PANDIT DEENDAYAL PETROLEUM UNIVERSITY GANDHINAGAR

SCHOOL OF TECHNOLOGY

COURSE STRUCTURE FOR B TECH IN COMPUTER ENGINEERING

Semester III			B Tech in Computer Engineering											
Sr. No.	Course/Lab Code	Course/Lab Name	Teaching Scheme					Examination Scheme						
			L	T	P	C	Hrs/Wk	Theory			Practical		Total
								CE	MS	ES	CE	ES	Marks
1	MA 201T	Mathematics III	3	1	0	4	4	25	25	50	-	-	100
2	CP 201T	Data & File Structures	4	0	0	4	4	25	25	50	-	-	100
3	CP 201P	Data & File Structures Lab	0	0	2	1	2	-	-	-	25	25	50
4	CP 202T	Database Management Systems	3	1	0	4	4	25	25	50	-	-	100
5	CP 202P	Database Management Systems Lab	0	0	2	1	2	-	-	-	25	25	50
6	CP 203T	Digital Logic & Design	3	1	0	4	4	25	25	50	-	-	100
7	CP 203P	Digital Logic & Design Lab	0	0	2	1	2	-	-	-	25	25	50
8	MA 206T	Discrete Mathematics	3	1	0	4	4	25	25	50	-	-	100
		CSSI	-	-	-	1							
		TOTAL	16	4	6	24	26						600

CE- Continuous Evaluation, MS-Mid Semester; ES – End Semester Exam

Course Code: MA 201T					**Course Name: Mathematics III**			
Teaching Scheme					**Examination Scheme**			
L	**T**	**P**	**C**	**Hrs/ Wk**	**Theory**			**Total**
					Continuous Evaluation	**Mid Semester**	**End Semester**	**Marks**
3	1	0	4	4	25	25	50	100

Prerequisites: Maths II

Learning objectives:

- To impart knowledge of basic and applied sciences.
- To connect linear algebra to other fields both within and without mathematics.
- To introduce students the theory and concepts of linear algebra, Fourier Series, Special Functions and Applications of Partial Differential Equations which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.
- Apply Fourier series expansion to different kind of wave forms and solve some partial differential equations using Fourier series
- To impart the knowledge of matrices, vector space, transformation, etc and develop the capability of logic development and find solutions by different methods.

Unit wise allocation of course content

UNIT I (8 L, 3 T)

Systems of linear equations : Matrices, Matrix Operations, Special matrices, Elementary Matrices, Elementary transformation, Rank, Introduction to systems of Linear Equations, Conditions for consistency of the system of equations, Solution by Gauss Elimination and Gauss Jordan Method, Solving system of equation using inverse of a Matrix and Cramer's rule.

UNIT II (13 L, 4 T)

Vector spaces: Euclidean n - space, Linear Transformations from Rn to Rm; Properties of Linear Transformations from Rn to Rm, Matrices of General Linear Transformations, Similarity; Isomorphisim, Vector space and Subspaces, Linear dependence and Independence of vectors; Basis, Dimension, Row space; null space; column space and rank of a matrix, Rank and Nullity, Dimension Theorem, Inner product spaces, Eigen values and Eigen vectors, Inner product , Angle and Orthogonality in Inner Product Spaces, Orthonormal Bases; Gram-Schmidt process; Least squares approximation, Orthogonal Matrices, Eigen values and Eigen vectors, Diagonalization.

UNIT III (13 L, 4 T)

Fourier Series: Periodic functions, Euler's formulae, Dirichlet's conditions, expansion of even and odd functions, half range Fourier series, Perseval's formula, complex form of Fourier series.

Special Functions: Power series method to solve the equation, Frobenius method for solution near regular singular points, Legendre's equation, Legendre polynomials, Rodrigue's formula, Bessel's equation and Orthogonality.

UNIT IV (5 L, 2 T)

Partial Differential Equations and its Applications: Classification of partial differential equations, Solutions of one dimensional wave equation, one dimensional unsteady heat flow equation in Cartesian and polar coordinates by variable separable method with reference to Fourier trigonometric series and by Laplace transform technique.

Student centering learning: (The student centering learning contents should be declared at the commencement of semester. It should be maximum 10% ; however exact contents is left to faculty)

Lecture: 39 Hrs
Tutorial: 13 Hrs
Approximate Total: 52 Hrs

Texts and References

1. R. K. Jain & S. R. K. Iyengar, Higher Engineering Mathematics, Narosa.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publication
4. H. Anton, Elementary Linear Algebra with Applications, John Wiley.
5. G. Strang, Linear Algebra and its Applications, Thomson.

