VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

(Revision 2018)

For

Second Year

of

Four Year Undergraduate Programmes Leading to

Bachelor of Technology (B Tech) Degree in Information Technology

Implemented from the batch admitted in Academic Year 2018-2019

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute Affiliated to University of Mumbai)

Curriculum

(Course Contents)

For

Second Year

of

Four Year Undergraduate Programmes Leading to

Bachelor of Technology (B. Tech.)

In

INFORMATION TECHNOLOGY

(2019-20)

Institute Vision and Mission

Vision

To establish global leadership in the field of Technology and develop competent human resources for providing service to society

Mission

- To provide students with comprehensive knowledge of principles of engineering with a multi-disciplinary approach that is challenging
- To create an intellectually stimulating environment for research, scholarship, creativity, innovation and professional activity.
- To foster relationship with other leading institutes of learning and research, alumni and industries in order to contribute to National and International development.

Department Vision and Mission

Vision

To become the world-class student-centred department which fosters high- quality learning and research for both undergraduate and graduate students.

Mission

To equip our graduates with the knowledge and expertise to contribute significantly to the knowledge and information industry and to continue to grow professionally.

- To collaborate with local, state, national, and international entities in education and research.
- To engage faculty, students and alumni in research activities.
- To nurture our graduate's interpersonal and entrepreneurial skills so they can provide leadership within the information industry's diverse culture.

B.Tech. Information Technology

Program Educational Objectives (PEOs)

1. Achieve excellence in their profession and demonstrate leadership skills in multidisciplinary domain.
2. Promote design, analysis, product implementation, research, and services in the field of Information Technology through strong technical, communication and entrepreneurial skills.
3. To complement the class room teaching with live projects, fieldwork, seminars to build self-learning, and lifelong learning capability, and to develop out of box thinking.

Program Outcomes (POs)

After the completion of the B.Tech. Information Technology programme, the graduates of the department will have

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. Develop an ability to use and apply Engineering conceptual knowledge and practices in the core information technologies of programming, networking, web technologies, human computer interaction and information management.
2. Skills to synthesize extensible and reusable code or systems to strive balance between increasing complexity and reduction in time available for development.
3. Understanding of professional ethics like confidentiality, restraining from use of unethical practices, due respect to IPR issues.
4. Aptitude for contemporary technological developments.

Proposed Revised Scheme B.Tech (IT) (Sem III to IV): AY 2018-19
onwards SEM-III

Sr No	Course Code	Course Name	L-T-P Hrs/Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4MA2007S	Linear Algebra	3	1	0	4	20	20	60
2	R4IT2001S	Discrete Mathematics	3	1	0	4	20	20	60
3	R4IT2002T	Fundamentals of Data Structures	3	0	0	3	20	20	60
4	R4IT2002P	Data Structures Lab	0	0	3	1.5	60	0	40
5	R4IT2003S	Digital Systems and Logic Design	3	0	0	3	20	20	60
6	R4IT2004S	Computer Organizations and Architectures	3	0	0	3	20	20	60
7	R4IT2005A	Program Development Lab	0	1	3	2.5	60	0	40
8	R4CH2001A	Environmental Studies	1	0	1	MNC	60	0	40
9	R4IT2006A	Development Engineering	2			P/NP	20	20	60
			19	3	7	21			

SEM-IV

Sr No	Course Code	Course Name	Hrs/Week			Credits	Evaluation Scheme		
			L	T	P		TA	MST	ESE
1	R4MA2017S	Data Interpretation and Analysis	3	1	0	4	20	20	60
2	R4IT2007S	Design and Analysis of Algorithms	3	0	0	3	20	20	60
3	R4IT2008S	Theory of Computations	3	0	0	3	20	20	60
4	R4IT2009T	Operating Systems	3	0	0	3	20	20	60
5	R4IT2009P	Operating Systems Lab	0	0	2	1	60	0	40
6	R4IT2010T	Database Management Systems	3	0	0	3	20	20	60
7	R4IT2010P	Database Management Systems Lab	0	0	2	1	60	0	40
8	R4IT2011S	Introduction to Geospatial Technologies	2	0	2	3	60	0	40
9	R4IT2012A	Open Source Computing	2			MNC	60	0	40
			19	1	6	21			

Programme Name	B. Tech. (Information Technology)	Semester – III
Course Code	R4MA2007S	
Course Title	Linear Algebra	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of course Students will be able to

1. Solve linear equations using various methods including Direct and Iterative methods.
2. Understand real vector spaces and subspaces and apply their properties.
3. Compute linear transformations, inverse linear transformations, and find matrices of general linear transformations and Find the dimension of spaces such as those associated with matrices and linear transformations.
4. Find eigenvalues and eigenvectors and use them in applications, compute inner products on a real vector space and compute angle and orthogonality in inner product spaces. Create orthogonal and orthonormal bases: Gram-Schmidt process and use bases and orthonormal bases to solve application problems.

COURSE CONTENTS

Unit No.	Topics	Hrs	CO
1	**Vector spaces:** Vectors in two and three space dimensions. Algebraic properties. Dot products and the norm of a vector. Important inequalities. Vector spaces, subspaces and vector space axioms. Application examples. Basis and dimension of a vector space.	4	2
2	**Inner product** : Introduction and examples , The Gram-Schmidt orthogonalisation, related algorithms and operation count, Least Squares Approximation	4	4
3	**Systems of Linear Equations**: Gauss Elimination method, Gauss Jordan method, Crout's method equations , Iterative methods for solving linear equations: The methods of Jacobi, Gauss-Seidel, successive over relaxation, and steepest descent. Error analysis	8	1

4	**Elementary Matrix Factorisations**. LU factorisation, related algorithms and operation count. PLU factorisation. Solving systems of linear equations. Application examples: network analysis, global positioning systems and intersection of planes	8	1
5	**Linear Transformations**: Definition and examples. Properties and Composition of linear transformations, Matrix of Linear Transformation, Rotations, reflections and stretches. Translations in homogeneous coordinates. One-to-one and onto transformations, Inverse linear transformation, Rank-Nullity Theorem, Effect of change of bases on linear operators,.	8	3
6	**Eigenvalues and Eigenvectors:** Definition, Cayley-Hamilton Theorem, Similarity and Diagonalization, Application to Quadratic forms, Normal or Canonical forms, Population growth	8	4

Text Books

1. H. K. Dass , Advanced Engineering Mathematics, S. Chand & Co. Ltd- 3rd Edition
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10thedition, 2010.
3. N.P. Bali & Dr. Manish Goyal , A Text Book of Engineering Mathematics, Laxmi Publication , 9thEdition, 2010.

Recommended Reading

1. Linear Algebra, Hauffmann and Kunze, 2nd Edition.
2. Linear Algebra A Geometric Approach, S.Kumaresan
3. Schaum's outline of Linear Algebra, 3rd Edition, McGraw Hill India.

