THEORY							
5th SEM							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	PC(CS/IT)511	Operating Systems	3	1	0	4	4
02	PC(CS/IT)512	DBMS	3	1	0	4	4
03	PC(CS/IT)513	Object Oriented Programming	3	1	0	4	4
04	PEC(IT)501	Elective-I A: Information Theory and Coding B: Computer Graphics C: Advanced Computer Architecture D: Computational Geometry	3	0	0	3	3
05	MC(CS/IT)502	Constitution of India/ Essence of Indian Traditional Knowledge	2	0	0	2	0 (non-credit according to AICTE)
PRACTICAL							
01	PCL(CS/IT)514	Operating System Lab	0	0	3	3	1.5
02	PCL(CS/IT)515	DBMS Lab	0	0	3	3	1.5
03	PCL(CS/IT)516	Programming Lab using Java	0	0	3	3	1.5
		SESSIONAL					
01	CLA(IT)-5	Comprehensive Laboratory Assessment	0	0	0	0	1
		TOTAL	14	3	9	26	20.5

Operating System
Code: PC(CS/IT)511
Contact: 3L + 1T
Credit: 4
Allotted Hrs: 36L

Module I:
Introduction of O.S [2L]: Concept of OS. Operating system services, dual-mode operation, Evaluation of O.S, Different types of O.S: batch, multi-programmed, timesharing, real-time, distributed, network.
Introduction of Process [2L]: Concept of process, Process life cycle, Operations on processes, IPC.

Module II:
System Structure [2L]: Computer system operation, Operating system structure, kernel: microkernel, monolithic kernel, system calls.
Threads [2L]: Overview, Benefits of threads, User and kernel threads.

Module III:
CPU Scheduling [4L]: Scheduling criteria, Preemptive & non-preemptive scheduling, Scheduling algorithms(FCFS,SJF/SRTF,RR,Priority), MLQ scheduling, Multi-processor scheduling.
Process Synchronization [3L]: Race condition, Critical Section problem, Semaphore, Mutex, Monitor.
Deadlocks [3L]: Deadlock criteria, Methods for handling deadlocks, Resource allocation graph, Banker's algorithm, Recovery from deadlock.

Module IV:
Memory Management [3L]: Background, Logical vs. physical address, Address binding, Swapping, Contiguous memory allocation, Fragmentation, Segmentation, Paging.
Virtual Memory [3L]: Concept**,** Demand paging, Page replacement, Page replacement algorithms (FCFS, LRU, Optimal).
File Systems [2L]: File attributes, File system structure, File access methods, File allocation methods (contiguous, linked, indexed).

Module V:
Disk Management [3L]: Disk structure, Disk formatting, Boot block, Bad blocks, Disk scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK,C-LOOK).

Module VI:
I/O Management [3L]: I/O hardware, Polling, Interrupts, DMA, Application I/O interface, Kernel I/O subsystem, Spooling and device reservation.
Protection & Security [2L]: Goals of protection, Security problem, Authentication, Program threats, System threats
Case Study [2L]: Windows family, Linux family, Mac and iOS, VMWare, XEN family, Android.

Text Books / References :

1. Silbersehatz A.,Galvin P. And Gagne G."Operating System Concepts", Willey.
2. Tanenbaum A.S. and Woodhull "Operating System Design & Implementation", Pearson Education US.
3. Milenkovie M, "Operating System : Concept & Design", McGraw Hill.
4. Dhamdhere: Operating System. TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions.
6. Dietel H. N, "An Introduction to Operating Systems", Addison Wesley.

Course Outcomes:

After successful completion of this course students can able to
CO1: Understand the concept of operating system with different types of operating system and concept of process.
CO2: Understand the structures of operating system and mechanism to handle resources and concept of kernel and thread.
CO3: Analyze different mechanism to handle CPU scheduling of processes, process synchronization, deadlock.
CO4: Analyze different memory management mechanism to provide better performance to users, file management mechanism
CO5: Implement different disk management policies.
CO6: Implement input/output devices management technique, evaluate protection and security aspects related to operating system and some case studies related to modern day operating systems.

Database Management System
Code: PEC(CS/IT)512
Contacts: 3L + 1T
Credits: 4
Allotted Hrs: 36L

Module 1: Introduction [2L]:
Concept of File system & Database system & their differences, Data abstraction & Data independence in DBMS, Instances & Schemas, Data models, Database languages (Data definition & Data manipulation languages).