Course Outcomes:

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

1. Solve a system of linear equations by gauss elimination method and find the inverse of a matrix.
2. Diagonalize a matrix using its eigenvectors.
3. Formulate Fourier series for various wave forms and solve some partial differential equations using Fourier series.
4. Become familiar with various applications of partial differential equations and their solution methods.

Course Code: CP 201T					**Course Name: Data & File Structures**			
Teaching Scheme					**Examination Scheme**			
L	**T**	**P**	**C**	**Hrs/ Wk**	**Theory**			**Total**
					Continuous Evaluation	**Mid Semester**	**End Semester**	**Marks**
4	0	0	4	4	25	25	50	100

Prerequisites: Computer Programming

Learning objectives:

- To understand function of linear and non-linear data structures
- To enhance logical reasoning and programming skills
- To learn implementation of linear and non-linear data structures
- To use suitable data structure in variety of applications

Unit wise allocation of course content

UNIT 1 (12 L)

Introduction to Data Structure: Data types: primitive and non-primitive, Types of Data Structures: Linear & Non Linear Data Structures.

Linear Data Structures Stack & Queue: Representation of arrays; Applications of arrays; Sparse matrix and its representation; Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse, Polish Expression, Infix to postfix conversion and evaluation of postfix expression, Recursion, Tower of Hanoi,

Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue.

UNIT 2 (14 L)

Linear Data Structure Linked List: Singly; Doubly and Circular linked list; Implementation of Stack and Queue using linked list; Applications of linked list

Performance Analysis and Measurement: Time and space analysis of algorithms-Average; best and worst case analysis; Asymptotic Notations

Nonlinear Data Structures: Tree-Definitions and Concepts; Representation of binary tree; Binary tree traversal (Inorder, Postorder, Preorder); Threaded binary tree;

UNIT 3 (14 L)

Nonlinear Data Structures: Binary search trees; Conversion of General Trees to Binary Trees; Applications Of Trees; Some balanced tree mechanism; e.g. Heap, AVL trees; 2-3 trees; Height Balanced; Weight Balance; Red black tree; Multi-way search tree: B and B+ tree; Graph: Adjacency Matrices and List Representations of Graphs; Elementary Graph Operations: Depth First Search & Breadth first Search.

UNIT 4 (12 L)

Data Structures for Strings: Tries and compressed Tries, Dictionaries allowing errors in queries, suffix trees and arrays

Hashing and File Structures: Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques , File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-

Key file organization and access methods

Student centering learning: (The student centering learning contents should be declared at the commencement of semester. It should be maximum 10% ; however exact contents is left to faculty)

Lecture: 52 Hrs
Tutorial: 0 Hrs
Approximate Total: 52 Hrs

Texts and References:

1. Tanenbaum, "Data Structures using C & C++", Prentice-Hall International
2. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill
3. Sartaj Sahani, "Fundamentals of Data Structures in C++", Galgotia.Publishers
4. Peter Brass, Advanced Data Structures, Cambridge University Press
5. Gilberg & Forouzan, "Data Structures: A Pseudo-code approach with C", Thomson Learning
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein , "Introduction to Algorithms", PHI
7. Sanjeev Sofat, "Data Structures using C & C++", Khanna Book Publishing Pvt. Ltd.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the concept of data structures and its applications.
2. Implement linear and non-linear data structures
3. Analyze the complexity of different algorithms.
4. Identify suitable data structures to solve complex computing problems
5. Apply the algorithms on the small and large data sets
6. Design and implement an appropriate hashing function for an application

Lab Code CP 201P					Lab Name: Data & File Structures Lab		
Teaching Scheme					**Examination Scheme**		
					Practical		**Total**
L	**T**	**P**	**C**	**Hrs/Wk**	**Continuous evaluation**	**End Semester Exam**	**Marks**
0	0	3	1.5	3	25	25	50

Prerequisites: Computer Programming

Course objectives:

1. To understand function of linear and non-linear data structures
2. To learn implementation of linear and non-linear data structures
3. To use suitable data structure in variety of applications

List of Experiments:

1. Study and implementation of Stack data structure and its applications
2. Study and implementation of various types of Queue data structure and their applications
3. Study and implementation of various types of Linked list data structure and their applications
4. Study and Implementation of binary tree and its traversals
5. Study and Implementation of Threaded binary tree, Binary search tree
6. Memory representation of General trees and their conversion to Binary trees
7. Study and Implementation of Balanced trees: AVL trees, 2-3 trees, Height Balanced, Weight Balance, Red black tree
8. Study and Implementation of B and B+ tree
9. Memory representation of Graph data structure, DFS & BFS traversals
10. Study and implementation of the data Structures for Strings
11. Study and implementation of Hash functions and tables
12. Study and implementation of file structures: indexing and hashing for file organization

Details of Assessment Instruments under LW Practical Component:

- Experiments during lab sessions and record-keeping of lab work (Term Work)
- Assignments / Mini project / Quiz / Practical Test

Course Outcomes (COs):

At the end of this course students will be able to

1. Differentiate linear and non-linear data structures
2. Enhance logical reasoning and programming skills
3. Implement linear and non-linear data structures
4. Identify suitable data structures to solve complex computing problems
5. Apply the algorithms on the small and large data sets
6. Design and implement an appropriate hashing function for an application

Course Code: CP 202T					Course Name: Database Management Systems			
Teaching Scheme					Examination Scheme			
L	T	P	C	Hrs/ Wk	Theory			Total
					Continuous Evaluation	Mid Semester	End Semester	Marks
3	1	0	4	4	25	25	50	100

Prerequisites: Nil

Learning objectives:

- To learn fundamental concepts of Database management system
- To study various Database design models and normalization concepts
- To apply the above concepts to optimal Database design for various applications and carryout data retrieval and manipulation using SQL

Unit wise allocation of course content

UNIT 1 (10 L, 3T)

Introduction: Database system applications; Purpose of Database Systems, View of Data, Data models, Approaches to building a database, Database management system (DBMS), Three levels of the architecture, Challenges in building a DBMS, Various components of a DBMS architecture.

Database Models:

ER-Model: Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema.

Relational Data Model: Concept of relations, Schema-instance distinction. Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax; All set Operators.

UNIT 2 (10 L, 4T)

Relational algebra query & operators: Selection, Projection, Cross product, Various types of joins, Division, Example queries, Tuple relation calculus, Domain relational calculus, Converting the database specification in E/R notation to the relational schema.

SQL: Appropriate tool for DBMS, Basics of SQL, DDL, DML, DCL, structure creation, alteration, defining constraints, Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands, Commit, Rollback, Save point. Embedded SQL, PL SQL Concepts, Cursors, Stored Procedures, Stored Function, Database Triggers.

UNIT 3 (10 L, 3T)

Dependencies and Normal Forms: Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers, Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them, Algorithms for 3NF and BCNF normalization, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.

UNIT 4 (9 L, 3T)

Transaction Processing and Error Recovery: Concepts of transaction processing, ACID properties, Concurrency control, Locking based protocols for CC, Error recovery and logging, Undo, Redo, Undo-redo logging and recovery methods; Backup Methods.
Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, and materialized views.
Security: Discretionary and Mandatory Access Control; Audit Trails; Multi-Level Security; Statistical Databases; Data Encryption.
Introduction to NOSQL Databases.

Student centering learning: (The student centering learning contents should be declared at the commencement of semester. It should be maximum 10% ; however exact contents is left to faculty)

Lecture: 39 Hrs
Tutorial: 13 Hrs
Approximate Total: 52 Hrs

Texts and References:

1. A Silberschatz, H F Korth and S Sudarshan, "*Database System Concepts*", McGRAW Hill.
2. C. J. Date, A. Kennan, and S. Swamynathan, "*An Introduction to Database Systems*", Person Education
3. Ramez Elmasri and Shamkant B Navathe, "*Fundamentals of Database Systems*", Addison Wesley
4. Ivan Bayross, "*SQL, PL/SQL the Programming Language of Oracle*", BPB Publication.
5. Ramkrishnan, Raghu, "*Database Management Systems*", Mc-Graw Hill

Course Outcomes (COs):
On the completion of course, Students will be able to,

1. Understand need of database management systems.
2. Explain database models
3. Apply SQL commands in database systems.
4. Analyzed normalization techniques in database systems.
5. Determine security levels in database systems
6. Create database systems for real time problems

Lab Code CP 202P					**Lab Name: Database Management Systems Lab**		
Teaching Scheme					**Examination Scheme**		
L	**T**	**P**	**C**	**Hrs/Wk**	**Practical**		**Total**
					Continuous evaluation	**End semester exam**	**Marks**
0	0	3	1.5	3	25	25	50

Prerequisites: Nil

Course objectives:

- To learn fundamental concepts of database management system
- To study various Database design models and normalization concepts
- To apply the above concepts to optimal database design for various applications and carryout data retrieval and manipulation using SQL

List of Experiments:

1. Installation of relational database management system e.g MYSQL
2. Introduction to SQL, DDL, DML, DCL, database and table creation, alteration, defining constraints, primary key, foreign key, unique, not null, check, IN operator
3. Study and use of inbuilt SQL functions - aggregate functions, Built-in functions numeric, date, string functions
4. Study, write and use the set operations, sub-queries, correlated sub-queries in SQL
5. Study and use of group by, having, order by features of SQL
6. Study different types of join operations, Exist, Any, All and relevant features of SQL
7. Study and implement different types of Views
8. Study and use of Transaction control commands, Commit, Rollback, Save point features of SQL.
9. Study and apply Database Normalization techniques
10. Introduction to Embedded SQL, PL SQL Concepts
11. Study and Implementation of Cursors, Stored Procedures, Stored Function, Triggers.
12. Analysis of query cost, creating indices and evaluating their effect on query evaluation plans and cost

Details of Assessment Instruments under LW Practical Component:

- Experiments during lab sessions and record-keeping of lab work (Term Work)
- Assignments / Mini project / Quiz / Practical Test

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand concepts of database and database management systems
2. Construct an Entity-Relationship (E-R) model from specifications and transform in to relational data model
3. Install and configure a relational database management system and formulate queries to access the database
4. Design normalized database
5. Understand principles of database transaction management, database recovery, and security
6. Develop a database management system application

Course Code: CP 203T					Course Name: Digital Logic & Design			
Teaching Scheme					Examination Scheme			
L	T	P	C	Hrs/Wk	Theory			Total
					Continuous Evaluation	Mid Semester	End Semester	Marks
3	1	0	4	4	25	25	50	100

Prerequisites: Basic Electronics

Learning objectives:

- To learn digital circuit design principles and basic concepts.
- To learn design of combinational circuits as per the application needs.
- To learn design of sequential circuits as per the application needs.

Unit wise allocation of course content

UNIT 1 (7L, 2T)

Introduction: Digital Systems; Data representation and coding; Logic circuits; integrated circuits; Analysis; design and implementation of digital systems. Truth table; Basic logic operation and logic gates.

Number Systems and Codes: Positional number system; Binary; octal and hexadecimal number systems; Methods of base conversions; Binary; octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and IEEE floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming codes.

UNIT 2 (13L, 5T)

Boolean Algebra & Simplification of Boolean Algebra: Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions; The Map Method; SOP and POS forms; Simplification of switching functions K-map and Quine-McCluskey tabular methods; Synthesis of combinational logic circuits.

Combinational Logic Modules and their applications: Decoders; encoders; multiplexers; demultiplexers and their applications; Parity circuits and comparators; Arithmetic modules- adders; sub tractors and ALU; Design examples.

UNIT 3 (13L, 4T)

Sequential Logic systems: Definition of state machines; state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch; D-latch; D flip-flop; JK flip-flop; T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table; state assignment; transition/excitation table; excitation maps and equations; logic realization; Design examples.

Finite State machine design and applications: Designing state machine using ASM charts; Designing state machine using state diagram; Design approaches for Synchronous and asynchronous machines; Registers and Counters; Application examples.

UNIT 4 (6L, 2T)

Logic Families: Transistor-Transistor Logic (TTL); MOSFET; CMOS.

Programmable Logic Devices: PLAs and their applications; Sequential PLDs and their applications;

State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs).

Student centering learning: (The student centering learning contents should be declared at the commencement of semester. It should be maximum 10% ; however exact contents is left to faculty)

Lecture: 39 Hrs
Tutorial: 13 Hrs
Approximate Total: 52 Hrs

Texts and References:

1. M Morris Mano, "*Digital Logic and Computer Design*", Prentice Hall Publication
2. A. Anand Kumar, "*Fundamentals of Digital Circuits*", PHI Learning Pvt. Ltd.
3. Malvino and Leach, "*Principle of digital Electronics*", McGraw-Hill Education.
4. R.P. Jain, "*Modern Digital Electronics*", McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the basics of Number Systems, Boolean algebra and Logic Gates.
2. Design combinational circuits using logic gates.
3. Construct combinational circuits using multiplexers, demultiplexers, encoders and decoders.
4. Evaluate different types of logic families for digital circuit design.
5. Design sequential circuits.
6. Design digital logic circuits using PLD and FPGA.