Programme Name	B. Tech. (Information Technology)	SEMESTER – III
Course Code	R4IT2001S	
Course Title	Discrete Mathematics	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of course Students will be able to

1. Formulate problems precisely, solve the problems, apply formal proof techniques, and explain their reasoning clearly.
2. Illustrate by example, basic terminology and model problems in computer engineering using graphs and trees.
3. Apply principles of discrete probability to calculate probabilities and expectations of simple random processes.
4. Calculate numbers of possible outcomes of elementary Combinatorial processes such as permutations and combinations.

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1	**Set Theory, Logic and Mathematical Induction:** Introduction to the theory of sets, combination of sets, power sets, finite and infinite sets, principle of inclusion and exclusion, selected problems from each topic. Proposition, predicate logic, logic operators, logic proposition and proof, method of proofs. Different forms of the principle of mathematical induction, predicates, Quantifiers, selected problems on mathematical induction.	5	1
2	**Permutation, Combination and Discrete Probability:** The rules of Sum and Product, Permutation, Combination, Generation of Permutation and Combination Counting principles. Random experiment; sample space; events; axioms of probability; conditional probability. Theorem of total probability; Bayes' theorem. Application	6	1

	to information theory: information and mutual information.		
3	**Relations and Functions:** Definitions and properties; Equivalence relations and equivalence classes. Representations of relations by binary matrices and digraphs; operations on relations. Closure of a relation; reflexive, symmetric and transitive closures. Warshall's algorithm to compute transitive closure of a relation, Partial order relations; POSETS; lattices. Definition, types of functions and mappings, composition of functions, identity and inverse functions, Peono postulates, pigeonhole principle, recursive function theory.	**6**	**2**
4	**Boolean Algebra, Group and Rings:** Introduction to Boolean algebra and Boolean functions, Algebraic Systems. Different representations of Boolean functions. Application of Boolean functions to synthesis of circuits. Group, Subgroups, Groups, Semi Groups, Monoids, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Automorphisms, Homomorphism and Normal Subgroups, Ring, Integral Domain, Field, Ring Homomorphism, Polynomial Rings and Cyclic Codes.	**6**	**3**
5	**Graph and Trees :** Path, cycles, handshaking theorem, bipartite graphs, sub-graphs, graph isomorphism, operations on graphs, Eulerian graphs and Hamiltonian graphs, planar graphs, Euler formula,travelling salesman problem, Graph Coloring, shortest path algorithms (Dijkstra's algorithm).Basic terminology and characterization of trees, Prefix codes and optimal prefix codes,Binary search trees Tree traversal, Spanning trees and cut sets, Minimal Spanning trees, TheMax flow-Min Cut Theorem (Transport network).	**8**	**4**
6	**Discrete Numeric Functions and Recurrence Relations:** Introduction of discrete numeric functions; asymptotic behavior, generating functions. Linear recurrence relations with constant coefficients (homogeneous case); discussion of all the three sub-cases. Linear recurrence relations with constant coefficients (non-homogeneous case); discussion of several special cases to obtain particular solutions. Solution of linear recurrence relations using generating functions.	**7**	**4**

Text Books:

1. Liu C. L. , “Elements of Discrete Mathematics”, Six Edition, TataMcGraw-Hill, 2008, ISBN 10:0-07-066913-9
2. Mott J. L, Kandel A. and Baker T. P., “Discrete Mathematics for Computer Scientists and Mathematicians”, Second Edition, Prentice Hall India, 1986.
3. Semyour Lipschutz, Marc Lipson, “Discrete Mathematics”, Schaum’s out lines, McGraw- Hill Inc.

Recommended Reading:

1. Graham, Knuth, Patashnik, “Concrete Mathematics (Foundation for Computer Science)” ,Second Edition, Pearson Education.
2. Kenneth H. Rosen, “Discrete Mathematics and Its Applications”, Seventh Edition by, McGraw Hill Education (India) Private Limited. (2011)

Programme Name	B. Tech. (Information Technology)	SEMESTER – III
Course Code	R4IT2002T	
Course Title	Fundamentals of Data Structures	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand basic data structures such as various linear and nonlinear data structures, concepts, operations like insertion, deletion, traversing etc on them and hash tables.
2. Understand use of basic data structures in different applications and implement various applications and solve exercises using appropriate data structures.
3. Understand methods for analysis of algorithms, learn, analyze and implement different searching and sorting techniques and their implementation.
4. Understand and apply fundamental algorithmic problems including Tree traversals, Graph theory and hashing techniques.

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1.	**Introduction to Data structures and Analysis of Algorithms:** Need of data structures, Types of data structures, recursion, ADT (Abstract Data Types). Basics of algorithm, analysis of algorithm through time complexity and space complexity, asymptotic notations, pseudo code analysis, various examples to show time complexity calculation. Recurrence Relations and Solving Recurrences Using Substitution, Recursion Tree and Master Method.	5	1, 2
2.	**Stack and Queue :** Stack: The stack as an ADT, Representation, Stack operation, Application.Queue: The Queue as an ADT, Representation, Queue operation, Circular and Priority queue,Applications.	4	1, 2

3.	**Linked List:** Linked list as an ADT, Operation on linked list, Linked stacks and Queues, Array implementation of Linked List, Linked list using Dynamic Variable, Doubly, circular linked list.	5	1, 2, 3
.4	**Binary Tree:** Basic tree concept, Binary tree operations, Binary tree representation, Binary tree traversals ,Binary search tree and operations on it, balanced tree: AVL trees and operations, applications of these binary trees and exercises on it. Implementing priority queue using binary heap data structure.	5	1, 2, 3, 4
5.	**Graphs:** Basics concepts of graphs, representation of graphs, graph traversals BFS and DFS, minimum spanning tree algorithms: Kruskal's algorithm and Prim's algorithm, application and related exercises in brief.	4	1, 3 4
6.	**Searching Techniques and Hashing:** Linear Search and Binary Search, Hashing: Direct-address tables, Hash tables, open addressing, Perfect Hashing, Sorting techniques: Various sorting methods and their time complexity analysis: Insertion sort, selection sort ,merge sort, quick sort, heap sort,	7	1, 2, 3

Text Books:

1. Y. Langsam, M. J.Augenstein and A. M. Tanenbaum “Data structures using Java”, Second edition 2007 Pearson Education
2. T. H. Cormen, C. E. Leiserson, R. L.Rivest and C. Stein, “Introduction to Algorithms”, Third Edition, MIT Press/McGraw Hill.

Recommended Reading:

1. Goodrich and Tamassia, Data Structures and Algorithm in Java, John Wiley and Sons, Sixth Edition 2014.

Programme Name	**B. Tech. (Information Technology)**	**Semester – III**
Course Code	**R4IT2002P**	
Course Title	**Data Structures Lab**	
Prerequisite	**Nil**	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand basic data structures such as various linear and nonlinear data structures, concepts, operations like insertion, deletion, traversing etc on them and hash tables.
2. Understand use of basic data structures in different applications and implement various applications and solve exercises using appropriate data structures.
3. Learn, analyse and implement different searching and sorting techniques and their implementation.
4. Understand and apply fundamental algorithmic problems including Tree traversals, Graph theory and hashing techniques.

