Entropy - English Word Classes - Tag sets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging.

UNIT-III

CONTEXT FREE GRAMMARS: Context Free Grammars for English Syntax- Context-Free Rules and Trees -Understand the network simulation tools. Sentence- Level Constructions–Agreement – Sub Categorization. Parsing – Top-down – Early Parsing - feature Structures – Probabilistic Context-Free Grammars.

UNIT-IV

SEMANTIC ANALYSIS: Representing Meaning-Meaning Structure of Language-First Order Predicate Calculus Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis - Semantic Attachments -Syntax-Driven Analyzer. Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval.

UNIT-V

LANGUAGE GENERATION AND DISCOURSE ANALYSIS: Discourse -Reference Resolution - Text Coherence -Discourse Structure – Coherence. Dialog and Conversational Agents - Dialog Acts–Interpretation - Conversational Agents. Language Generation– Architecture-Surface Realizations - Discourse Planning. Machine Translation -Transfer Metaphor–Interlingua – Statistical Approaches.

Text Books:

1. Daniel Jurafsky and James H Martin, ”*Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*”, Prentice Hall, 2nd Edition, 2008.
2. C. Manning and H. Schutze, ”*Foundations of Statistical Natural Language Processing*”, MIT Press. Cambridge, MA:,1999.

Reference Books:

1. C. Manning and H. Schutze, ”*Foundations of Statistical Natural Language Processing*”, MIT Press. Cambridge, MA:,1999.
2. Bharati A., Sangal R., ChaitanyaV.. *Natural language processing: a Paninian perspective*, PHI, 2000.
3. Siddiqui T., Tiwary U. S. *Natural language processing and Information retrieval*, OUP 2008.

CODE	SOFTWARE ENGINEERING LAB	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, Rational **Products**. The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically, the assignments have been completed during the semester requiring approximately 60-80 hours from each project team.
2. The goal of the Software Engineering Project is to have a walk through from the requirements, design to implementing and testing. An emphasis is put on proper documentation. Extensive hardware expertise is not necessary, so proportionate attention can be given to the design methodology.
3. Despite its apparent simplicity, the problem allows plenty of alternative solutions and should be a motivating and educating exercise. Demonstration of a properly functioning system and sufficient documentation is proof of a completed assignment.

COURSE OUTCOMES:

1. Design different Structural UML Diagrams for a project using Rationale Architect Software Design.
2. Design different Behavioral UML Diagrams for a project using Rationale Architect Software Design.
3. Develop the contents of the project for a given problem.

Projects

- Documentation including
- A problem statement
- A requirements document
- A Requirements Analysis Document.
- A System Requirements Specification.
- A Software Requirements Specification.
- A design document
- A Software Design Description and a System Design Document.
- A test specification.
- Manuals/guides for
- Users and associated help frames
- Programmers
- Administrators (installation instructions)

- A project plan and schedule setting out milestones, resource usage and estimated costs.
- A quality plan setting out quality assurance procedures
- An implementation.

Reference Books:

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2. Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Education
3. UML2 Toolkit, Hans -Erik Eriksson, etc; Wiley.

CODE	SOFT COMPUTING LAB	
Instruction: 4 Periods /week, Ext. Exam: 3 Hours		Credits: 2
Internal: 50 Marks	External Exam: 50 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. Understand Fuzzy concepts
2. Learn neural networks with back propagation and without preparation

COURSE OUTCOMES:

1. Learn the operators of genetic algorithms
2. Practice on crisp partitions.

LIST OF EXPERIMENTS:

1. PERCEPTRON

Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.

2. ARTIFICIAL NEURAL NETWORKS

Write a program to implement artificial neural network without back propagation.

Write a program to implement artificial neural network with back propagation.

3. FUZZY SETS

Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

4. GENETIC ALGORITHMS

Implement travelling sales person problem (TSP) using genetic algorithms.

5. COVARIANCE

Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

6. DATA FITTING BY REGRESSION

Implement linear regression and multi-regression for a set of data points.