Module 2: Entity Relationship Model [3L]:
Basic concepts, Types of attributes, Relationship sets, Mapping cardinalities & Participation constraints, Types of Keys., Entity – Relationship diagram(E-R diagram)., Strong & Weak entity sets, Specialization & Generalization & Aggregation in ER model.

Module 3: Relational Model [4L]:
Fundamental operations in Relational Algebra, Extended Relational Algebra operations, Concept of View, Relational Calculus.

Module 4: Relational Databases [11L]:

Introduction to SQL [4L]:
Characteristic of SQL, Types of SQL commands(DDL, DML, DCL, TCL), SQL operators & their procedures, Queries, Sub-queries & nested queries., Aggregate Functions, Operations on Modification of databases (Insertion, Updation, Deletion).

Integrity Constraints [2L]:
Concept of Foreign Key, Definition of integrity constraints, Types of integrity constraints(Domain Constraints, Entity Integrity Constraint, Referential Integrity Constraints, Key Constraints).

Functional Dependencies & Normalization [5L]:
Functional Dependency, Closure of functional dependency, Armstrong's Axioms, Canonical Cover., Lossless join decomposition & Dependency preservation, Full & Partial & Transitive dependency, Prime & Non-prime attribute, Need of Normalization, 1NF, 2NF, 3NF, BCNF.

Module 5: Transaction Management [13L]:

Transaction [6L]:
Overview of Database transaction concepts, ACID properties, Transaction state, Concurrent executions, Conflicts in Transaction, Serializability, Conflict & View Serializability, Test for serializability (Precedence Graph), Recoverability, Recoverable& Cascadeless & Strict schedules.

Concurrency Control [4L]:
Shared lock & Exclusive lock, Two phase locking protocol, Deadlock handling, Deadlock prevention, Deadlock detection, Deadlock Recovery

Recovery System [3L]:
Causes of transaction failure, Storage structure, Log-based recovery, Write Ahead Logging (WAL) protocol, Checkpoints, Shadow paging

Module 6: Storage [3L]:
Single level & Multi level indexing, Structure of B & B^+ tree, File organization in B^+ tree, Hashing techniques.

Text Books
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan Gehrke: Database Management System , McGraw-Hill

Reference
1.SQL, PL/SQL the Programming Language of Oracle,4th edition, Ivan Bayross
2.An Introduction to Database Systems, 8th edition, C.J. Date,

Course Outcomes:

After completing the course the student will be able to-

CO 1: Design ER-models to represent simple database application scenarios.
CO 2: Implement SQL queries on data.
CO 3: Apply normalization to Improve database design.
CO 4: Solve concurrency problems in database transactions.
CO 5: Explain basic database storage structures and access techniques.

Object Oriented Programming
Code: PC(CS/IT)513
Contact: 3L + 1T
Credit: 4
Allotted Hrs: 36L

Module I [2L]
Introduction to Object Oriented Programming Concepts
Object Oriented Programming language concepts & features, Comparison between Object Oriented Programming language and conventional programming languages, Object Oriented Modelling concepts.

Module II [10L]
Introductory Concept of Java Programming
Advantages of Java, Data types & variables, Loops, Arrays, Operators, Control statements, constants, methods, Compile time Polymorphism: Method Overloading, Keyboard input operations.

Classes & Objects
Defining Classes and Creation of objects, Access specifiers, Instance variables and Static variables, Constructors, Constructor overloading, Static blocks, Array of objects, Use of **this** keyword, Passing objects as parameter to a method & returning objects from a method, Nested classes & Inner classes concept of string object with length(), equals() and charAt() method of string object, Command Line Arguments, garbage collection.

Module III [10L]
Inheritance and Polymorphism in Java
Concept of Inheritance, Super classes & Subclasses, Object Modelling in Java: Generalization and Specialization, Constructor calling mechanism in inheritance, Use of **super** keyword, Runtime Polymorphism: Method Overriding. Use of **static** keyword in java.

Abstract classes & Interfaces
Concept of Abstract classes & Interfaces and their properties, use of **final** keyword, Dynamic binding in abstract classes and interfaces, Inheritance of interfaces, Nested Abstract classes & Nested Interfaces.

Packages in Java
Creation of packages, Importing packages, Member access rules in the aspect of packages.

Module IV [5L]
Exception handling in Java
Basic concept of exception handling in Java, Different types of exception classes, Concept of **try** and **catch** block, Concept of nested try block and multiple catch blocks, **throw** and **throws** clause, Concept of **finally** block, Creation of user defined exception classes.

