

Master of Computer Applications Semester – III (2019-21)							
Subject Code	Title		L	T	P	S	Credits
CAT-702	Operational Research		3	0	0	-	3
CAT-705	Advanced Computer Networks		3	0	0	-	3
CAT-706	Parallel and Distributed Computing		3	0	0	-	3
CAT-708	Design and Analysis of Algorithms		3	0	0	-	3
CAT-711	Advanced Internet Programming		3	0	0	-	3
CAP-713	Linux Administration Lab		0	0	4	-	2
CAP-710	Design and Analysis of Algorithms Lab		0	0	4	-	2
CAP-712	Advanced Internet Programming Lab		0	0	4	-	2
Total							21
Career options							
Subject Code	Title	Category	L	T	P	S	Credits
TDT – 202	Aptitude	TPP	0	2	0	-	1
TDT – 201	Soft Skills	TPP	0	0	2	-	1
CAY-713	Enterprise Resource Planning	DE - I	2	0	0	-	2*

* For TPP, students will be opted for Aptitude and Soft Skills both.

** For Non-TPP, students will be opted for departmental elective.

CAT-702	OPERATIONAL RESEARCH	L	T	P	C
	Total Contact Hours : 45	3	-	-	3
	Applicable to which branch: MCA				
	Prerequisite: Basic Mathematics				
Marks					
Internal :40			External :60		
Course Objective					
<ul style="list-style-type: none">• Student will learn to use quantitative methods and techniques for effective decisions–making, model formulation and applications that is used in solving business decision problems.• To provide a formal quantitative approach to problem solving and an intuition about situation.• To develop mathematical skills to analyze and solve integer programming from a wide range of applications.					
Unit	Course Outcomes				
1.	Ability to identify the situation in which operational research and statistics can be applied.				
2.	Able to implements and analysis of computational environment and to understand to find the best optimal solution out of several options				
3.	Understand the mathematical tools that are needed to solve optimization problems and able to find out the optimize way from source to destination.				

Content of the Syllabus

Unit-I

[15]

Introduction and Overview of the OR Modeling Approach: Introduction: The Historical development, Nature, Meaning and Management Application of Operational research. Modeling, Its Principal and Approximation of O.R. Models, Main characteristics and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Introduction to Linear Programming: Linear Programming: Formulation, Graphical solution

Unit-II

[15]

Solving LPP - the Simplex Method: Simplex method and its flow chart, Two-phase Simplex method, Degeneracy. Big-M Method

Duality: Definition of Dual Problem, General Rules for converting any Primal into its Dual Simplex method and its flow chart.

Unit-III

[15]

Transportation and Assignment Problems:

The transportation problem, a stream line simplex method for the transportation problem, assignment problem, a special algorithm for the assignment problem

PERT and CPM:

Network representation, Critical path (CPM) computations and PERT networks

Text Books –

1. Taha Hamdy- Operations Research-An Introduction (Prentice-Hall, 7th edition), 1996, 5th ed.
2. J K Sharma- Operations Research (Pearson)
3. S.D Sharma- Operation Research , Kedarnath & Ramnath Company

Reference Books –

1. Operations Research – Methods & Problems 1st Edition , Sasieni M, Yaspan A & John Wiley & Sons Friedman

CAT-702	OPERATIONAL RESEARCH											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	1	1	1	2	3	2	1	1
CO2	2	2	2	1	2	1	1	2	2	1	1	1
CO2	2	1	1	1	1	1	1	2	1	1	1	1

CAT-705	ADVANCED COMPUTER NETWORKS	L	T	P	C
	Total Contact Hours: 45 hours	3	-	-	3
	Applicable to which branch: MCA				
	Prerequisite : Basic Knowledge of Computer Networks				
Marks					
Internal:- 40			External:- 60		
Course Objective					
<ul style="list-style-type: none">• Student will understand the concepts of data communication and to study the functions of different layers used in communication the data over network.• To introduce IEEE standards employed in computer networking.• To make the students to get familiarized with different protocols and network components.					
Unit	Course Outcomes				
1	Analyze and implement some of the most advanced routing and congestion control algorithms.				
2	Understand basics and principles of new generation of computer networks (VPN, wireless networks, mobile network				
3	Understand network applications.				

Content of the Syllabus

UNIT –I

[15]

Introduction: Overview of computer networks, OSI model, TCP/IP suite of protocols.

Network Layer: IP address classes, subnetting, Classless Inter-domain routing (CIDR), ARP, RARP and DHCP concepts, IPv4 & IPv6, The routing protocols: RIP, OSPF, BGP, IP Multicasting, Multicast routing protocols, address assignments, session discovery, etc.