7. CRISP MODEL

Implement crisp partitions for real-life iris dataset.

8. PERCEPTRON RULE

Write a program to implement Hebb's rule Write a program to implement Delta rule.

9. LOGIC GATES

Write a program to implement logic gates.

10. CLASSIFICATION

Implement SVM classification by Fuzzy concepts.

Reference Books:

D.K Prathikar, —Soft Computing, Narosa Publishing House, New Delhi, 2008.

**GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE & P.G. COURSES (A)
RUSHIKONDA, VISAKHAPATANAM - 530045.**

**ENGINEERING & TECHNOLOGY PROGRAM
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**M.Tech in Computer Science and Technology
Semester III [Second year] Curriculum**

Sl No	Course Type	Name of the subject	Periods/week		Max. Marks		Total	Credits
			Theory	Lab	Ext.	Int.		
1	Program Elective	Elective-V	3	-	70	30	100	3
2	Open Elective	Open Elective	3	-	70	30	100	3
3	Dissertation-I/ Industrial project			-	100	-	100	10
	Total		6	-	240	60	300	16

Elective-V: Machine Learning/Recommender Systems/Computer Vision

Open Elective: Business Analytics/Python Programming/IoT Fundamentals and Applications

CODE	ELECTIVE-V MACHINE LEARNING	
Instruction: 3 Periods /week, Univ. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

- 1.To introduce students to the basic concepts and techniques of Machine Learning.
- 2.To become familiar with regression methods, classification methods, clustering methods.
- 3.To become familiar with Dimensionality reduction Techniques.
- 4.To Understand the Concepts of ANN, Learning Mechanisms, applications of ML.

COURSE OUTCOMES:

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

1. Understand basic concepts of Machine Learning and apply Dimensionality reduction techniques.
2. Apply various machine learning techniques suitable on a given problem
3. Gain Knowledge on Concept Learning and general to specific ordering .
4. Design Neural Networks for Machine Learning applications.
5. Develop machine learning applications.

UNIT-I

Machine Learning Concepts : Classification, Regression, **Supervised Learning :** Learning a Class from Examples, Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm, **Dimensionality Reduction:** Introduction, Subset Selection, Principal Components Analysis, Linear Discriminant Analysis. **Clustering:** Introduction, k means Clustering, Expectation-Maximization Algorithm, Hierarchical Clustering, Choosing the number of clusters.

UNIT-II

Learning Mechanisms: Decision Tree Learning:Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree learning algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning. **Bayesian Learning:** Introduction, Bayes Theorem, Bayes Theorem and Concept Learning, Bayes Optimal Classifier, Gibbs Algorithm, Naïve-Bayes Classifier, An Example Learning to classify Text, The EM Algorithm. **Instance-Based Learning:** Introduction, K-Nearest Neighbor Learning, Radial Basis Function, Case Based Reasoning. **Reinforcement Learning:** Introduction, Learning Task, Q-Learning.

UNIT-III

Concept Learning and General to Specific Ordering: Introduction, well- posed learning problems, Designing a Learning System, Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search, Find-S, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version Spaces and the Candidate Elimination, Inductive Bias.

UNIT-IV

Artificial Neural Networks: Introduction, Neural Network Representation, Appropriate Problems for Neural Networks Learning, Perceptrons, Multilayer Networks and the BACKPROPAGATION Algorithm, Remarks on the BACKPROPAGATION Algorithm, An Illustrative example Face Recognition, Advanced Topics in Artificial Neural Networks.

UNIT-V

Design and Analysis of Machine Learning Experiments: Introduction, Factors, Response and Strategy of Experimentation, Response Surface Design, Randomization, Replication and Blocking, guidelines for Machine Learning Experiments, Cross-Validation and Resampling Methods, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets.

Text Books:

1. Machine Learning by Tom Mitchell, Publisher: McGraw-Hill .
2. E. Alpaydin, "Machine Learning", MIT Press, 2010

Reference Books:

1. Understanding Machine Learning, From theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press.
2. K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
4. John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.

