Bachelor of Technology

(Four Year Full Time Degree Program)

SYLLABUS

(B. Tech. Second Year)

School of Computer Science and Engineering

Shri Mata Vaishno Devi University Katra

(April 2018)

	ABBREVIATIONS / CODES / NOMENCLATURE
Course Code Convention	
SCT – LSAY Example ALL 9101 ALP 9102 ALS 9110	Course Code for various Courses / Subjects SC: School Code T: Course Type Code (Lecture/Studio/Practical/Project etc.) L: Course Level (1, 2, 3, 4 & 5 for First, Second years …) SA: Study Area / Sub Area Y: Semester Wise Course Number
CSE	School Code (SoCSE)
L	Lecture
P	Practical
E	Elective
C	Colloquium
D	Project Based
T	Training
S	Self Study
N	Non Credit
V	Special Lecture Topic
Teaching Scheme Convention	
L	Lecture
T	Tutorial
P	Practical
C	Course Credit
Evaluation Scheme Convention	
Minor	(Mid Term Exams / Tests) I & II
Major	Semester End Examination (ESE)
FFCS	Fully Flexible Credit System
CBCS	Choice Based Credit System

Teaching & Examination Scheme

			B-Tech. Semester-III (Fall), Second Year											
			Teaching & Credits Scheme						Evaluation & Examination Scheme					
S. No	**Subject Code**	**Title of the Subject**	**L**	**T**	**P**	**S**	**Total Periods /week**	**C**	**Minor E Duration (Hours)**	**Major E Duration (Hours)**	**Internal Marks**	**Minor Marks (I+II)**	**Major Marks**	**Total Marks**
1	CSL 2041	Theory of Computation	3	1	0			4	1.5	3	10	40	50	100
2	CSL 2051	Operating System	3	0	2			4	1.5	3	10	40	50	100
3	CSL 2022	Object Oriented Programming(PL-3)	3	0	2			4	1.5	3	10	40	50	100
4	MTL 2024	Discrete Structures	3	0	0			3	1.5	3	10	40	50	100
5	ECL 3061	Microprocessors & Interfacing	3	0	2			4	1.5	3	10	40	50	100
6	PCL 2042	Introduction to Logic	3	0	0			3	1.5	3	10	40	50	100
7		Open Elective-1 (Entrepreneurship)	2	0	0			2	1.5	3	10	40	50	100

Teaching & Examination Scheme

			B-Tech. Semester-IV (Winter), Second Year											
			Teaching & Credits Scheme						Evaluation & Examination Scheme					
S. No	**Subject Code**	**Title of the Subject**	**L**	**T**	**P**	**S**	**Total Periods /week**	**C**	**Minor E Duration (Hours)**	**Major E Duration (Hours)**	**Internal Marks**	**Minor Marks (I+II)**	**Major Marks**	**Total Marks**
1	CSL 3071	Computer Network & Communications	3	1	2			5	1.5	3	10	40	50	100
2	CSL 2061	Computer Organization & Architecture	3	1	0			4	1.5	3	10	40	50	100
3	CSL 3032	Design & Analysis of Algorithm	3	1	2			5	1.5	3	10	40	50	100
4	CSL 3081	Database Management System(PL-4)	3	1	2			5	1.5	3	10	40	50	100
5	MTL 2025	Engineering Computational Methods	3	0	2			4	1.5	3	10	40	50	100
6		Open Elective-II	3	0	0			3	1.5	3	10	40	50	100

CSL 2041			**Theory of computation**				**Pre Requisites**			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	0	4	1.5 Hours	3 Hours	10	20	20	50	100

COURSE OJECTIVES

The learning objectives of this course are :

Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

COURSE CONTENTS

Unit - I

Introduction

Basic Concepts: Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine and Finite State Machine. Finite Automata: Definition and Construction – Deterministic Finite Automata, Non Deterministic Finite Automat, NFA with Epsilon-Moves, Equivalence of NFA and DFA, Minimization of Finite Automata, Concept of Generalized non-deterministic finite automata.