Sr No	**List of Experiments**	**Hrs**	**CO**
1.	Analyze the Time and memory complexity of a given program.	3	1
2.	Two Experiments Stacks and Queue and Applications of it. • Add an element in Stacks and Queue • Edit an element in Stacks and Queue • Delete an element in Stacks and Queue • Search an element in Stacks and Queue	6	2
3.	Two Experiments from Linked List, Different Types and its Applications. • Add an element in Linked list • Edit an element in Linked list • Delete an element in Linked list • Search an element in Linked list	6	2
4.	Two Experiments on Binary Trees covering Binary Trees, Binary Seach Trees, Traversal techniques, and Concepts /Applications of Binary Tree.	6	2,4

- Add an element in Binary tree
- Edit an element in Binary tree
- Delete an element in Binary tree
- Search an element in Binary tree

5.	Three Experiments from Graphs Unit demonstrating Graph as Data structure, Problem statements covering different graph algorithms such as BFS, DFS, Minimum Spanning Tree, Graph Applications.	9	4
6.	Three Experiment from Searching, Hashing and Sorting Algorithms	9	3

Text Books

1. E. Horowitz S. Sahani, D. Mehata, “Fundamentals of data structures in C++”, Galgotia Book Source, New Delhi, 1995, ISBN: 1678298.
2. "Data Structures Using C and C++", Y. Langsam, M. J. Augenstein and A. M. Tannenbaum, Prentice Hall India, Second Edition.
3. "Data Structures and Program Design in C", R. Kruse, Prentice-Hall India.

Recommended Reading

1. G. Brassard and P. BratIey , "Fundamentals of Algorithmics", Prentice-Hall India.
2. T. H. Cormen, C. E. Leiserson, R. L.Rivest and C. Stein, “Introduction to Algorithms”, Second Edition, MIT Press/McGraw Hill.
3. Aho, J. E. Hopcroft and J. D. Ullman , "Data Structures and Algorithms", Addison Wesley.
4. A Michael Berman, “Data structures via C++”, Oxford University Press, 2002, ISBN 0-19-510843-4
5. Goodrich and Tamassia, Data Structures and Algorithm in Java, John Wiley and Sons, Sixth Edition 2014.

Programme Name	**B. Tech. (Information Technology)**	**Semester – III**
Course Code	**R4IT2003S**	
Course Title	**Digital Systems and Logic Design**	
Prerequisite	**Nil**	

COURSE OUTCOMES

At the end of the course student will be able to

1. Understand and analyze the basic of digital system
2. Understand and analyze the use of combinational and sequential logic.
3. Understand and analyze the working of programmable logic design
4. Understand and analyze the use of VHDL design.

COURSE CONTENTS

Sr No	Topics	Hrs	CO
1.	**Number Systems and Boolean Algebra:** Number Systems: Decimal, Binary, Octal and Hexadecimal number system and conversion ,Binary weighted codes, Signed number binary order, l's and 2's complement codes, Binary arithmetic. Boolean Algebra: Binary logic functions, Boolean laws, Truth tables, Associative and distributive properties, DeMorgan's Theorems, Realization of switching functions using logic gates.	5	1
2.	**Combinational Logic:** Switching equations, Canonical logic forms, Sum of product & Product of sums, Karnaugh maps, Two, three and four variable Karnaugh maps, Simplification of expressions, Quine-McCluskey minimization techniques, Mixed logic combinational circuits, Multiple output functions. Analysis and Design of Combinational Logic: Introduction to combinational circuit, Code conversion, Decoder, Encoder, Priority encoder, Multiplexers as function generators, Binary address, Subtractor, BCD adder, Binary	5	2

	comparator, Arithmetic and logic units.		
3.	**Sequential Logic:**Sequential circuits, Flip-flops, Clocked and edge triggered flip flops timing specifications counters asynchronous and synchronous, Counter design with state equations registers, Serial in serial out shift registers, Tristate register, and Register transfer timing considerations. Sequential Circuits: State diagrams and tables, Transition table, Excitation table and equations. Examples using flip flops. Simple synchronous and asynchronous sequential circuit analysis, Construction of state diagram and counter design	6	2
4.	**Programmable Logic:** Programmable logic devices, Programmable logic arrays and programmable array logic, Design using PAL, Field programmable gate arrays, Algorithmic State Machines, ASM charts, notations, design of simple controller, multiplexer controller method.	6	3
5.	**Digital Integrated Circuits:** Digital circuit logic levels, Propagation delay times, Power dissipation, Fan-out and fan- in,Noise margin for popular logic families, TTL, LSTTL, CMOS, and ECL integrated circuits and their performance comparison, Open collector and Tri-state gates and buffers.	7	3
6.	**Introduction to VHDL:** Defining modules in VHDL, Structural modeling, Data flow models, Behavior models. Design of digital circuits using VHDL.	7	4

Text Books

1. R. P. Jain , “Modern Digital Electronics”, Tata McGraw-Hill, 3rd Edition, (2003)
2. M. Morris Mano, "Digital Logic and Computer Design", PHI

Recommended Reading

1. James Bignell, Robert Donavan, “Digital Electronics”, 5th edition CenegageLearning ISBN
2. Stephen Brown and ZvonkoVranesic , “Fundamentals of Digital Logic with VHDLDesign” , McGraw-Hill.
3. J.Bhaskar , “VHDL Primer, Pearson Edition, 3rd Edition

Programme Name	B. Tech. (Information Technology)	Semester – III
Course Code	R4IT2004S	
Course Title	Computer Organizations & Architectures	
Prerequisite	Digital Logic	

COURSE OUTCOMES

At the end of course Students will be able to

1. Describe a computer system in terms of its main components and organization of these components.
2. Design Control Unit, Arithmetic Logic Unit.
3. Design Memory and Input/output subsystems.
4. Describe/explain/categorize architecture of computer system including different parallel computer architectures.