CODE	ELECTIVE-V RECOMMENDER SYSTEMS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

- 1.To familiarize with basics of Recommender Systems
- 2.To understand various Recommendation Filtering Techniques
- 3.To explore the various Recommender system applications

COURSE OUTCOMES:

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

- 1.Understands the key concepts for Recommender Systems
- 2.Develop Content based Recommender System
- 3.Develop Collaborative Recommender System
- 4.Solve complex problems using hybrid Recommender System
- 5.Evaluate various types of Recommender Systems on the basis of metrics

UNIT-I

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT-II

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

UNIT-III

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

UNIT-IV

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT-V

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, CambridgeUniversity Press (2011), 1st ed.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.

Reference Books:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011),1st ed.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer(2013), 1st ed.

CODE	ELECTIVE-V COMPUTER VISION	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To learn various digital image processing techniques.
2. To learn applying segmentation techniques and watermarking.
3. To learn pattern recognition concepts.
4. To understand deep learning concepts.

COURSE OUTCOMES:

1. Understand and Apply morphological algorithms and image processing techniques in both the spatial and frequency (Fourier) domains.
2. Understand various image segmentation approaches.
3. Understand 3D vision and motion analysis.
4. Apply the object recognition techniques.
5. Apply the deep learning and image classification techniques.

UNIT-I

IMAGE PRE-PROCESSING: Elements of digital image processing, Sampling and Quantization, Relationships between pixels, Spatial filtering: Smoothing, Median, & Sharpening, Color Models. Morphological operation: Dilation and Erosion, Opening and Closing, Convex hull, Region filling, boundary extraction.

UNIT-II

IMAGE SEGMENTATION: Thresholding-basic global thresholding, optimum global thresholding using otsu's method. Edge based segmentation: point, line, edge detection, Region based segmentation - region growing, split and merging. Canny edge detection, region segmentation using graph cuts, mean shift segmentation, digital watermarking.

UNIT-III

3D GRAPH BASED IMAGE SEGMENTATION: 3D Vision and Video analysis: Basic Projective Geometry, 3D information from Radiometric measurement: Shapes from Shading, Photometric Stereo. Video tracking, Background modeling, Kalman filter, Particle filter.

UNIT-IV

OBJECT RECOGNITION: Knowledge representation, statistical pattern recognition-classification principles, classifier setting, classifier learning, support vector machines, cluster analysis. Neural nets- feed forward networks, unsupervised learning, hop field networks. Recognition as graph matching.

UNIT-V

DEEP LEARNING: Understanding deep learning - Perceptron, activation functions, artificial neural network, training neural networks, CNN, RNN, LSTM. Deep learning for Computer Vision, Development environment setup, Image Classification.

Text Books:

1. R.C. Gonzalez & R.E. Woods, *Digital Image processing*, Addison Wesley/ Pearson education, 2nd Edition, 2010.
2. Sonaka, Vaclav Hivac and Roger Boyle, *Digital Image processing and Computer Vision*, Cengage Learning, 2008
3. Rajalingappaa Shanmugamani, *Deep Learning for Computer Vision*, Packt Publishing, 2018.

Reference Books:

1. A.K.Jain, “*Fundamentals of Digital Image Processing*”, PHI, 1st Edition, Prentice Hall, 1989.
2. William K. Pratt, John Wiley, *Digital Image processing*, 3rd Edition, Wiley Publications, 2004.
1. Forsyth and Ponce, *Computer Vision: A Modern Approach*, 2nd Edition, 2011.

CODE	OPEN ELECTIVE – BUSINESS ANALYTICS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVE:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Mange business process using analytical and management tools.

COURSE OUTCOMES:

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

1. Understand the concept of business analytics and use of statistical tools.
2. Explain about Regression Analysis in analytics.
3. Understand predicative and prescriptive modeling to support business decision-making in business analytics.
4. Understand various forecasting techniques in business analytics.
5. Explain about decision analysis and recent trends in business analytics.