Unit - II

Regular Expressions, Regular Grammar And Languages

Definition and Identities of Regular Expressions, Regular Grammar and Finite Automata: FA to RG and RG to FA, Left Linear and Right Linear Grammar and Inter-conversion between them. Closure Properties of Regular Languages, Non-regular languages and Pumping Lemma.

Unit - III

Context Free Grammar And Languages

Definition and Construction of CFG, Definition, Parse tree, derivation, ambiguity, Ambiguous Grammar and Removal of Ambiguity. Simplification of Grammar. Normal Forms of Grammar: Chomsky normal form and GNF. Non-Context Free Languages, pumping lemma.

Unit - IV
Pushdown Automata

Definition and Construction of Deterministic pushdown automata (DPDA) and Non-Deterministic pushdown automata (NPDA). Pushdown Automata - Examples and Relation with CFGs, Equivalence of PDAs and CFGs, Closure Properties of CFLs.

Unit - V
Turing Machines
Definition and Construction of Turing Machines. Languages of TM. Types of TM. Time Complexity of TM, Halting Problem, Church's Turing Hypothesis.

Unit – VI
Decidability and Reducibility

Decidable Languages, Decidable Problems Concerning Regular Languages, Decidable Problems Concerning Context-Free Languages. Decidable Problems with the TM, Turing Reducibility. Closure Properties of Decidable and Turing recognizable languages

Reference Books

1. Hopcroft Ulman, "Introduction To Automata Theory, Languages And Computations", Pearson Education Asia, 2nd Edition
2. K.L.P Mishra, N. Chandrasekaran, " Theory Of Computer Science(Automata, Languages and Computation)", Prentice Hall India, 2nd Edition
3. John C. martin, "Introduction to Language and Theory of Computation", TMH, Third Edition. 978-0-07-066048-9.
4. Michel Sipser "Introduction to Theory of Computation" Thomson Course Technology, Second Edition 0-534-95097-3.
5. Peter Linz, "An introduction to formal languages and Automata", Narosa Publication.

COURSE OUTCOMES

After Successful Completion of this Course, students shall be able to:

- Comprehend various computational models such as deterministic and non-deterministic finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.
- Understand more powerful class of language i.e. context-free languages by mastering the concepts of context- free grammars and more powerful machine push- down automata as compared to NFA's and DFA's.
- Solve analytical problems in related areas of theory in computer science by designing efficient Turing Machines to understand the concepts of recursive and recursively enumerable languages.

CSL 2051			**Operating system**				Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	0	2	4	1.5 Hours	3 Hours	10	20	20	50	100

COURSE OBJECTIVES

A successful student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.

COURSE CONTENTS

Unit I

Introduction to OS**:** Processor management, memory management, file system management, system calls.

Unit II

Memory management**:** Single user contiguous: protection; fixed partition multiprogramming; protection, fragmentation, relocation; variable partition multiprogramming: compaction, storage placement strategies; multiprogramming with storage swapping; paging: segmentation; paging and segmentation together; virtual memory: page replacement and strategies, locality, working sets, page fault frequency, demand paging, optimization technique.

Unit III

Processor management**:** Scheduling levels, quantities to be optimized, preEMEPtive/non preEMEPtive, interrupting clock, FIFO , shortest job first, shortest remaining job first, round robin, priority, multilevel queues, multilevel feedback queues.

Unit 1V

File systems: directory organization, functions, data hierarchy, blocking and buffering, file organization, free space management, allocation techniques: contiguous, non contiguous; sector oriented linked; block: block chaining , index block chaining, block oriented file mapping;

Unit V

Device management**:** types: block, character; PIO, DMA, I/O channels, virtual devices.
Dead locks: Resource concepts, necessary conditions, resource allocation graph, deadlock prevention: three strategies of Havender, deadlock avoidance: Bankers algorithm, deadlock detection: reduction of resource allocation graph, deadlock recovery.