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1	**Computer Evolution & Arithmetic** Computer Structure and Function, A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection, Arithmetic and Logic Unit, Scalar Data Types, Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm, Hardware Implementation, Division, Restoring and Non Restoring algorithms.	5	1
2	**The Central Processing Unit** Machine Instruction characteristics, types of operands, types of operations, Instruction formats, Instruction types, Processor organization, Register Organization, Instruction Cycle, and Instruction Pipelining.	4	1,2
3	**The Control Unit** Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer, Hardwired Implementation, Micro-	6	2

	programmed Control: Basic concepts, Microinstructions and micro- program sequencing, Microinstruction Execution.		
4	**Memory Organization** Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM ,High-Speed Memories: Cache Memory, Organization and Mapping Techniques, Replacement Algorithms, Cache Coherence, Virtual Memory: Main Memory allocation, Paging, Segmentation, Paged Segments, Address Translation Virtual to Physical,Secondary Storage: Magnetic Disk, Tape, RAID, Optical memory, CDROM, DVD	8	3
5	**I/O Organization** Input/Output Systems, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA), Input/Output Channels and Processors	4	3
6	**Parallel Organization** Parallelism in Uniprocessor Systems, Instruction level pipelining, Pipeline Computers, Array Computers, Multiple Processor Organizations, Closely and Loosely coupled multiprocessors systems, Symmetric Multiprocessors.	6	4

Text Books

1. W. Stallings, “Computer Organization and Architecture: Designing for performance”, Prentice Hall of India, 8th Edition, 2003, ISBN 81 – 203 – 2962 – 7
2. C. Hamacher, V. Zvonko, S. Zaky, “Computer Organization”, McGraw Hill, , 5th edition, 2002 ISBN 007-120411-3
3. Kai Hwang and Briggs, "Computer Architecture and Parallel Processing", Tata Mc-Graw Hill.

Recommended Reading

1. J. Hays, “Computer Architecture and Organization”, McGraw-Hill, 2nd Edition, 1988 ISBN 0 – 07 – 100479 – 3
2. Tanenbaum, “Structured Computer Organization”, Prentice Hall of India, 4th Ed, 1991 ISBN 81 – 203 – 1553 – 7 (Chapter: 1,4,5,6,8).
3. G. George, “Computer Organization: Hardware and Software”, Prentice Hall of India, 2nd Edition, 1986 (Chapter: 3,4,5).

4. D. Paterson, J. Hennesy, “Computer Organization and Design: The Hardware Software Interface”, Morgan Kauffman,2nd Edition, 2000 ISBN

Programme Name	B. Tech. (Information Technology)	Semester – III
Course Code	R4IT2005A	
Course Title	Program Development Lab (Python)	
Prerequisite	Programming Fundamentals	

COURSE OUTCOMES

At the end of course Students will be able to

1. Implements Python programs to solve problems
2. Develop design of GUI Applications in Python
3. Design and develop Client Server network applications using Python and evaluate different database operations.
4. Design different Decision Making statements and Functions in python

COURSE CONTENTS

- Introduction
- Conditional Statements
- Looping
- Control Statements
- String Manipulation
- Lists
- Tuple
- Functions
- Modules
- Input-Output
- Exception Handling

Sr No	List of Experiments	Hrs	CO
1.	Write a programs to implement following a) Square root of a number b) Sum of elements of an Array using Recursion c) Fibonacci of a number d) Implement service to find prime numbers.	4	1

2.	Write programs implements List comprehensions	4	1
3.	Write a program to analyze list using map, reduce, filter methods	4	2
4.	Write an contact application using dictionary	4	2
5.	Write an application to edit a text file.	4	2
6.	Write an application to create GUI using Tk, Tkinter.	4	2
7.	Write an application to implement client-server programming	4	2
8.	Write an application to connect with database	4	3
9.	Write an application to draw plots using matplotlib library	4	3
10.	Write an application to analysis the data using NumPy, Pandas libraries	4	3
11.	Write an application to perform image processing using pillow library	4	4
12.	Mini Project on Python	4	4

Text Books

1. Introduction to Python for Computational Science and Engineering (A beginner's guide), Hans Fangohr.
2. Exploring Python, Timothy A. Budd, McGraw Hill Education.

Recommended Reading:

1. Python for Informatics: Exploring Information, Charles Severance.
2. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication

Programme Name	B. Tech. (Information Technology)	Semester – III
Course Code	R4CH2001A	
Course Title	Environmental Studies	
Prerequisite	Nil	

Course Outcome:

After completing this course, students will be able to

1. Imply the basic knowledge of environmental protection, sustainable development and improvement.
2. Categorize and scrutinize impact of human development on natural resources. Provide the student with an understanding of radioactive waste.
3. Interpret the impact of environmental problems on socio economic growth and human health.
4. Imply various strategies, technological improvement, and methods for sustainable management of environmental systems and for the remediation of degraded environment.
5. Apply different Science and Technology (S&T) based sustainability solutions and limitations as well as to identify impact of human population on the natural environment and human health.

Sr. No.	Course Contents	Hrs	Cos
Module 1	**Significance of Environment Science:** Definition, basic principles and scope of environment science. Earth Man and Environment inter-relationship. Need for awareness Industrialization & Urbanization; Modern Human Life, Basic Ecological Concepts Ecosystems, nature of environmental threats Current environmental problems, Importance of clean air.	6	1
Module 2	**Ecosystems and Its conservation:** Introduction, definition: genetic, species and ecosystem diversity. Concept of an ecosystem: Structure and function of an ecosystem, Producers, consumers and decomposers. Conservation of ecosystem: Natural Resources, Renewable and Non-renewable Resources, Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation of natural resources. Biodiversity and its significance, and conservation. Global, National and effects of biodiversity	6	2

Module 3	**Fundamentals of Environmental Chemistry:** Definition, Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) Radioactive Waste (I) E-waste. Importance of Environmental Chemistry to access and manage environmental pollution.	**6**	**3**
Module 4	**Pollution Monitoring and Control Methods:** Methods of controlling air pollution: Pollution controlling methods, Principle, construction, working and application of Equipment for gaseous pollutants control: Method to control water pollution: Principle, construction, working. Concept of Sustainability and Green Chemistry as a tool for sustainable development.	**6**	**4**
Module 5	**Environmental Assessment, Management and Legislation:** Aims And Objectives Of Environmental Impact Assessment (EIA). Environmental Impact Statement (EIS) And Environmental Management Plan (EMP) Environmental Ethics: Issues And Possible Solutions: Environment Audit :Principle, Procedure And Benefits Case study can be submit by the students. **Projects and activities by students on Current Environmental Issues in India** Global Environmental Issues: Biodiversity loss ,Climate change, Ozone layer depletion, Sea level rise Global Warming International efforts for environmental protection and contribution of India for same, National Action Plan on Climate Change	**6**	**5**
Total		**30**	**1 to 5**

Text Books

1. De , Environmental Chemistry,6th Edition ,New Age International
2. P.K.Goel, Water Pollution, Causes, Effects and Control, New Age International
3. Erach Bharucha, Text Book of Environmental Studies for Undergraduate Courses, Universities Press, Second Edition
4. Dr. Jagdish Krishnaswamy and Dr. R. J. Ranjit Daniels, Environmental Studies, Wiley India Private Limited, New Delhi, First Edition, 2009.

Recommended Readings:

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad,
2. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 200
3. Jadhav, H &Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995
4. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998

Programme Name	**B. Tech. (Information Technology)**	**Semester – III**
Course Code	**R4IT2006A**	
Course Title	**Development Engineering**	
Prerequisite	**Nil**	

COURSE OUTCOMES:

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

1 Analyze basics of development engineering
2 Analyze basics of social connect
3 Identify society to economic development
4 Identify issues in product formation for development.