UNIT-I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III

Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Text Book:

1. Business Analytics by James Evans, Pearson Education.

Reference Book:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

CODE	OPEN ELECTIVE – PYTHON	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam: 70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. Learn basic programming of Python.
2. To develop programs using Python packages.

COURSE OUTCOMES:

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

1. Develop the Python programs using operators, conditional statements and strings.
2. Implement programs using functions and different types of Data structures.
3. Develop the programs using functions in Python.
4. Explain file handling in Python.
5. Understand Python Packages, OOP and GUI concepts.

UNIT-I

Introduction: History of Python, Need of Python Programming, Python Installation, Python basics. Operators in python, conditional statements.

UNIT-II

Iterations, continue and break statements, Strings, string functions, string slicing, Lists and Tuples. Strings, string functions, string slicing, Lists and Tuples, Dictionaries and dictionary methods, Sets and set methods.

UNIT-III

Functions: Defining Functions, Calling Functions, Passing Arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Recursion.

UNIT-IV

Regular expressions: Metacharacters, Special Sequences, Sets, RegEx Function, File handling: modes, reading files, writing and closing files, Iterators, Generators, Filters and Lambda.

UNIT-V

Packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages.
Install packages requests, flask and explore them. using (pip), Basics of NumPy and Pandas packages, Basics of Matplotlib library, Graphics, GUI.

Text Book:

1. Python ,The Complete Reference, Indian Edition, Martin C Brown, Mc Graw Hill.

Reference Book:

1. Think Python, 2nd Edition, Allen B. Downey, O'Reilly Publications.

CODE	OPEN ELECTIVE – IOT FUNDAMENTALS AND APPLICATIONS	
Instruction: 3 Periods /week, Ext. Exam: 3 Hours		Credits: 3
Internal: 30 Marks	External Exam:70 Marks	Total: 100 Marks

COURSE OBJECTIVES:

1. To provide an overview of Internet of Things and Sensors.
2. To provide clear understanding about the role of Protocols in IoT systems.
3. To learn different technologies used in IoT Applications.

COURSE OUTCOMES:

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

1. Understand characteristics and principles of IoT and Sensors.
2. Familiarize and usage of different protocols in IoT system design.
3. Differentiate different Computing Technologies in IoT
4. Understand the usage of data analytics in IoT
5. Study different IoT applications.

UNIT-I

Introduction to Internet of Things: Introduction and Definition of Internet of Things, IoT Growth – A Statistical View, Application Areas of IoT, Characteristics of IoT, Things in IoT, IoT Stack, Enabling Technologies IoT Challenges. Introduction to Sensors: Introduction to Sensor Interfacing, Types of Sensors, Controlling Sensors through Webpages.

UNIT-II

Protocols for IoT: Messaging and Transport Protocols: Introduction, Messaging Protocols, XMPP and DDS Protocols 85, Transport Protocols. Addressing and Identification: Introduction, Internet Protocol Version 4 (IPv4), Internet Protocol Version 6 (IPv6), IPv6 – A Quick Overview, Internet Protocol Version 5 (IPv5), Uniform Resource Identifier (URI).

UNIT-III

Cloud for IoT-Introduction, IoT with Cloud – Challenges, Selection of Cloud Service Provider: An Overview, Introduction to Fog Computing, Cloud Computing: Security Aspects.

UNIT-IV

Data Analytics: Visualizing the Power of Data from IoT: Introduction, Data Analysis, Machine Learning, Types of Machine Learning Models, Model Building Process, Modeling Algorithms, Model Performance, Big Data Platform, Big Data Pipeline, Real Life Projects, Recommendation in IoT Gadgets.

