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 Computer Engineering

Implemented from the batch admitted in Academic Year 2018-2019

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

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Four Year Undergraduate Programme Leading to

Bachelor of Technology (B. Tech.)

In

COMPUTER ENGINEERING

(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-centered 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. Computer Engineering

Program Educational Objectives (PEOs)

1. To provide graduates with the ability to communicate effectively & successfully work in multi-disciplinary teams to succeed in diverse range of careers as engineers, consultants, and entrepreneurs.

2. To provide graduates with the ability to apply their skills and concepts acquired to continue further education in Computer engineering and interdisciplinary areas to emerge as researchers, domain experts, and educators.

3. To provide graduates with ability to re-learn and innovate in ever-changing global economic and technological environments of the current era.

4. To provide graduates with ability to practice technical standards and communicate to colleagues and the public at large about their work and accomplishments.

5. To provide graduates with the ability to function ethically and responsibly with good cultural values and integrity which would enable them to apply the best principles and practices of Computer engineering towards the society.

Program Outcomes (POs)

After the completion of the B.Tech. Computer Engineering programme, the graduates of the department will have

1. An ability to apply the knowledge of Mathematics, Science, Applied Mechanics, Engineering Graphics, Basic Electrical and Electronic Engineering, Basic Workshop Practices and Computer Engineering for the solution of complex engineering problems.

2. An ability to identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusion using sound principles of Mathematics, Applied Sciences and Computer Science & Engineering.

3. An ability to 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, & the cultural, societal and environmental considerations using sound principle of Computer Engineering.

4. An ability to use research based knowledge and research methods in Computer Engineering including design of experiments, analysis & interpretation of data and synthesis of the information to provide valid conclusions.

5. An ability to create, select and apply appropriate techniques, resources and modern Computer engineering & IT modeling tools to complex engineering problems.

6. An ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Computer Engineering Practice.

7. An ability to analyze the impact of Computer Engineering solutions in societal & environmental contexts, and will demonstrate the knowledge of and need for sustainable solution development.

8. Ethical principles and will commit to professional ethics, responsibilities, and norms of Computer engineering practice.

9. An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary environments.

10. Demonstrative ability to 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. Knowledge and understanding of the Computer Engineering and Management principles and apply these to his own work as a member and leader in a team to manage projects and in multidisciplinary environments.

12. An ability to recognize the need for, and will have the preparations and ability to engage in independent and life-long learning in the broadest context of technological change in Computer Engineering.

Program Specific Outcomes (PSOs):

After the completion of the B.Tech. Computer Engineering programme, the graduates of the department will have

1 Professional Skills: The ability to analyze, design and implement application specific computer engineering domains related to Big Data Systems, Cloud Computing, Artificial Intelligence, Machine Learning, Networking and Cyber Security applications for efficient design of computer based system of varying complexity by applying the knowledge of core science, engineering mathematics and engineering fundamentals.

2 Problem-Solving Skills: The ability to adapt and apply rapid changes in tools and technology in software development using open ended programming environment to deliver a quality product relevant to professional engineering practice through life-long learning.

3 Successful Career and Entrepreneurship: Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics, societal responsibilities and a zest for higher studies.

Proposed Revised Scheme B Tech Computer Engineering (Sem III to VIII):
Academic Year 2018-19 onwards

SEM- III

S.N.	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	R4CO2001S	Discrete Mathematics and Applications	3	0	0	3	20	20	60
3	R4CO2002S	Digital Logic Design	3	1	0	4	20	20	60
4	R4CO2003T	Data Structures and Algorithms	3	0	0	3	20	20	60
5	R4CO2003P	Data Structures and Algorithms Lab	0	0	3	1.5	60	0	40
6	R4CO2004S	Computer Organization and Architecture	3	0	0	3	20	20	60
7	R4CO2005A	Programming Lab 1	0	1	3	2.5	60	0	40
8	R4CH2001A	Environmental Studies	1	0	1	MNC	60	00	40
9	R4CO2006S	Essence of Indian Traditional Knowledge	2			P/NP	20	20	60
		TOTAL	18	3	7	21			