Sr. No.	Topics	Hrs	CO
1.	**Introduction to Development Engineering** Introduction to development engineering; need of development engineering; core disciplines and concept; major issues in development; urban development; rural development; socioeconomic development; scientific social research, formulation of research problem, field work and data collection, report drafting.	6	1
2.	**Design of Sustainable Communities** Concept and development of sustainable communities; sustainable design principles, building regulations, codes and standards – ANSI,ASTM,ASHRAE ,approval process; green buildings – green building techniques-energy solutions, site solutions, site solutions, exterior and interior solutions, Certification – BREEAM, GRIHA, NAHB, LEED,IGBC.	6	2
3.	**Town/City Planning** Town Planning, history of town planning in India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum redevelopment; Smart city planning introduction on city planning, infrastructure elements of smart city planning, dimensions of smart cities global standards and	7	2

	performance benchmark; smart solutions e-governance, waste management, water management, energy management, urban mobility, citizen services, other services such as tele-medication and education, trade facilitation, skill development; GIS for Planning.		
4.	**Planning and Development of Rural Areas:** District administration, District Planning, introduction to various sectors of rural areas such as drinking water, Waste water treatment, electricity ,public transport, irrigation, sanitation and cooking energy; issues and challenges associated with these sectors; People's participation and role in development of rural areas; various schemes and policies floated by state and central government – phases in the schemes; life cycle costing of these schemes	6	2
5.	**Geoinformatics for Planning and Development** Introduction to Geoinformatics; Advantages, benefits and limitations; Interdisciplinary applications; Data extraction; use of Geoinformatics for planning, mapping and preparation of layouts.	6	3
6.	**Development aspects: Urban and Rural:** Planning and designing of a model town / city and using Auto-CAD and/or GIS, Visit to a village or small town – The project will be carried out in groups .Problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution.	6	4

.**Text Books:**

1. Chand M. and Purr U.K. (1983), 'Regional Planning in India', Allied Publisher, NewDelhi.
2. Kaiser E. J., et.at., 'Urban Land use Planning', 4th Edition Urbana, University of Illinois Press.
3. Sundaram K. V.,'Geography Planning', Concept Publishing Co., New Delhi.
4. Ayyar C.P.V., 'Town Planning in Early South India', Mittal Publications, Delhi.
5. Longley, et.al,' Geographic Information Systems and Science', John Wiley & Sons, NewYork.
6. Desai V., 'Rural Development of India', Himalaya publishing house, Mumbai.

Recommended Reading:

1. Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India,New Delhi, UDPFI Guidelines, 1996.
2. Miles R. Simon, 1970, ‘Metropolitan Problems’, Methuen Publications, Canada.
3. B.I.S., 1980, 'National Building Code of India’, ISI, NewDelhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High – Performance Green Buildings Except Low-Rise Residential Buildings.
5. ASHRAE Standard 90.1,Energy Standard for Buildings Except Low-Rise Residential Buildings
6. Reeder, Hoboken, 'Guide to green building rating systems’, John Wiley& sons, Inc.

Programme Name	B. Tech. (Information Technology)	Semester – IV
Course Code	R4MA2017S	
Course Title	Data Interpretation and Analysis	
Prerequisites	Basic Mathematics	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand the concepts of Data Interpretation and Analysis like different way to represent the data and make data summarization.
2. Identify and analyze the data whether it is a discrete or continuous and find the probability.
3. Analyze the random variable and its applications.
4. Understand different random variables and make parameter estimation.

COURSE CONTENTS

Sr No	Topics	Hrs	CO
1	**Descriptive Statistics:** Data summarization: mean and median, Proofs that median minimizes the sum of absolute deviations: with and without using calculus, Standard deviation and variance, some applications.	4	1
2	**Discrete and Continuous Probability** Discrete probability: Conditional probability, Bayes rule, False Positive Paradox, Birthday paradox in discrete probability.	4	2
3	**Random Variables and Expectation** Random variable: Probability mass function (pmf), cumulative distribution function (cdf) and probability density function (pdf), Variance and standard deviation, with alternate expressions, Markov's and Gambler's fallacy, Concept of joint PMF, PDF, CDF, Concept of covariance, concept of mutual independence and pairwise independence, Properties of covariance, Concept of conditional PDF, CDF, PMF, moment generating functions	8	3

4	**Special Random Variables:** Bernoulli distribution, difference between binomial and geometric or negative binomial distribution, Gaussian distribution, Central limit theorem and its extensions; Bessel's correction for standard deviation, Chi square distribution, Poisson distribution	8	4
5	**Parameter Estimation** Maximum likelihood estimation (MLE), MLE for parameters of Bernoulli, Poisson, Gaussian and uniform distributions, Least squares line fitting as an MLE problem, interval estimates: two-sided confidence intervals	8	4

Text Books

1. Sheldon Ross, “Probability and Statistics for Engineers and Scientists”, Fourth Edition, Elsevier, 2008.

Recommended Reading

1. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh , “An Introduction to Probability and Statistics”, Second Edition,Wiley.

2. Ronald E. Walpole , Raymond H. Myers, Sharon L. Myers, “Probability & Statistics for Engineers &; Scientists” ,Pearson Education International.

Programme Name	**B. Tech. (Information Technology)**	**Semester – IV**
Course Code	**R4IT2007S**	
Course Title	**Design and analysis of Algorithm**	
Prerequisites	**Data Structures, Discrete Mathematics**	

COURSE OUTCOMES

At the end of course Students will be able to

1. Analyse, calculate and represent the time complexity and space complexity for given algorithm.
2. Understand, analyse and formulate problem statement from given information and design an efficient algorithm to solve it using algorithm design techniques.
3. Identify weather given problem is NP-Complete or not,and develop efficient algorithm that gives good solution.
4. Analyse the time and space complexity of algorithms

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1.	**The Role of Algorithms in Computing Algorithms** Algorithms as a technology fundamental of algorithmic problem solving. Fundamental of the analysis of algorithm efficiency. analyzing algorithms ,designing algorithms growth of functions, asymptotic notation, , substitution method the recursion-tree method , the master method. Brief introduction to different algorithm design techniques	**6**	**1,4**
2.	**Divide and Conquer Technique** General Method, Revision and analysis of merge sort, quick sort and binary search, Counting inversions, Finding closest pair of points, Integer multiplication**.**	**5**	**2**
3.	**Greedy Method** Elements of greedy technique, Activity selection problem, Fractional Knapsack Problem, Job Sequencing problem, Huffman Coding, Finding Single Source Shortest path in graph: Dijkstra's Algorithm, Revision and analysis of minimum spanning tree algorithms.	**7**	**2**

4.	**Dynamic Programming** Elements of Dynamic Programming, Principles of Dynamic programming-memorization or iteration over sub problems, Assembly line scheduling, Matrix chain multiplication, Longest common subsequence, All pair shortest path algorithm- Floyd-Warshall's Algorithm.	**6**	**2**
5.	**NP-Completeness** Matching , Introduction to NP-Complete , Search/Decision, SAT, Independent Set, 3VC ,Exact Cover, Multi Set, Subset Sum & Partition, Hamiltonian Circuit.	**7**	**3**
6.	**Approximation Algorithms** The vertex-cover problem, The set-covering problem, The subset sum problem.	**7**	**3**