Transport layer: Design issues of transport layer, addressing, establishing connection, flow control and multiplexing, Transport protocols: TCP and UDP.

UNIT –II

[15]

Application layer: WWW, DNS, MIME, HTTP, SMTP, POP, IMAP, FTP, Telnet.

Mobile Computing: Introduction to Mobile Computing, Devices, Networks: Wireline, Wireless, Ad-hoc, Architecture: Architecture of Mobile Computing, 3- Tier Architecture, Presentation (Tier-1), Application (Tier -2), Data (Tier – 3).

UNIT-III

[15]

Introduction to Wireless Communication System: Comparison of Common wireless system, Architecture of 2G, 3G, 4G. Wireless Local Area network (WLAN), Wi-Fi, WiMAX, Wireless Ad-hoc Network, Security issues and challenges in a Wireless network.

MANET: Introduction to ad-hoc networks – definition, characteristics features, applications, Ad-hoc Mobility Models:- Indoor and out-door models. Security issues and challenges in ad-hoc networks, Routing Protocols: Design issues, goals and classification, Data Dissemination and Clustering

SDN: Introduction and Architecture of Software Defined Network, Characteristics of SDN, Operations, Devices, Controller, Applications of SDN.

Text Books-

1. Behrouz A Forouzan, “Data Communications and Networking”, McGraw Hill.
2. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education.
3. Subir Kumar Sarkar, T.G.Basavaraju, C. Puttaamadappa,”AdHoc Mobile Wireless Network : Principles, Protocols, and Applications, CRC Press.
4. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach” ELSEVIER.

Reference Books-

1. James F. Kurose, Keith W. Ross, “Computer Networking”, Pearson Education.
2. Michael A. Gallo, William M. Hancock, “Computer Communications and Networking Technologies”, CENGAGE Learning.

CAT-705	ADVANCED COMPUTER NETWORKS											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	3	1	2	1	1	2	2	1	2
CO2	2	3	2	3	2	2	1	0	2	2	1	2
CO2	1	3	1	3	2	1	1	1	2	2	1	2

CAT-706	PARALLEL & DISTRIBUTED COMPUTING	L	T	P	C
	Total Contact Hours : 45	3	-	-	3
	Applicable to which branch: MCA				
	Prerequisite: Basic Knowledge of Computer Networks				
Marks					
Internal:- 40			External :- 60		
Course Objective					
<ul style="list-style-type: none">To provide students with contemporary knowledge in parallel and distributed systemsTo equip students with skills to analyze and design parallel and distributed applicationsTo provide master skills to measure the performance of parallel and distributed Algorithms.					
Unit	Course Outcome				
1	Apply the principles and concept in analyzing and designing the parallel and distributed systems				
2	Gain an appreciation on the challenges and opportunities faced by parallel and distributed systems				
3	Understand the middleware technologies that support distributed applications such as RPC, RMI and object based middleware.				

Content of the Syllabus

UNIT-I

[15]

Introduction: Parallel Computing, Parallel Architecture, Architectural Classification Scheme, Performance of Parallel Computers, Performance Metrics for Processors, Parallel Programming Models, Parallel Algorithms.

Pipeline Processing Introduction, Pipeline Performance, Arithmetic Pipelines, Pipelined Instruction Processing, Pipeline Stage Design, Hazards, Dynamic Instruction Scheduling.

Synchronous Parallel Processing: Introduction, Example-SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, Data Mapping and memory in array processors, Case studies of SIMD parallel Processors.

Unit-II

[15]

Introduction to Distributed Systems: Definition, Issues, Goals, Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept, Models of Middleware, Services offered by middleware, Client Server model.

Communication: Layered Protocols, Remote Procedure Call, Remote Object Invocation, Message Oriented Communication, Stream Oriented Communication

Resource and Process Management: Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration.

Unit-III

[15]

Synchronization: Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms.

Consistency and Replication: Introduction, Data-Centric and Client-Centric Consistency Models, Replica Management.

Distributed File Systems: Introduction, good features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Network File System(NFS), Andrew File System(AFS), Hadoop Distributed File System and Map Reduce.

Text Books-

1. M.R. Bhujade, "Parallel Computing", 2nd edition, New Age International Publishers 2009.

2. Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education, Inc., 2007, ISBN: 0-13-239227-5.

Reference Books-

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design" (4th Edition), Addison Wesley/Pearson Education.