SEM-IV

S.N.	Course Code	Course Name	L-T-P 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	R4CO2007S	Automata Theory	3	1	0	4	20	20	60
3	R4CO2008S	Design and Analysis of Algorithms	3	0	0	3	20	20	60
4	R4CO2009T	Operating Systems	3	0	0	3	20	20	60
5	R4CO2009P	Operating Systems Lab	0	0	2	1	60	0	40
6	R4CO2010T	Database Management Systems	3	0	0	3	20	20	60
7	R4CO2010P	Database Management Systems Lab	0	0	2	1	60	0	40
8	R4CO2011A	Web Technologies Lab	0	1	2	2	60	0	40
9	R4CO2012A	Development Engineering	2			P/NP	20	20	60
		TOTAL	17	3	6	21			

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

COURSE OUTCOMES

At the end of the course student will be able to

1. Solve systems of 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	2
3	**Systems of linear equations:** Gauss Elimination method, Gauss Jordan method, Crout's method Equations, Iterative methods for solving linear	8	1

	equations: The methods of Jacobi, Gauss-Seidel, successive over relaxation, and steepest descent. Error analysis		
4	**Elementary matrix factorizations.**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	3
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. (Computer Engineering)	Semester – III
Course Code	R4CO2001S	
Course Title	Discrete Mathematics and Applications	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of the course student will be able to

1. Express mathematical properties formally using the formal language of propositional logic and predicate logic and to construct simple mathematical proofs and possess the ability to verify them.
2. Understand, analyze and apply basic counting techniques, concept of sequences, induction and recursion and to construct inductive hypothesis and carry out simple induction proofs.
3. Specify and manipulate basic mathematical objects such as sets, functions, relations and graphs and be able to use graph theoretic models and data structures to model and solve some basic problems in computer science (e.g., network connectivity, etc.)
4. Understand and prove elementary arithmetic and algebraic properties of the integers, and modular arithmetic with its application to cryptography.

COURSE CONTENTS

Unit No.	Topics	Hrs	CO
1	**The Foundations**: Sets Theory And Its Applications ,Principle of inclusion and exclusion, Propositional Logic, Propositional Equivalences, Propositional Algebra, Basic logical operations, De Morgan's laws, Predicates and quantifiers, Rules of Inference, Proof Methods and strategy. Applications of Logic: Translating English statements into propositions, Boolean Searches in web pages, bit operations.	6	1
2	**Induction, Sequences and Summations:** Induction and Recursion Mathematical Induction, Recursive definitions, Recursive algorithms.	6	1

	Applications: Proofs using mathematical induction, Program correctness, Well-formed formulae. Functions, Sequences and Summations. Job scheduling Problem, countability of rational numbers.		
3	**Basic Counting Principles:** Permutations, Combinations, Binomial coefficients. Generating Permutations and combinations, Recurrence Relation, Solving Linear Recurrence Relations with constant coefficients. Applications of Counting Principles: Telephone Numbering plan, Counting Internet Addresses, Tower of Hanoi, Codeword enumeration Pigeonhole Principle and Its Applications: Pigeonhole Principle.	6	2
4	**Relations:** Properties of Binary Relations, Closure of relations, Warshall's algorithm, Equivalence Relations and partitions, Partial ordering relations and Lattice Application of Relations: n-Ary Relations and their Applications, Databases and relations and SQL.	6	3
5	**Graph Theory:** Basic terminology, multi graphs and weighted graphs, paths and circuits, shortest path in Weighted graph, Hamiltonian and Euler paths and circuits, factors of a graph, plan Shortest path algorithm, Travelling salesman problem, Transport Networks. Special types of Graphs & applications: Job Assignment, LANs, Interconnection networks for parallel Computation, Mesh networks. Graph coloring and Applications - scheduling exams, TV Frequency Assignment	6	3
6	**Algebraic Structures:** Algebraic Systems, Groups, Semi Groups, Monoid, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Automorphisms, Homomorphism, Fermat's Little Theorem, Polynomial Rings. Applications of Groups: Hamming Code ,Public key cryptography: RSA Algorithm	6	4

Text Books

1. Kenneth H Rosen, "Discrete mathematics & its Applications", Tata McGraw Hill Publication, 8th edition, 2018.

Recommended Reading

1. B. Kolman, R. Busby and S. Ross, “Discrete Mathematical Structures”, Pearson Education, 4th Edition, 2002, ISBN 81-7808-556-9
2. Jean-Paul Tremblay, R.Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill.