Module V [6L]
Multithreading in Java
Basic concept of multithreading, Concept of main thread and child thread, Thread life cycle, Creation of multiple threads, Thread priorities, Thread synchronization, Inter thread communication, Deadlocks, Suspending & Resuming threads.

Module VI [3L]
Applet Programming in Java
Basics of applet programming, Applet life cycle, Differences between application & applet programming, Parameter passing through applets, I/O operations in applets.

Text books:
1. **Core Java Volume I — Fundamentals (9th Edition)** by **Cay S Horstmann and Gary Cornell**
2. Object Oriented Modelling and Design by Rambaugh, James Michael, Blaha; Prentice Hall, India
3. **Java: A Beginner's Guide** by Herbert Schildt, Oracle Press.

References:
1. Head First Java by Kathy Sierra and Bert Bates
2. Deitel and Deitel- "Java How to Program", Pearson Education.

Course Outcomes:

After completion of this course the students will be able to -
CO1: Recognize some of the enhanced features of Object Oriented Programming (OOP) and also be able to design an entity structure in the perspective of object oriented modelling.
CO2: Implement ADT with data protection, method overloading, string operations and object independent access features of the java programming.
CO3: Inherit selective members of the parent class, implement run time polymorphism for abstractions, and build modular programming scenarios with packages.
CO4: Effectively handle java run time exceptions, recognize the control flow of exception paths and also design user defined exception classes.
CO5: Implement parallel processing scenarios with multithreading concepts and their synchronizations.
CO6: Design window based I/O operations for web applications through applet programming.

Information Theory and Coding
Code: PEC(IT)501 A
Contact Hrs./Week: 3L
Credit: 3
Allocated Hrs: 36L

ModueI
Information Theory [4L]
Review of probability theory, Uncertainty and Information, Self and Mutual Information, Entropy, Mathematical Properties of the Entropy Function.

ModueII
Source Coding Theorem [5L]
Entropy and Coding, Shannon-Fano Coding, Variable-Length Codes: Unique Decoding, Instantaneous Codes, Construction of Instantaneous Codes, Prefix tree for prefix code, The Kraft Inequality, Huffman codes.

ModueIII
Channel Capacity and Coding [5L]
Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

ModueIV
Error Control Coding [6L]
Introduction, Matrix description of linear block codes, parity check matrix, Encoding and decoding of Linear Block-codes, Syndrome Decoding, Hamming Codes.

Cyclic Codes [4L]
Polynomials, Method for generating Cyclic Codes, Matrix description of Cyclic codes, Golay codes.

ModueV
BCH Codes [6L]
Properties of BCH codes, minimal polynomials, generator polynomials, check polynomials, examples of BCH codes, Reed Solomon Code.

ModueVI
Convolutional Codes [6L]
Introduction, Polynomial description of Convolutional Codes, Generating function, Matrix description of Convolutional Codes, Viterbi Decoding of Convolutional codes, Trellis codes.

Text Books:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes – S Gravano; Oxford.

References :
3. Coding and Information Theory – R. W. Hamming; Prentice Hall.
4. Information and Coding Theory - G. A. Jones and J. M. Jones ; Springer – Verlag.
5. Essentials of Error-Control Coding – Jorge C. Moreira and Patrick G Farrell; Wiley.
6. Error Control Coding - Shu Lin and D J Costello Jr.; Prentice Hall.

Course Outcomes:

After completion of the course, the students will be able to
CO1: Learn the basic notions of information and channel capacity.
CO2: Design the channel performance using Information theory.
CO3: Comprehend various error control code properties.
CO4: Implement linear block codes and cyclic codes for error detection and correction
CO5: Design BCH & RS codes for Channel performance improvement against burst errors.
CO6: Apply convolution codes for performance analysis.

Computer Graphics
Code: PEC(IT)501 B
Contact Hrs./Week: 3L
Credit: 3
Allotted Hrs: 36L

Module I [4L]
Introduction to Computer Graphics & Graphics Systems
Overview of CG, definitions of CG, types of CG, storage tubes displays, CRT technologies– Raster Scan Display, Computer graphics software.

Module II [4L]
Scan Conversion
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generating algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module III [6L]
2D Transformation
Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.

Module IV [4L]
Viewing
Viewing pipeline, Window to Viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

Module V [6L]
3D Transformation & Viewing
3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, Viewport clipping, 3D viewing, perspectives & Depth Cueing.

Module VI [4L]
Curves and Fractals
Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Module VII [4L]
Hidden Surfaces
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Module VIII [4L]
Color & Shading Models
Introduction, Modeling Light Intensities and Sources, Diffuse Reflection, Lambert's Cosine Law, Specular Reflection, Halftoning, Color Models - RGB Color, CMY Color.