2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and design", IEEE computer society press

CAT-706	PARALLEL & DISTRIBUTED COMPUTING											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1	1	1	2	2	1	0	1
CO2	2	1	2	2	1	1	1	1	2	1	0	1
CO2	2	1	2	2	1	1	1	1	1	1	0	1

CAT-708	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
	Total Contact Hours: 45	3	-	-	3
	Applicable to which branch: MCA				
	Prerequisite:- Basic Knowledge of programming algorithm				
Marks					
Internal:- 40			External :- 60		
Course Objective					
Students will be able to					
<ul style="list-style-type: none">• Demonstrate a familiarity with major algorithms and data structures.• Analyze the performance of algorithms.• Apply important algorithmic paradigms and methods of Analysis.					
Unit	Course Outcomes				
1	Analyze and implement Performance analysis notations and basic data structures.				
2	Understand basics and principles Divide and Conquer and Greedy Method approach to program development.				
3	Understand Dynamic Programming and Backtracking.				

Content of the Syllabus

UNIT-I

[15]

Introduction: Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples. Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries.

Unit-II

[15]

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Advantages and disadvantages of divide and conquer. Decrease and Conquer approach: Topological Sort.

Greedy Method: General method, Coin change Problem, Knapsack Problem, Job sequencing with deadlines, Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source Shortest paths: Dijkstra's Algorithm. Optimal Tree Problem: Huffman Trees and Codes .Transform and Conquer Approach: Heaps and Hear Sort.

Unit-III

[15]

Dynamic Programming: General method with Examples, Multistage Graphs, Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack Problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Reliability design.

Backtracking: General method: N-Queens problem, Sum of subset problem, Graph coloring. Hamilton cycles, Branch and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution. NP-Complete and NP –Hard problems: Basic concepts, non-deterministic algorithms.

Text Books-

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books-

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, PHI
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

CAT-708	DESIGN AND ANALYSIS OF ALGORITHMS											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	1	2	1	0	0	2
CO2	1	1	2	1	2	1	0	2	1	0	1	1
CO2	1	1	2	1	2	1	0	2	1	0	1	1

CAT- 711	ADVANCED INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours :45	3	-	-	3
	Applicable to which branch: MCA				
	Prerequisite: Basics of internet programming				
Marks					
Internal :40			External:60		
Course Objective					
The students to understand the concept and underlying principles of Java Programming. The students also develop problem-solving and programming skills using Advance Java concept.					
Unit	Course Outcomes				
1	To understand the basic concepts of Java, Exceptions, JDBC and Swings.				
2	Understanding and work with Servlet, JSP and web services.				
3	Understanding the Java Hibernate & Spring frameworks.				

Content of the Syllabus

UNIT-I

[15]

Classes and other constructs: Class, Constructors, Methods, this, String Handling Using String Class, StringBuffer vs StringBuilder.

Array and Collection: An Introduction and need of collection, Array and ArrayList, HashTable.

Exception Handling: The Idea behind Exceptions, Types of Exceptions, Dealing with Exceptions, Exception Objects, Defining Your Own Exceptions, Checked and unchecked Exceptions, Creating user-defined exception class

Java Data Base Connectivity (JDBC): JDBC and ODBC, Types of Drivers for connection, CRUD operations, Statement and PreparedStatement interface, query and executeQuery, ResultSet interface, ResultSetMetaData interface.

UNIT-II

[15]

Java Servlets: Server-Side Programming, Web Server, Java Server side components, Servlet Architecture, Web Container, Servlet Life Cycle, Tomcat Interface, Servlet interface, Types of Servlet, HttpServletRequest and HttpServletResponse, GET and POST request methods, Retrieving data from database to Servlet, Servlet Collaboration: RequestDispatcher and sendRedirect, ServletConfig and ServletContext, Session Tracking.

JSP: Introduction to JSP and its advantages over Servlet, Architecture of JSP, Elements of JSP, Scripting elements, Directives and actions, JSP configuration, implicit objects.

UNIT-III

[15]

NodeJS: Introduction to JavaScript. Creating functions, Introduction to Node JS, npm, V8, Asynchronous vs Synchronous request, REPL, Reading and writing into file and directories, working with buffer and stream, Creating Server with Http request, Event, Process, Web Modules, Cryptography in NodeJS, NodeJS CRUD.

Text Books:

1. **Java: The Complete Reference**, Tenth Edition, Herbert Schildt, McGraw-Hill Education, 2017
2. **Java Persistence with Hibernate** by Gavin King, Christian Bauer, Manning publisher, New York-USA.

Reference Books:

1. Introduction to Java Programming, Y. D. Liang, Pearson Education.
2. JAVA 2 Unleashed, Tech Media Publications, New Delhi.
3. JAVA 2(1.3) API Documentations.