Unit VI

Concurrent processes: Mutual exclusion and Bernstein's conditions, Fork/Join construct, PARBEGIN/PAREND construct; semaphores: use of semaphores to complement PARBEGIN/PAREND; critical section problem ; 2 process critical section problem and solution, both H/W and S/W; monitors; message passing ; case studies: dining philosophers problem, reader writer problem and disk head scheduler problem.

Unit VII

Disk scheduling**:** operations of disks, quantities to be optimized, seek optimization : FCFS, SSTF, SCAN, C-SCAN, M-STEP SCAN, Eschenbach; rotation optimization, system consideration, disk caching and other optimizations.

Recommended Books:

1. Operating system concepts : Silberschatz, Addison Wesley Longman
2. Modern Operating Systems : Tanenbaum, PH(I)
3. Operating systems : H.M.Deitel, Addison Wesley Longman
4. Operating systems : Madnick and Donovan, McGraw-Hill I.E.

COURSE OUTCOMES

- Understand the basics of operating systems like kernel, shell, types and views of operating systems
- Describe the various CPU scheduling algorithms and remove deadlocks.
- Explain various memory management techniques and concept of thrashing
- Use disk management and disk scheduling algorithms for better utilization of external memory.
- Recognize file system interface, protection and security mechanisms.
- Explain the various features of distributed OS like Unix, Linux, windows etc.

CSL 2022			**Object oriented Programming (Pl-3)**				**Pre Requisites**			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	0	2	4	1.5 Hours	3 Hours	10	20	20	50	100

COURSE OBJECTIVES

1. Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
2. Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
3. Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
4. Learn syntax, features of, and how to utilize the Standard Template Library. Learn other features of the C++ language including templates, exceptions, forms of casting, conversions, covering all features of the language.

COURSE CONTENTS

Unit I

Principles of Object Oriented Programming: - The Traditional Approach, Shortcoming of procedure oriented languages, Basic concepts of Object Oriented Programming, Benefits of OOP, Object Oriented Languages

Unit II

Overview of Programming Basics:- Input/Output using cin/cout, processor directives, basic and user defined data types, operators, loops, decision making, control statements, functions, pointers to functions

Unit III

Classes :Definition, Class objects, Class member functions, Static Class Members, Class Scope, Nested Classes, Local Classes, Composite class, Constructor, Destructor, Friends, *this* Pointer

Unit IV

Operator Overloading:-Overloading unary and binary operators, Special operators : Operator [ ], ( ), →, ++ and --, << and >>

Unit V

Inheritance and Polymorphism :- Class hierarchy : Definition, Identifying the members of the hierarchy, Base class member access, Base and derived class construction, Member wise initialization and assignment, virtual functions, multiple inheritance, class scope under inheritance, virtual classes.

Unit VI

Templates:- Class Templates, Function Templates

Unit VII

Exception Handling :- Throwing, The try…..catch block, Exception specifications

Recommended Books:

1. Object Oriented Programming with C++ ANSI/ISO Standards, R. Subburaj
2. Object oriented programming Yashwant Kanitkar
3. OOP with C++ R.Subbraj

COURSE OUTCOMES

Students should be able to:

- Understand the basic components of an object-oriented program including methods and attributes.
- The distinction between classes and instances, the structures required to write basic algorithms, the components of simple text and graphics based interfaces, the relevance of the design process and basic object-oriented design notation.
- The applicability and effectiveness of various basic software testing techniques.

MTL 2024			**Discrete Structures**				Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	0	0	3	1.5 Hours	3 Hours	10	20	20	50	100

COURSE OBJECTIVES

This course provides a foundation for Computer Science. Many other areas of Computer Science require the ability to work with concepts from discrete structures. Discrete structures include topics such as set theory, logic, graph theory, and probability theory.