Course Code: MA206T					Course Name: Discrete Mathematics			
Teaching Scheme					Examination Scheme			
L	T	P	C	Hrs/Wk	Theory			Total
					Continuous Evaluation	Mid Semester	End Semester	Marks
3	1	0	4	4	25	25	50	100

Prerequisites: Maths II

Learning objectives:

- To understand the concept of sets, functions, relations and algebraic structures
- To learn graph theory based modeling and applying the same to solve real problems
- To study combinatorics as an analytical method for problem solving

Unit wise allocation of course content

Unit 1 (12L, 4T)

Sets, Relations and Logic: finite and infinite sets, countable and uncountable sets, Mathematical Induction, Functions and relations, Partial Ordered relations, Hasse diagram, Lattices, Recursive functions, Recurrence relations, Solutions of recurrence relations by generating function. Propositions-simple and compound. Basic logical operators. Implication. Truth tables. Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers

Unit 2 (7L, 2T)

Combinatorics: Counting principles, permutation, combination, derangement, inclusion-exclusion principle, pigeon hole principle, etc.

Unit 3 (14L, 5T)

Graph Theory: Graphs and related definitions, Subgraphs, homomorphism and isomorphism, paths and connectivity. Bipartite, line and chordal graph. Eulerian graph and Konigsberg problem. Hamiltonian graph. Labeled and weighted graphs. Independent sets, covering, matching. Graph coloring. Four color problem. Planar Graphs. Digraphs and related definitions. Trees. Rooted trees. Algebraic expressions and Polish notation. Sequential representation. Sequential representation. Adjacency matrix. Path matrix. Shortest path. Linked representation of directed graphs. Binary trees, Strongly and weakly connected graphs

Unit 4 (6L, 2T)

Algebraic Structures: Groups, order of group and its elements, Subgroups, Lagrange's Theorem, Quotient groups, Rings, Integral domains, Fields

Student centering learning: (The student centering learning contents should be declared at the commencement of semester. It should be maximum 10% ; however exact contents is left to faculty)

Lecture: 39 Hrs
Tutorial: 13 Hrs
Approximate Total: 52 Hrs

Texts and References

1. Lipschutz, S., Lipson, M., Discrete Mathematics, Schaum Series (TMH).
2. Rosen and Kenneth H, Discrete Mathematics and Its Applications, Tata Mc-Graw Hill, New Delhi

3. Kolman, B. and Busby, R. C., and Ross S., Discrete Mathematical Structures, Prentice Hall.
4. Koshy, T. Discrete Mathematics with Applications, Academic Press.
5. Gramaldi, R. P., Discrete Combinatorial Mathematics, Pearson Education.
6. Jain, R. K. & Iyenger, S. R. K., Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.
7. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the concepts of sets, relations, logic, etc.
2. Apply the algebraic structures suitably in different applications
3. Use formal methods for constructing mathematical proofs
4. Design solutions to various classic problems related to the Graph theory
5. Apply graph theory as a modelling tool for solving problems in various domains
6. Analyze Combinatorial arguments as an analytical method for problem solving.

Lab Code: 18CP203P					**Lab Name: Digital Logic Design Lab**		
Teaching Scheme					**Examination Scheme**		
L	**T**	**P**	**C**	**Hrs/Wk**	**Practical**		**Total**
					Continuous evaluation	**End semester exam**	**Marks**
0	0	2	1	2	25	25	50

Prerequisites: Basic Electronics

Course objectives:

- To impart knowledge of digital logic circuit design.
- To facilitate the understanding of interfacing of inputs and outputs to digital circuits.
- To implement different logic circuit using integrated circuits.

List of Experiments:

1. Logic Gates and truth table verification and implementation of simple combinational logic using Gates.
2. SOP and POS implementations.
3. Study of different adder and subtractor circuits.
4. Study of different encoder and decoder circuits.
5. Study of different multiplexer and de-multiplexer circuits.
6. Study of ALU circuits.
7. Study of various flip flop circuits.
8. Study of various counter and register circuits.
9. Interfacing of TTL and CMOS circuits.
10. Simulation of digital circuits.
11. Design of practical systems using digital circuits.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand use of logic gates to form a combinational logic circuit.
2. Understand the input and output interfacing with digital circuits.
3. Understand the difference between combinational and sequential circuit design.
4. Design a small-scale digital system.
5. Implement different kinds of logic families.
6. Understand the complexity of circuits like ALU, memory, and control unit.