Programme Name	B. Tech. (Computer Engineering)	Semester – III
Course Code	R4CO2002S	
Course Title	Digital 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 comparator, Arithmetic and logic units.	5	2
3.	**Sequential Logic:** Sequential circuits, Flip-flops, Clocked and edge	6	2

	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		
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 Cenegage Learning ISBN
2. Stephen Brown and Zvonko Vranesic , “Fundamentals of Digital Logic with VHDL Design” , McGraw-Hill.
3. J.Bhaskar , “VHDL Primer, Pearson Edition, 3rd Edition

Programme Name	B. Tech. (Computer Engineering)	Semester – III
Course Code	R4CO2003T	
Course Title	Data Structures and Algorithms	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of the course student 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

Sr 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.	5	1
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 in computer engineering	6	2
3.	**Linked List 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, Applications in computer engineering	6	2

4.	**Binary Tree :** Basic tree concept, Binary tree operations, Binary tree representation, w44Binary 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	3
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	4
6.	**Searching Techniques and Hashing** Linear Search and Binary Search, Hashing: Direct-address tables, Hash tables, open addressing, Perfect Hashing	5	3
7.	**Sorting Techniques** Various sorting methods and their time complexity analysis: Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort	3	3

Text Books

1. Y. Langsam, M. J. Augenstein and A. M. Tannenbaum, "Data Structures Using C and C++",, Prentice Hall India, Second Edition.
2. T. H. Cormen, C. E. Leiserson, R. L.Rivest and C. Stein, “Introduction to Algorithms”, Second Edition, MIT Press/McGraw Hill.
3. Y. Langsam, M. J.Augenstein and A. M. Tanenbaum “Data structures using Java”, Pearson Education

Recommended Reading

1. Goodrich and Tamassia, “Data Structures and Algorithm in Java”, John Wiley and Sons.
2. John Kleinberg and Eva Tardos, “Algorithm Design”, Pearson Education

Programme Name	B. Tech. (Computer Engineering)	Semester – III
Course Code	R4CO2003P	
Course Title	Data Structures and Algorithms Lab	
Prerequisite	Programming Language	

COURSE OUTCOMES

At the end of the course student 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
3. 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.

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 Search Trees, Traversal techniques, and Concepts /Applications of Binary Tree. • Add an element in Binary tree • Edit an element in Binary tree	6	2

- 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.	4	4
6.	Three Experiment from Searching, Hashing and Sorting Algorithms	3	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. Dr.B.B.Meshram “Object oriented programming with c++ “,Shroff publications, India
4. "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

Programme Name	B. Tech. (Computer Engineering)	Semester – III
Course Code	R4CO2004S	
Course Title	Computer Organization and Architecture	
Prerequisite	Nil	

COURSE OUTCOMES

At the end of the course student 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, Memory subsystems.
3. Understand architecture of computer system including different parallel computer architectures.
4. Understand architecture of computer system I/O

COURSE CONTENTS

Unit No.	Topics	Hrs	CO
1	**Computer Evolution:** 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.	6	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	2
3	**The Control Unit:** Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer, Hardwired Implementation, Micro-programmed Control: Basic concepts,	5	2

	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	6	3
5	**I/O Organization:** Input/Output Systems, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA), Input/Output Channels and Processors	6	2, 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	3

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

Programme Name	B. Tech. (Computer Engineering)	Semester – III
Course Code	R4CO2005A	
Course Title	Programming Lab –I	
Prerequisite	Programming Fundamentals	

COURSE OUTCOMES:

At the end of this 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. (Computer Engineering)	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	CO's
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.	4	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.	**5**	**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.	**4**	**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	**5**	**5**
Total		**24**	**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. Bharucha Erach, 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. (Computer Engineering)	Semester – III
Course Code	R4CO2006S	
Course Title	Essence of Indian Traditional Knowledge	
Prerequisite	Nil	

COURSE OUTCOME

After completion of the course, students will be able to:

1. Understand the concept of traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to traditional knowledge in different sectors.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.