Text books:
1. Computer Graphics (C version) – Hearn D, Baker M P, Pearson.

2. Computer Graphics –A programming Approach– Harrington, Steven; McGraw Hill

References:

1. Computer Graphics – principles and practice - Foley, Van Dam, Feiner and Huges; Pearson.
2. Computer Graphics, Multimedia and Animation – Pakhira Malay K ; PHI Learning Pvt. Ltd.

Course Outcomes:

After completion of this course the students will be able to -
CO1: Understand basic working principle of graphics systems and hardware.
CO2: Design and implement algorithm to display basic geometric 2D graphic on graphic systems they have learned.
CO3: Implement 2D transformation to animate their graphic on graphic systems they have learned.
CO4: Perform clipping operations according to the user viewing system.
CO5: Understand and perform operations on 3D graphics system.
CO6: Understand the curves and fractal geometry.
CO7: Understand and implement algorithm for hidden surface removal on 3D graphic systems.
CO8: Understand and control the colour, light, material, and shadow in a graphics environment.

Advanced Computer Architecture
Code: PEC(IT)501C
Contact Hrs./Week: 3L
Credit: 3
Allocated Hrs: 36L

Module 1 [12L] :
Introduction to High Performance Computing
Pipeline Processing : Pipeline Performance, design of arithmetic pipelines Pipeline hazards – structural hazards, data hazards, control hazards & their solutions Pipeline scheduling Theory: Greedy pipeline scheduling algorithm – Static and Dynamic Pipelining.
Parallel Processing, Taxonomy of Parallel Architectures : 1) SISD, 2) SIMD, 3) MIMD, 4) MISD, Concurrent and Exclusive Read-Write PRAM variants Parallel Algorithms, Matrix Multiplication ,Selection Problem. Amdahl's Law and parallel speed up.

Module 2 [7L] :
RISC architecture, RISC VS CISC, VLIW architecture Vector and Array Processors, Super-scalar machines,Distributed computing architectures, Data flow architectures.

Module 3 [5L] :
Interfacing : Peripheral interfacing, Interfacing a microprocessor with memory and various I/O controllers.

Module 4 [8L] :
Advanced Memory Technology : SRAM, SDRAM, Flash memory, Dual port memory, Cache memory. Memory interleaving, virtual memory.

Module 5 [4L] :
Introduction to FPGA and Reconfigurable architecture.

Text Books :
[1] M. R. Bhujade, "Parallel Computing", Newage International Pvt. Ltd., 1995.
[2] Stallings William, "Computer organization and architecture, designing for performance", Prentice Hall of India, 1997
[3] J. L. Hennessy and D. A. Patterson, "Computer architecture: a quantitative approach", Harcourt Asia, Singapore 1996
[4] Hwang and Briggs, —Computer Architecture and Parallel Processing‖, TMH.
[5] Hayes, —Computer Architecture and Organization‖, McGraw-Hill.

References :
[1] Hwang, —Advanced Computer Architecture‖, McGraw-Hill.
[2] Kain, —Advanced Computer Architecture: a system Design approach‖, PHI.
[3] Flynn, —Computer Architecture‖, New Age Computer Network
[4] Parhami – Computer Architecture, Oxford University Press
[5]Quinn,M.J, -Parallel Computing 'Theory and Practice McGraw Hill
[6]Akl,Selim G. The Design and Analysis of Parallel Algorithms ,Prentice-Hall

Computational Geometry
Code: PEC(IT)501 D
Contact Hrs./Week: 3L
Credit: 3
Allotted Hrs: 36L

Module 1 [10]
Introduction: Geometric preliminaries. Convex Hulls: Convex Hull Algorithms in the Plane -Graham's Scan Algorithm, Jarvi's March, Divide and Conquer Algorithm.
Line Segment Intersection (using plane sweep), Doubly linked edge list
Overlay subdivisions. Triangulations: Polygon Triangulation (Triangulating monotone polygons, Partitioning monotone polygons). Convex Partitioning.

Module 2 [7]
Voronoi diagrams: algorithms, closest pair problems.
Delaunay triangulations: algorithms (divide-and-conquer, flip, incremental), duality of Voronoi diagrams, properties (min-max angle).

Module 3 [9]
Orthogonal Search: Geometric data structures; Range search (Quad-tree, kd-tree), Improvements on range searching (Range tree, fractional cascading), Inverse Range Search (Segment tree, interval tree, priority search tree)
Geometric searching: point-location, 2d linear programming with prune and search.