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L.Rivest and C. Stein, “Introduction to Algorithms”, MIT Press/McGraw Hill, Second Edition.
2. Jon Kleinberg, Eva Tardos, “Algorithm Design”, Pearson, Addison Wesley

Recommended Reading

1. A. V. Aho, J. E Hopecroft and J.D. Ullman, The design and analysis of algorithm, Addision-Wesley, 1974

Programme Name	**B. Tech. (Information Technology)**	**Semester – IV**
Course Code	**R4IT2008S**	
Course Title	**Theory of Computations**	
Prerequisites	**Data Structures, Discrete Mathematics**	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand the concepts of automata theory like finite automata, grammar, regular expressions, pushdown automata, and Turing machine.
2. Analyze, describe and transform the regular expressions and context free grammar.
3. Analyze, and design DFA, NFA, pushdown automata and equivalent context free grammar, Turing machines with its equivalent languages.
4. Understand basic concepts of complexity theory and apply the concepts of theory of computations in real-time problems or designs.

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1.	**Fundamentals** Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, Deterministic finite automaton and Non-deterministic finite automaton, Transition diagrams, Language recognizers.	**6**	**1**
2.	**Finite Automata** Transforming NFA to DFA, NFA with epsilon moves, Minimization of DFA, Finite state automata with output – Moore and Mealy machine	**5**	**1**
3.	**Regular Languages** Regular sets, Closure properties of regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets.	**5**	**2**

4.	**Grammar** Formal Grammar, Types of Grammar, Chomsky Hierarchy, Regular Grammar, Equivalence of Regular Grammars and Finite Automata, Left Linear and Right Linear Grammar	**4**	**2**
5.	**Context Free Grammar** CFG, Derivation, Parse Tree, Ambiguity in grammars and languages, Language Specification using CFG, Minimization of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Closure properties of CFL	**6**	**3**
6.	**Pushdown automata** Pushdown automata Definition, Model, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata.	**4**	**3**
7.	**Context Free Languages** Pumping Lemma for CFL, Closure properties of CFL, Turing Machines: Definition, Model ,Design of Turing Machine, Computable Functions, Properties of Recursive and Recursively Enumerable Languages, Programming Techniques for Turing Machine	**3**	**4**
8.	**Undecidability** Decidability of problems, Universal Turing Machine, Undecidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.	**3**	**4**

Text Books

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, “Introduction to Automata Theory, Languages and Computations”, Pearson Education, second Edition, 2007.

Recommended Reading

1. Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole,1997.
2. John Martin, “Introduction to Languages and the Theory of Computation”, McGraw-Hill, 2003

Programme Name	**B. Tech. (Information Technology)**	**Semester – IV**
Course Code	**R4IT2009T**	
Course Title	**Operating System**	
Prerequisites:	**C and C++ programming**	

COURSE OUTCOMES

At the end of course Students will be able to

1. Analyze various process management concepts including scheduling, synchronization, and deadlocks.
2. Identify issues in process and thread management, memory management.
3. Analyze I/O management, File management
4. Identify issues in, buffer management ,Unix architecture , OS security

COURSE CONTENTS

Unit No:	Topics	Hrs	CO
1.	**Introduction:** Computers and Software, General System software, Resource abstraction & Sharing, Operating system strategies (Batch, Timesharing, real time, embedded etc)Concept of Multiprogramming Operating system organization, Basic functions-Implementation considerations, Computer organization, bootstrapping the machine, Mobile computers, Multiprocessors and parallel computers, Device Management-Device controllers & Device drivers – I/O strategies (direct I/O with polling, Interrupt driven I/O, DMA), Buffering, Disk scheduling strategies	**5**	**1**
2.	**Process and Threads Management:** Process & Threads- Implementing process & Threads – Process address space- process state transition diagram- Process manager responsibilities- concept of Linux process & thread descriptors-Process scheduler organization- different scheduling strategies(non preemptive & non-preemptive)- Process synchronization- critical section- semaphore & its implementation – classical synchronization problems and its solutions (Producer-consumer, readers-writers, dining philosopher)- Deadlock-prevention-avoidance-bankers algorithm-detection-reduced resource allocation graph- Inter process communication(Pipes, message passing etc)-concept of process management in Linux and Windows NT	**7**	**2**

3.	**Memory Management:** Memory management- address space abstraction-address binding-memory allocation- Fixed partition & variable partition memory strategies-dynamic address binding- swapping-paging-virtual memory address translation-dynamic paging-static paging algorithms-dynamic paging algorithm-working set algorithm-segmentation- implementation-memory mapped files-concept of memory management in Linux & Windows NT/XP	**5**	**2**
4.	**File Management:** File Management – Low level files and Structured files- Low level file implementation .– different approaches to Block management- Structured sequential file-Indexed sequential file-different directory structures-file systems-Mounting file systems- Protection and Security-security and Policy – Authentication , authorization and cryptography- Kerberos authentication- General protection model- Access matrix- Access control list – Capability list – Concept of File management in Linux and Windows NT	**6**	**3**
5.	**I/O Management:** I/O Devices , Organization of the I/O Function , Operating System Design Issues , Buffer	**3**	**3**
6.	**Architecture of the UNIX:** Introduction to system concepts, Kernel data structures, system administration	**4**	**4**
7.	**Buffer Cache:** Structure of the buffer pool, Advantages and disadvantages of the buffer cache. Internal representation of files: I-nodes. Structure regular file. Directories – Conversion of a path name to an I-node. Super block. Other file types,Unified Buffer Cache.	**3**	**4**
8	**Protection and Security:** Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Security problems, Authentication, Program threats, System threats, Threat monitoring	**3**	**4**

Text Books:

1. Silberschatz & Galvin, “Operating system concepts”, Addison Wesley ,10th edition
2. Tanenbaum A.S, “Modern Operating Systems”, Pearson Education 3rd edition, 2008
3. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall, 2008

Recommended Reading:

1. Gary Nutt, Nebendu Chaki, and Sarmistha Neogy, “Operating Systems”, Pearson Education, 3rd edition, 2009
2. Jerry D. Peek, Grace Todino, John Strang, “Learning the Unix Operating System”, O'Reilly & Associates Publication, 5th edition, 2002
3. Maurice J. Bach; The Design of the Unix Operating System; Prentice Hall of India; ISBN: 978-81-203-0516-8

Programme Name	B. Tech. (Information Technology)	Semester – IV
Course Code	R4IT2009P	
Course Title	Operating System Lab	
Prerequisite	C and C++ programming	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand and apply OS commands ,shell scripts
2. Understand various CPU Scheduling algorithm ,file allocation algorithms
3. Analyze the performance of the various page replacement algorithms ,dead lock avoidance and detection
4. Implement IPC