Sr. No.	Topics	Hrs	CO
1.	**Introduction to traditional knowledge**: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge ,traditional knowledge vis-à-vis formal knowledge	5	1
2.	**Protection of traditional knowledge**: the need for protecting traditional knowledge Significance of traditional knowledge Protection, value of traditional knowledge in global economy, Role of Government to harness traditional knowledge.	4	2
3.	**Legal frame work and traditional knowledge**: A: Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.	5	2
4.	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and	5	4

traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

5.	**Traditional knowledge in different sectors**: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge and biotechnology, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of Traditional Knowledge.	5	3

Text Books:

1. Traditional Knowledge System in India, by Amit Jha,2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan2012.
3. "Knowledge Traditions and Practices of India"Kapil Kapoor, Michel Danino

Programme Name	B. Tech. (Computer Engineering)	Semester – IV
Course Code	R4MA2017S	
Course Title	Data Interpretation and Analysis	
Prerequisite	Basic Mathematics	

COURSE OUTCOMES

At the end of the 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. EhsanesSaleh , "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. (Computer Engineering)	Semester – IV
Course Code	R4CO2007S	
Course Title	Automata Theory	
Prerequisite	Data Structures, Discrete Mathematics	

COURSE OUTCOMES

At the end of the 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. 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, finite automaton model, acceptance of strings, and languages, Deterministic finite automaton and Non-deterministic finite automaton, 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. 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	8	1
3.	**Grammar:** Formal Grammar, Types of Grammar, Chomsky Hierarchy, Regular Grammar, Equivalence of Regular Grammars and Finite Automata, Left Linear and Right Linear Grammar , Context Free Grammar CFG, Derivation, Parse Tree, Ambiguity in grammars and	6	2

	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		
4.	**Pushdown automata**: Pushdown automata Definition, Model, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata, Context Free Languages :Pumping Lemma for CFL, Closure properties of CFL, Turing Machines: Definition, Model	5	2
5.	**Turing Machine:** Design of Turing Machine, Computable Functions, Properties of Recursive and Recursively Enumerable Languages, Programming Techniques for Turing Machine	5	3
6.	**Types of Problems:** 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.	6	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. (Computer Engineering)	Semester – IV
Course Code	R4CO2008S	
Course Title	Design and Analysis of Algorithms	
Prerequisite	Data Structures, Discrete Mathematics	

COURSE OUTCOMES

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

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

COURSE CONTENTS

Unit No.	Topics	Hrs	CO
1.	**Introduction:** 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
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.	7	1
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.	5	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.	4	2

5.	**NP-Completeness :** Matching , Introduction to NP-Complete , Search/Decision, SAT, Independent Set, 3VC ,Exact Cover, Multi Set, Subset Sum & Partition, Hamiltonian Circuit.	6	4
6.	**Approximation Algorithms:** The vertex-cover problem, The set-covering problem, The subset sum problem.	6	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. (Computer Engineering)	Semester – IV
Course Code	R4CO2009T	
Course Title	Operating System	
Prerequisite	C and C++ programming	

COURSE OUTCOMES:

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

1. Analyze various process management concepts including scheduling, synchronization, and deadlocks.
2. Will be familiar with multithreading, and analyzes the issues related to file system
3. Analyze the memory management and system resource sharing.
4. Will be familiar with Operating System 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 & preemptive)- Process synchronization- critical section- semaphore & its implementation – classical synchronization problems and its solutions (Producer-consumer, readers-writers, dining philosopher)- Deadlock-prevention-	7	2

	avoidance-bankers algorithm-detection-reduced resource allocation graph- Inter process communication(Pipes, message passing etc)- concept of process management in Linux and Windows NT		
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	3
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	4
5.	**I/O Management:** I/O Devices , Organization of the I/O Function , Operating System Design Issues , Buffer	2	3
6.	**Architecture of the UNIX:** Introduction to system concepts, Kernel data structures, system administration	2	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. Crowley C., “Operating Systems – A Design oriented Approach”, TMH
4. Maurice J. Bach; The Design of the Unix Opearating System; Prentice Hall of India; ISBN: 978-81-203-0516-8

Programme Name	B. Tech. (Computer Engineering)	Semester – IV
Course Code	R4CO2009P	
Course Title	Operating System Lab	
Prerequisite	C and C++ programming	

COURSE OUTCOMES:

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

1. Students will be able to execute OS commands ,shell scripts
2. Students will be able to compare the performance of various CPU Scheduling Algorithm ,file allocation algorithms
3. Students will analyze the performance of the various page replacement algorithms ,dead lock avoidance and detection
4. Students will be able to create processes and implement IPC