Module 4 [6]
Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems.
Arrangements: Zones (Duality, line arrangements; many-faces complexity, incremental algorithm, zone theorem), algorithms.

Module 5 [4]
Geometric Applications: Robot Motion Planning (Trapezoidal Maps, point robots, Translational Motion Planning), Computing the Visibility Graph.

Text Book:
1. M. de Berg, M. van Kreveld, M. Overmars, and O. Schwarzkopf. Computational Geometry: Algorithms and Applications. Springer-Verlag, 2nd edition, 2000.

Reference Book:
1. Franco P. Preparata and Michael Ian Shamos, Computational geometry: An Introduction, 1 st edition, Springer-Verlag New York.

Constitution of India
Code: MC(CS/IT)502
Contact: 2L
Credit: 0
Allotted Hrs: 35L

Indian Constitution: [5]
Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Union government and its administration: [10]
Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Supreme court: [10]
Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL.

Local Administration: [10]
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Text books:
1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

Reference books:

1. D D Basu, " Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication ltd, India.

Course Outcomes:

After completion of this course, the learners will be able to
1. describe
   - different features of Indian constitution.
   - power and functioning of Union, state and local self-government.
   - structure, jurisdiction and function of Indian Judiciary.
   - basics of PIL and guideline for admission of PIL.
   - Functioning of local administration starting from block to Municipal Corporation.

2. identify authority to redress a problem in the profession and in the society.

OPERATING SYSTEM LAB
Code: PCL(CS/IT)514
Contact:3P
Credits: 1.5
Allotted Hrs: 33P

1. Managing Unix/Linux Operating System [9P]:
Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. Process [3P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. Signal [3P]: signal handling, sending signals, signal interface, signal sets.

4. Semaphore [6P]: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. POSIX Threads [6P]: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. Inter-process communication [6P]: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Database Management System Lab
Code: PCL(CS/IT) 515
Contacts: 3P
Credits: 1.5
Allotted Hrs: 33P

1. Structured Query Language [6P]
   Creating a Database, Creating a Table, Specifying Relational Data Types, Specifying Constraints, Creating Indexes

2. Table and Record Handling[6P]
   INSERT statement, Using SELECT and INSERT together, DELETE, UPDATE, TRUNCATE statements, DROP, ALTER statements.

3. Retrieving Data from a Database[9P]
   The SELECT statement, Using the WHERE clause, Using Logical Operators in the WHERE clause, Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause, Using Aggregate Functions, Combining Tables Using JOINS, Sub queries.

4. Database Management[6P]
   Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE

5. PL/SQL Concepts and Constructs[6P]
   Introduction of PL/SQL , Structure of basic PL/SQL Structure, Conditional statements, Basic loops, Cursors in Oracle PL / SQL

Programming Lab Using Java
Code: PCL(CS/IT)516
Contact: 3P
Credit: 1.5
Alloted Hours:

1. Programming with java classes involving data members having various access protection, class methods, constructors, overloading features, this and final keyword, static block, static variables and methods.

2. Use of array of objects, passing of object in method and returning of object form method, use of string handling functions– length (), equals (), charAt(), keyboard input operations, command line arguments.

3. Program implementation for nested/inner classes, name conflict resolving for inner and outer classes.

4. Programme implementation for abstract class, interface, inheriting multiple interfaces in a single class, extending multiple interfaces within a single interface, combined inheritance of both abstract class and interface. Use of dynamic method dispatch for abstract class and interface implementation.

5. Implementation of nested abstract class and interface combinations. Resolving name conflict scenarios for the combined inheritance of abstract class and interface.

6. Designing programme modules with creation and accessing of packages.

7. Handling exception with try, catch and finally. Adoption of throw, throws and user defined exception.

8. Programme writing for creation of multiple threads, thread synchronization, inter thread communication.

9. Applet programme execution with I/O operation, use of repaint () method.

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Course Outcome:

After completion of this course the students will be able to -

CO1: Implement java classes with incorporation of data protection, method overloading, string operations, call by reference aspects and object independent access of the class members.

CO2: Design nested structuring of classes and resolve name conflict issues for the nested classes.

CO3: Implement abstract class, interface and their nested structuring along with dynamic method dispatch.

CO4: Tackle java run time exceptions, and also design user defied exception classes.

CO5: Perform parallel processing with multithreading concept and implement their synchronization.

CO6: Execute applet programming for web applications with window based I/O operations.