COURSE CONTENTS

Unary and Binary operations, group partial order relation, chains and anti chains, elements of logic, Lattices, Boolean algebra, order relation in Boolean algebra, Boolean polynomials, Block diagrams for gating network, connections with logic. Boolean sub algebra,, Boolean morphisms.

Disjunctive and conjunctive normal form, Counting principles, pigeon-hole principle, generating functions, recurrence relations, linear recurrence relations with constant coefficients, homogenous solutions, particular solutions, total solutions, Solution of recurrence relations by the method of generating functions, asymptotic notations, monotonicity, comparison of standard functions- floors and ceilings, polynomials, exponentials, logarithms and factorials, summations: summation formulas and properties, bounding summations, approximation by integrals.

References:

1. Liu,C.L., Elements of Discrete Mathematics, McGraw-Hill Pub. Co., 1977.
2. Lipschutz, S., Lipson,M.L., Discrete Mathematics, Schaum's Outline Series, Mcgraw-Hill, 3rd Edition.
3. Lovász, L., Pelikán, J.,Vesztergombi, K., Discrete Mathematics: Elementary and Beyond, Springer,2000.
4. Graham, R.L., Knuth, D.E., Patashnik, O., Concrete Mathematics, Addison-Wesley, 2nd Edition .

COURSE OUTCOMES

- Perform operations on various discrete structures such as sets, functions, relations, and sequences.
- Ability to solve problems using Counting techniques, Permutation and Combination, Recursion and generating functions.
- Apply algorithms and use of graphs and trees as tools to visualize and simplify Problems.
- Apply algorithms and use of graphs and trees as tools to visualize and simplify Problems.
- Use of K-Maps and Truth Tables to construct and verify correctness of a Boolean expression.
- Understand the various properties of algebraic systems like Rings, Monoids and Groups.

CSL 3071			**Computer Networks & Communication**				**Pre Requisites**			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	2	5	1.5 Hours	3 Hours	10	20	20	50	100

COURSE OBJECTIVES

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry
4. Advanced courses in computer networking.
5. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

COURSE CONTENTS

Unit I

Introduction: Uses of Computer Networks, Network Architecture, Reference Model (ISO-OSI, TCP/IP-Overview, IP Address Classes, Subneting), Domain Name Registration & Registrars

Unit II

The Physical Layer**:** Theoretical basis for data communication, transmission media-Magnetic Media, Twisted Pair, Baseband Coaxial Cable, Broadband Coaxial Cable, Fibre Cable, Structured Cabling, Cable Mounting, Cable Testing, Wireless transmission, the telephone system, narrowband ISDN, broadband ISDN and ATM.

Unit III

The Data Link Layer**:** Data link layer design issues, error detection and correction, data link protocols, sliding window protocols, Examples of Data Link Protocols.

Unit 1V

The Medium Access Sublayer**:** The channel allocation problem, multiple access protocols, IEEE standard 802 for LANS and MANS, high-speed LANs, satellite networks, Network devices-repeaters, hubs, switches and bridges.

Unit V

The Network Layer**:** Network layer design issues, routing algorithms, congestion control algorithm, internetworking, the network layer in the internet, the network layer in ATM networks.

Unit VI

The Transport Layer**:** A simple transport protocol, internet transport protocols, UDP, introduction to TCP, service model, TCP connection establishment, transmission policy, congestion control, timer management, wireless TCP and UDP, transactional TCP.

Unit V

The Application Layer**:** HTTP, electronic mail, SNMP, SMTP, DNS.