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

Programme Name	B. Tech. (Computer Engineering)	Semester – IV
Course Code	R4CO2010T	
Course Title	Database Management System	
Prerequisite	Data Structures	

COURSE OUTCOMES:

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

1. Identify the database problems and design database using ER model and normalization technique.
2. Analyze Relational database design, object oriented database design and write Structured Query Language (SQL) for given problem.
3. Identify issues in data storage, transaction, and concurrency control of DBMS.
4. Describe issues in Recovery, Security 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.	3	1
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.	4	2
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	4	1

	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 Mapping.		
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.	3	2
5	**Object-Oriented and Object Relational 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, Persistent Programming Languages; OODBMS Architecture And Storage Issues.	4	2
6	**Transaction Processing Concepts:** Transactions: Transaction concept; Transaction and System Concepts; Properties of Transaction; Schedules based on Serializability; Recoverability; Transaction definition in SQL.	4	3
7	**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.	3	3
8	**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.	4	4
9	**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	5	3

	Query Optimization.		
10	**Database security :**DAC,MAC,RBAC	2	4

Text Books:

1. Elmasri & Navathe , “Fundamentals of Database System”, 7thEdition, 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 Edition(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. (Computer Engineering)	Semester – IV
Course Code	R4CO2010P	
Course Title	Database Management System Lab	
Prerequisite	Nil	

COURSE OUTCOMES:

At the end of the 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 case study

COURSE CONTENTS

Unit No.:	Topics	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	6	2,1

	involves proper data processing. iv. Create triggers and active elements to maintain the integrity of the 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 Modeling a. Defining Problem Statement b. Data Modeling 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	4	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.1 Performing Operations through Database connection string	4	2,1, 4

Developing GUI/Forms for the Case Study &performing database operations on database created in exp.2 Generating Reports for database created in exp.2

Text Books:

1. Elmasri & Navathe , “Fundamentals of Database System”, 6th Edition, Addison Wesely Publication.(2010).
2. Abraham Silberschatz, Henry Korth, Sudarshan , “Database System Concepts”, 6th Edition, (2010)

Programme Name	B. Tech. (Computer Engineering)	Semester – IV
Course Code	R4CO2011A	
Course Title	Web Technologies Lab	
Prerequisite	Nil	

COURSE OUTCOMES:

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

1. Design and analyze basics of Web pages.
2. Analyze basics of validation in web pages
3. Implement web pages using scripting languages.
4. Design interactive web sites as per the requirements of applications

COURSE CONTENTS

- HTML Basics
- DHTML Basics
- Servlet Basics
- XML Basics

Unit No.	List of Experiment	Hrs	CO
1	Basic HTML Programs • Resume Preparation using Tables • Home Page Creation using Frames • Form Creation	2	1
2	Create a web page with the following using HTML • To embed an image map in a web page • To fix the hot spots • To show all the related information when the hot spots are clicked. • To get the Coordinates from an Image using Java Script.	2	1
3	Create a web page with all types of Cascading style sheets.	2	1
4	Client Side Scripts for Validating Web Form Controls using DHTML	2	2
5	• To create applets incorporating the following features in Java	2	2,3

	• Create a color palette with matrix of buttons • Set background and foreground of the control text area by selecting a color from color palette. • In order to select Foreground or background use check box control as radio buttons • To set background images		
6,7	Java programs using Servlets: • To invoke servlets from HTML forms • To invoke servlets from Applets	2	2,3
8,9	Write a program • To create three-tier applications using JSP and Databases in Java for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.	2	4
10	Programs using XML – Schema – XSLT/XSL	2	4
11	Program using DOM / SAX	2	4
12	Programs using AJAX	2	4

Mini Projects on

1) Library system
2) Web Portal
3) Court System
4) Order processing system etc.

Programme Name	**B. Tech. (Computer Engineering)**	**Semester– IV**
Course Code	**R4CO2012A**	
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.	4	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.	4	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	5	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	4	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.	4	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.	3	4

Text Books:

1. Chand M. and Purr U.K. (1983), 'Regional Planning in India', Allied Publisher, New Delhi.
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, New York.
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, New Delhi.
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.