Unit No:	List of Experiments	Hrs	CO
1.	Basics of UNIX commands	2	1
2.	Shell Programming	2	1
3.	Implement the following CPU scheduling algorithms Round Robin SJF FCFS Priority	2	2
4.	Implement all file allocation strategies Sequential Indexed Linked	2	2
5.	Implement Semaphores	2	3
6.	Implement all File Organization Techniques	2	2
7.	Implement Bankers Algorithm for Dead Lock Avoidance	2	3
8.	Implement an Algorithm for Dead Lock Detection	2	3
9.	Implement e all page replacement algorithms FIFO LRU LFU	2	3
10.	Implement Shared memory and IPC	2	4
11.	Implement Paging Technique of memory management	2	3
12.	Implement Threading & Synchronization Applications	2	4
13	Write a C program to simulate producer-consumer problem using semaphores.	2	3

Programme Name	B. Tech. (Information Technology)	Semester – IV
Course Code	R4IT2010T	
Course Title	Database Management System	
Prerequisites	Data Structures	

COURSE OUTCOMES:

At the end of course Students will be able to,

1. Understand the database problems and design database using ER model and normalization technique.
2. Write Structured Query Language (SQL) for given problem.
3. Describe Data storage and querying of DBMS
4. Identify issues in transaction, concurrency control of DBMS.

COURSE CONTENTS

Unit No:	Topics	Hrs	CO
1	**Introduction to DBMS:** Characteristics of database , Database users , Advantages of DBMS , Data Models , Schemas and Instances , Three schema Architecture and Data Independence , Database Languages and Interfaces, The Database System Environment , Centralized and Client / Server Architecture for DBMS, ORDBMS, OODBMS. **Object-Oriented Databases** Overview of Object-Oriented Concepts. Object Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods, and Persistence, Type Hierarchies and Inheritance, Type extents and Queries, Complex Objects, Database Design for ORDBMS - Nested Relations and Collections Storage And Access methods: OQL, introduction to OODBMS Architecture.	6	1
3	**Entity-Relationship Model**:Entity Types ,Entity Sets ,Attributes and Keys ;Relationship Types, Relationship sets , Roles and structural Constraints; Design Issues; Entity Relationship diagram; Weak entity sets; Extended E- R features; Design of an E-R database schema; Reduction of an E-R schema to tables. Relational Model Concept of a relation; Relational Model Constraints; Relational Database Schema, Entity Integrity, Referential Integrity and foreign keys; the relational algebra and extended relational-algebra operations; Relational Database Design using ER-to Relational	5	1,2

	Mapping.		
2	**Structured Query Language :**DDL : Create, Modify, Alter, Drop, View definition, etc.DML : SELECT, INSERT, DELETE, Update, Nested Query, SQL with SET operations: Union, Intersect, Except, etc, Aggregate Functions: Group By, Having, SUM, etc, SQL with Logical operations, Nested and Complex Queries, Join Queries. DCL : GRANT, REVOKE, etc DBA level query. Cursors and Triggers, Procedures and Functions.	6	3
4	**Relational-Database Design:** First normal form; Pitfalls in relational-database design ;Functional dependencies; Decomposition; Desirable properties of decomposition; Boyce-Codd normal form; 3rd and 4th normal form; Mention of other normal forms; Overall database design process.	6	2,
5	**Transaction Processing Concepts:** Transactions: Transaction concept; Transaction and System Concepts; Properties of Transaction; Schedules based on Serializability; Recoverability; Transaction definition in SQL. Concurrency control: Concurrency Control Lock-based protocols; Timestamp-based protocols; Validation-based protocols; Multiple granularities; Multiversion schemes; Deadlock handling; Insert and delete operations; Weak levels of consistency; Concurrency in index structures, locking techniques.	5	4
6	**Database Recovery :**Database back up, Recovery System Failure classification; Storage structure; Recovery and atomicity; Log-based recovery; Shadow paging; Recovery with concurrent transactions; Buffer management, database security issues, access control, authorization, Distributed databases.	5	4
7	**Data Storage and Querying:** File organization, Indexing and Hashing Organization of records in files; Data dictionary storage. Basic Concepts of Indexing ; Types of Single Level Ordered Indices; Multilevel Indices using B+ Tree Index Files; B- Tree Index Files; Static Hashing; Dynamic Hashing; Index Definition in SQL; Multiple-Key Access. Fundamentals of Query Optimization.	6	3

Text Books:

1. Elmasri&Navathe, ”Fundamentals of Database System”, 7th Edition, Addison Wesely Publication.(2015).
2. Abraham Silberschatz, Henry Korth, Sudarshan , “Database System Concepts”, 6th Edition, (2010)
3. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rdEdition, McGraw-Hill,

2002

Recommended Reading:

1. Michael Mannino, “Database design, Application Development and Administration”, 4th Edn(2008)
2. Peter Rob and Coronel, “Database systems, Design, Implementation and Management”, 5th Edition, Thomson Learning,2001
3. C. J. Date, "Introduction To Database Systems", Seventh Edition, Addison Wesley Longman

Programme Name	B. Tech. (Information Technology)	Semester – IV
Course Code	R4IT2010P	
Course Title	Database Management System Lab	
Prerequisite	Nil	

COURSE OUTCOMES:

At the end of course Students will be able to

1. Apply operation of the relational data model.
2. Design database system.
3. Apply PL/SQL database operations
4. Apply all database operations on real time case study

Unit No.	List of Experiments	Hrs	CO
1.	Students shall take a mini project in to consideration for database application project. This mini project will be for any live problem observed in the real life. The problem shall have reasonably large data and transaction, complex operations, which will have multiple and interrelated entities. Design the database normalized up to 3NF minimum required. Staff in charge will approve mini project specification to be performed. Every group advised to choose the different problem to be implemented as project. The group size will be approved by staff-in-charge depend on the complexity of the problem chosen. 4-5 students in one group would be advisable. The student group must maintain a log book of the activities related to the projects progress. Finally, the mini project shall consists of, i. Create at least 5-10 tables using all types of possible constraints, and relationship (foreign key) between them. ii. Populate the database using SQL insert/creating forms. Iii. Implement suitable functionality related to the project which involves proper data processing. iv. Create triggers and active elements to maintain the integrity of the	8	2,1

	database and perform appropriate action on database updates v. Develop suitable User Interface using appropriate tools & languages vi. Generate at least 3-4 suitable data report related to the functionality of the system with proper heading sub headings and footers Group of students should submit the Project Report which will be consist of Title of the Project, Abstract, Introduction, scope, Requirements, Entity Relationship Diagram with EER features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Forms and Data Reports, Testing document, Conclusion. (Instructor will define/approve problem definition for each batch of reasonable complexity such that it facilitates the use of all ER/EER features, all types of relationships, all types of attributes, strong & weak entities, aggregation, generalization, integrity constraints, etc.)		
2.	**Group A: Design Database** Problem Definition & Data Modelling a. Defining Problem Statement b. Data Modelling for problem defined in exp.1a i. ER/EER Diagram ii. Optimization of ER/EER Diagram Creation of Database & use of DDL, DML statements on exp.1 c. Creation and Normalization of database schema from ER Diagram d. Building Database using DDL Statements e. Performing different DML operations on Created Databases	6	2,1
3.	**Group B: Database operations**: SQL and PL/SQL Performing Query Operations using SQL statements Writing PL/SQL programs, procedures, triggers	4	2,3
4.	**Group C: Database Connectivity, GUI and Report** Development of GUI for implementing the Case Study defined in exp.1Performing Operations through Database connection string Developing GUI/Forms for the Case Study &performing database operations on database created in exp.2 Generating Reports for database created in exp.2	6	2,1, 4