Recommended Books:

1. Computer Networks, 3 rd Ed, Tananbaum A.S, PHI
2. Computer Networks-Protocols, Standards and Interfaces, Black U. PHI
3. Computer Communication Networks, Stallings W., PHI
4. Data communication and networking, B. F. Ferouzan, TMH

COURSE OUTCOMES

- Understand computer network basics, network architecture, TCP/IP and OSI reference models.
- Identify and understand various techniques and modes of transmission.
- Describe data link protocols, multi-channel access protocols and IEEE 802 standards for LAN.
- Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme.
- Discuss the elements and protocols of transport layer.
- Understand network security and define various protocols such as FTP, HTTP, Telnet, DNS

CSL 2061			**Computer Organization and Architecture**				Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	0	0	1 Hours	2.5 Hours	10	20	20	50	100

COURSE OBJECTIVES

To study the basic organization and architecture of digital computers (CPU, memory, I/O, software). Discussions will include digital logic and microprogramming. Such knowledge leads to better understanding and utilization of digital computers, and can be used in the design and application of computer systems or as foundation for more advanced computer-related studies.

COURSE CONTENTS

Unit-I:
Introduction
Overview of Digital Fundamentals

Unit-II:
Register Transfer and Micro operation
Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations and Shift, Micro operations.

Unit-III:
Basic Computer Organization and Design
Instruction Codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupts, Design of Basic Computer, Design of Accumulator Logic.

Unit-IV
Micro-programmed Control Unit
Control Memory, Address Sequencing.
Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

Unit-V
Computer Arithmetic
Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operation, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Unit-VI
Input–Output Organization
Peripheral devices, Input – Output interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input – Output Processor.

Unit-VII
Memory Organization
Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Unit-VIII
Multiple Process Organization
Flynn's classification of parallel processing systems, pipelining concepts.

Suggested Books:

1. Computer System and Architecture, Mano, M , PHI
2. Computer Organization & Design, Pal Chaudhuri, P., PHI
3. Digital Computer Electronics: An Introduction to Microcomputers, Malvino
4. Digital Principles and Applications, 4/e ,Malvino , M G Hill
5. Computer Architecture and Organization, Hayes. J.P , M G Hill
6. Computer Organization & Architecture, Stallings, W , PHI

COURSE OUTCOMES

After successful completion of this course, students shall be able;

- To understand structure and function of a computer.
- To understand Basic digital logic circuits and their integration.
- To learn computer arithmetic operations.
- To learn architectural and organizational design of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit
- To understand the pipelining and parallel architecture of a computer

CSL 3032			Design & Analysis of Algorithms				Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	2	5	1 Hours	2.5 Hours	10	20	20	50	100

COURSE OBJECTIVES

1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design)
2. Knowledge of algorithm design strategies
3. Familiarity with an assortment of important algorithms
4. Ability to analyze time and space complexity

COURSE COTENTS

Unit I

Introduction: Definition of algorithm, algorithm specification, performance analysis: Time and space analysis, Asymptotic, recurrence relations.

Design of Efficient algorithms**:** Graphs, trees, recursion, divide and conquer, balancing, dynamic programming.

Unit II

Sorting: Merge sort, Heaps and maintaining the heap properties, building a heap, Heap sort, Quicksort: algorithm, performance and anlaysis, Sorting without comparison: Radix sort, counting sort, bucket sort.

Unit III

Some data structures**:** Hash tables, hash functions, Open addressing, Binary search trees-insertion and deletion, Balanced trees: AVL trees, m-way trees, B Trees, 2-3 Trees, Binomial heaps: Binomial trees and operations on binomial heaps.

Unit IV

Advanced design and analysis Techniques**:** Dynamic programming: Definition, Matrix-chain multiplication, Optimal binary search trees, Longest common subsequence, 0-1 knapsack problem.

Unit V

Greedy algorithms**:** Definition, Fractional knapsack problem, Huffman coding, Task-scheduling problem.

Divide and conquer algorithm**:** Definition, Strassen's matrix multiplication, finding minimum and maximum from an array.

Unit VI

Backtracking**:** Definition, n-queens problem, sum of subset problem.