UNIT-V

Application Building with IoT: Introduction, Smart Perishable Tracking with IoT and Sensors, Smart Healthcare – Elderly Fall Detection with IoT and Sensors, Smart Inflight Lavatory Maintenance with IoT, IoT–Based Application to Monitor Water Quality, Smart Warehouse Monitoring, Smart Retail – IoT Possibilities in the Retail Sector, Prevention of Drowsiness of Drivers by IoT-Based Smart Driver Assistance Systems, System to Measure Collision Impact in an Accident with IoT, Integrated Vehicle Health Management

Text Book:

1. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, 2nd Edition, 2019, Willey Publications.

Reference:

2. Internet of Things: Architectures, Protocols and Standards ,Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, 2018,ISBN: 978-1-119-35970-8,Willey Publications.
3. The Internet of Things: Key Applications and Protocols (Paperback) by Olivier Hersent , David Boswarthick , Omar Elloumi ,2011,Willey Publications.

CODE	AUDIT COURSE: ENGLISH FOR RESEARCH PAPER WRITING	
Instruction: 2 Periods /week, External Exam: 3 Hours		Credits: 0

COURSE OBJECTIVES:

1. To learn planning and preparation required for research communication.
2. To learn conciseness, clarity, process of literature survey, and plagiarism.
3. To learn writing of abstract, literature, methodologies and conclusion.
4. To learn using correct punctuation, citations and bibliography.

COURSE OUTCOMES:

1. Demonstrate writing meaningful sentences and coherent paragraphs
2. Show conciseness, clarity and avoid redundancy in writing
3. Summarize, evaluate literature, and write methodology, results and conclusion
4. Describe how to develop title, write abstract and introduction
5. Apply correct style of referencing and use punctuation appropriately

UNIT I

Planning and preparation, word order & breaking up long sentences, structuring sentences and paragraphs

UNIT II

Being concise, avoiding redundancy, ambiguity and vagueness, literature survey - highlighting your findings, hedging, paraphrasing and plagiarism

UNIT III

Sections of a paper – abstract, introduction, etc. review of the literature, writing - methods, results, discussion, conclusions and final check

UNIT IV

Writing – Title, Abstract and Introduction, Review of Literature and Methods

UNIT V

Useful phrases and punctuation, in-text citation and bibliography – MLA/APA styles

Reference Books:

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

CODE	AUDIT COURSE: DISASTER MANAGEMENT	
Instruction: 2 Periods /week, External Exam: 3 Hours		Credits: 0

COURSE OBJECTIVES:

1. To demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. To learn disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. To understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

COURSE OUTCOMES:

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

1. Understand the basics and different types of Disasters
2. Describe Repercussions Of Disasters And Hazards
3. Explain Disaster Prone Areas In India
4. Describe Disaster Preparedness And Management
5. Understanding of key concepts Risk Assessment and Disaster Mitigation

UNIT-I

Introduction

Disaster: Definition, Factors And Significance; Difference between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT-II

Repercussions Of Disasters And Hazards

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT-III

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

UNIT-IV

Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT-V

Risk Assessment

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. **Disaster Mitigation:** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India

Text Books:

1.R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies, New Royal book Company.

Reference Books:

1. Sahni, Pardeep Et.Al. (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
2. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

CODE	AUDIT COURSE: CONSTITUTION OF INDIA	
Instruction: 2 Periods /week, External Exam: 3 Hours		Credits: 0

COURSE OBJECTIVES:

1. To learn Indian constitution principles and policies.
2. To learn the roles of President and Prime Minister.
3. To analyse the role Governor, Chief Minister and State Secretariat.
4. To learn the importance of the roles of Mayor, and elected representatives of Municipalities.
5. To learn role of Election Commission.

COURSE OUTCOMES:

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

1. Describe historical background of the constitution making and its importance for building a democratic India.
2. Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.
3. Explain the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions.

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Pachayati Raj: Functions PRI: Zilla Panchayat, Elected officials and their roles, CEO ZillaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass-root democracy.

UNIT-V

Election Commission: Role of Chief Election Commissioner and Election Commission; State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt.Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-Resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