Programme Name	B. Tech. (Information Technology)	Semester – IV
Course Code	R4IT2011S	
Course Title	Introduction to Geospatial Technologies	
Prerequisites	Nil	

COURSE OUTCOMES

At the end of course Students will be able to

1. Understand basic, practical understanding of GIS concepts, techniques and real world applications.
2. Explore on geo-referencing, projection systems, mapping, satellite data systems, and spatial data acquisition systems.
3. Apply the spatial data analysis and visualise using GIS tools and softwares.
4. Develop the solve societal problems using Geo spatial technologies, tools and programming language like webGIS and MobileGIS.

COURSE CONTENTS

Unit No	Topics	Hrs	CO
1	**Geographic Information Systems, Science and Study:** Introduction: Why GIS, Science and Technology of problem solving, GISystems, GIScience, GIS applications, GIS Components, Geographic data representation, Geographic data models: Raster and Vector data models.	4	1
2	**Geo referencing and projection system:** Early measurements, The Geoid, Measuring the Earth: latitude and Longitude, Map projections and coordinate System, Digitizing: Coordinate capture, coordinate transformation, GNSS basics, GNSS control points, Map Projection vs. Transformation, Geo-referencing, satellite based positioning,	5	2
3	**Data acquisition and** assimilation: Data Sources: Aerial images, Satellite images, LiDAR, Digital data, remote sensing, Data acquisition methods: Field survey, Control survey, old records, Integration challenges in geospatial systems	5	2,3
4	**Visualizing spatial data**: Introduction to maps, visualization process, cartographic	5	3

	toolbox, Maps types, Map scales, Map Generalization, Map boundaries, maps and cartography, Principles of map design, how to map: qualitative, quantitative, terrain elevation, time series, geo visualization, map stories.		
5	**Spatial Analysis:** Introduction: what is spatial analysis?, Selection and Classification, Proximity Functions and Buffering,Fundamental spatial analysis techniques such as overlay, extraction, and interpolation, Raster analysis: Map Algebra, Local Functions, global Functions , terrain analysis	5	3
6	**Web GIS:** Introduction to Web GIS, Introduction to Mobile GIS, Scripting Languages for GIS	6	4
7	**Advances in GIS:** Data Standards, Data Quality,Data Accuracy, Advances and Currents developments in GIS, Challenges in GIS	4	2,4

Text books:

1. Paul Bolstad - GIS Fundamentals_ A First Text on Geographic Information Systems-XanEdu (2016)
2. Longley, Good child, Paul A., et al. *Geographic information systems and science*. John Wiley & Sons, 2005.
3. Otto Huisman - Principals of GIS

Recommended Reading:

1. Michael N. DeMers, 2009. *Fundamentals of Geographic Information Systems,* 4th edition. Hoboken, NJ: Wiley.
2. Lo, C. P., Yeung, Albert, 2007. *Concepts and techniques of geographic information systems*, 2nd edition. Upper Saddle River, NJ: Pearson Prentice Hall
3. Reddy, M. Anji, and Anji Reddy.*Textbook of remote sensing and geographical information systems*. Hyderabad: BS publications, 2008.
4. Sarda, N.L.,Acharya**,** P.S**.,** Sen**,** Sumit (Eds.), Geospatial Infrastructure, Applications and Technologies: India Case Studies, 2019

Experiments Contents

Exp	Experiments	Hrs	COs
1.	Understanding QGIS, and other GIS mapping tools	2	1
2.	Working with QGIS	2	1
3.	Creating digital maps using geospatial objects	2	2
4.	Understanding digital data, data collection techniques, and various data formats	2	2
5.	Importing various data formats to QGIS to build map and features	2	2
6.	Working with basics of spatial data analysis	2	3
7.	Working with basics of spatial data analysis	2	3
8.	Working with multiple layers of digital maps and complex query analysis	2	3
9.	Developing web pages for webGIS	2	4
10.	Working with scripting languages for dynamic webGIS contents	2	4
11.	Working with scripting languages for dynamic MobileGIS contents	2	4
12.	Accessing webGIS/Mobile through private/public hosting infrastructure using GeoNode server.	2	4

Programme Name	**B. Tech. (Information Technology)**	**Semester – IV**
Course Code	**R4IT2012A**	
Course Title	**Open Source Computing**	
Prerequisites	**C/C++ programming**	

COURSE OUTCOMES:

At the end of this course Students will be able to

1 Describe the open source computing.

2 Understand the java programming language.

3 Design the web applications using javascript framework.

4 Apply the open source technologies to build applications.

COURSE CONTENTS

Unit No:	Topics	Hrs	CO
1	**Open Source Technologies**: Introduction to open source technology, Internet, open source operating systems, open source platform.	4	1
2	**Open source development:** Demographics, sociology and Psychology of open source development, legal issues in open source, Economics of open source, the GNU Project	4	1
3	**Application development using Java**: Introduction to Java, object oriented programming, classes and objects, encapsulation, inheritance, polymorphism, method overloading, dynamic method lookup/dispatch, application programming interface.	4	2, 4
4	**Advanced Programming in java**: Input output, graphics programming, collection frameworks, swing components, multithreading, client-server programming using Sockets.	4	2, 4
5	**Web development programming**: Design Documents, understanding Hypertext Markup language, Cascading Style sheets. Understanding Express.js, Anjular.js, Node.js,Web page developments using MEAN (**M**ongoDB, **E**xpress, **A**ngular, **N**ode) framework	10	3, 4
6	**Javascript Framework**: javascript programming, functions, objects, arrays, introduction to DOM (Document Object Model), javascript libraries Jquery, web application development.	6	3, 4

Text Books:

1. Open Source: Technology and Policy, Fadee P. deek, James McHugh, 2008
2. Web Technologies: Achyut S. Godbole&AtulKahate, 2nd edition Tata McGraw Hill publication
3. Sams Teach Yourself JavaScript in 24 Hours, By Michael Moncur
4. MEAN frame work, web source

Recommended Reading:

1. Java Programming Black Book, Dreamtech Press, 2015.
2. Web Technologies, Tanveer Alam, 2008