Unit VII

Graph algorithm: Elementary graph algorithms, Breadth-first and Depth-first search, Minimum spanning trees: Prim's and Krushkal's algorithm, Single source shortest path problem, Bellman-Ford algorithm, Floyd- Warshall algorithm, Johnson's algorithm. Integer and Polynomial arithmetic: Polynomial addition and multiplication.

Recommended Books:

1) Introduction to Algorithm, TH Corman, Charles E, PHI
2) The design and anal. Of Comp. Algorithms Aho, Hopcroft, Ullman Addition Wesley
3) Computer Algorithms, Galgotia., Horowitz, Sahni and Rajsekaran
4) Data Structure, Tata McGraw Hill , Lipschuitz
5) Fundamentals of Data Structures, Galgotia , Horoqwitz, Sahni .

COURSE OUTCOMES

- Analysis of Algorithms: computational models, order notation, time and space complexities, worst-case and expected complexities, lower and upper bounds, Amortized cost
- Techniques for designing efficient algorithms: recursion, divide-and-conquer, dynamic programming, balancing and backtracking
- Problems on sets and sequences: merging, sorting, searching, and selection (including external memory)
- Graph/Network algorithms
- String matching algorithms
- Optimization algorithms LP, IP, SDP
- Tractable and intractable problems: The classes of P, NP and NP-Complete problems
- Approximation algorithms
- Spectral algorithms

CSL 3081			**Database Management System (PL - 4)**				Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Internal Marks	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	2	5	1 Hours	3.0 Hours	10	20	20	50	100

COURSE OBJECTIVES

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

COURSE CONTENTS

Unit I

Introductory Database Concepts: Introduction to data processing, overview of files and file systems, drawbacks of files systems, concept of a database, data abstraction and data independence, data models, database language, database users and administrators, transaction management, database system structure.

Unit II

Entity Relationship Model**:** Basic concepts, constraints, design issues, entity relationship diagram, week entity sets, extended ER features, design of ER database schema, reduction of ER schema to tables.

Unit III

Relational Model: Concept of a relation, primary and secondary keys, foreign keys, structure of relational databases, the relational algebra and extended relational algebra operations, formulation of queries, modification of the database, views.

Unit IV

SQL: Background, basic structure, set operations, aggregate functions, null values, nested queries, views, complex queries, database modification, DDL, embedded SQL, stored procedures and functions, dynamic SQL, other SQL features.

Unit V

Integrity & Security: Domain constraints, referential integrity, assertions, triggers, triggers and assertions in SQL, security in authorization in SQL.

Unit VI

Relational Database Design**:** First normal form, pitfalls in relational database design, functional dependencies, decomposition, desirable properties of decomposition, boyce codd normal form, third and fourth normal forms, other normal forms.

Unit VII

Transactions: Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, serializability, recoverability, implementation of isolation, transaction definition in SQL.

Unit VIII

Concurrency Control: Lock based protocols, timestamp based protocols, validation based protocols, multiple granularity, multiversion schemes, deadlock handling, inset and delete operations.

Unit IX

Recovery Systems**:** Failure classification, storage structure, recovery and atomicity, log based recovery, shadow paging, recovery with concurrent transitions, buffer management.

Recommended Books:

1. Principles of Database System, Ullman , Galgotia.
2. Database System Concepts, Silberschatz, Korth & Sudarshan, McGraw Hill.
3. Database Management Systems , Raghu Ramakrishnan, McGraw Hill.
4. Fundamentals of Database Systems , Elmasri & Navathe Addison Wesley

COURSE OUTCOMES

After successful completion of this course, students shall be able to;

- Define the terminology, features, classifications, and characteristics embodied in database systems.
- Convert any information model into a relational database schema and implement the same using SQL
- Formulate the data requirement in terms of Relational algebra operation
- Retrieve/update the data in database using query languages
- Apply the normalization theory to normalize the given Database schema
- Understand the requirement of ACID properties & their implementation