CAT-711	ADVANCED INTERNET PROGRAMMING											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1	1	2	1	2	2
CO2	2	1	2	2	2	1	1	0	2	1	2	2
CO2	2	1	3	2	2	1	1	1	2	1	2	2

CAP-710	DESIGN AND ANALYSIS OF ALGORITHMS LAB	L	T	P	C
	Total Contact Hours : 60	-	-	4	2
	Applicable to which branch: MCA				
	Prerequisite: Programming Concepts				
Marks					
Internal: - 60			External: - 40		
Course Objective					
Students will be able to <ul style="list-style-type: none">Describe computational solution to well-known problems like searching, sorting etc.Estimate the computational complexity of different algorithms.Devise an algorithm using appropriate design strategies for problem solving..					
Unit	Course Outcome				
1	Analyze and implement Performance analysis notations and basic data structures.				
2	Understand basics and principles Divide and Conquer and Greedy Method approach to program development				
3	Understand Dynamic Programming and Backtracking.				

Content of the Syllabus

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

3. a. Obtain the Topological ordering of vertices in a given digraph.
- b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
- b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

Text Books-

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin., 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books-

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, PHI
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

CAT-710	DESIGN AND ANALYSIS OF ALGORITHMS LAB											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	1	2	1	0	0	2
CO2	1	1	2	1	2	1	0	2	1	0	1	1
CO2	1	1	2	1	2	1	0	2	1	0	1	1

CAP-712	ADVANCED INTERNET PROGRAMMING LAB	L	T	P	C
	Total Contact Hours : 60	-	-	4	2
	Applicable to which branch: MCA				
	Prerequisite: Object oriented knowledge				
Marks					
Internal :60			External:40		
Course Objective					
<ul style="list-style-type: none">The students will understand and implement the concepts underlying principles of Advance Java.Ability to write computer program to solve specified problems.Understand concepts of programming such as conditional and iterative execution, variables, methods etc.					
Unit	Course Outcomes				
1	To learn Java Applets, Beans and Animation Techniques and Advanced Java Networking concepts.				
2	To learn Server Side Programming Concepts.				
3	To know about the JDBC Principles and to develop Media Applications, 3D Graphics.				

Content of the Syllabus

List of Experiments not limiting to:

1. Implementation of CRUD operations on JDBC Applications with Oracle-MySQL-PostgreSQL.
2. Implementation of Java Swings with JDBC Applications with Oracle-MySQL-PostgreSQL.
3. Create Servlet file which contains following functions:
 - Connect
 - Create Database
 - Create Table

- Insert Records into respective table
 - Update records of particular table of database
 - Delete Records from table.
 - Delete table and also database.
4. Create login form and perform state management using Cookies, HttpSession and URL Rewriting.
 5. Study and Implement MVC using Spring Framework
 6. Create database of student subject-wise data and retrieve all data using JSP and generate xml structure along with DTD and XML Schema definition
 7. Create a table of the cookies associated with the suitable home page. If there are no active cookies display as stating “No Cookies” otherwise display cookie name and value in a tabular format
 8. Create a Servlet that uses session tracking to keep per-client access counts. Also show other generic- info about the session.
 9. Make a program which creates a cookie on the server side using servlets & when server returns a response to the user also send cookies to clients for later retrieve its data from that client.
 10. **JavaScript/CSS**
 - a. Create a registration page using HTML and CSS with right corner of the page having current date and time.
 - b. Design specification for the webpage as follows:
 - i. The text box background color will be displayed and shadowed when the cursor inserts into the text field.
 - ii. The text area background color will be displayed and shadowed when the cursor places into text area.
 - iii. The submit button background color will be displayed and shadowed when the cursor moves over the submit button.
 - c. For the same page and write validation function for registration page and modify the onSubmit event handler in the form code to validate the following form fields:
 - i. FirstName
 1. Must be entered

2. Must be Character
- ii. Password
 1. Password length should be between 6 to 20 characters.
- iii. Gender(Use radio button)
 1. Must be selected
- iv. Mobile Number
 1. Must be in format(XX-XXXXXX-XXXXXX)
- v. Email
 1. Email address must contain at least an @ sign and a dot(.)

11. Java Server Pages:

Experiment: I

- i. Create a bean that represents information needed to calculate an employee's salary. Has String (employee name) and int (employee ID) properties. Create an application to demonstrate automatically filling in bean properties from request parameters.

Experiment: II

- ii. Create an emp table in the database with fields name, id and designation.
- iii. Create a HTML file with fields name, id and designation. Make sure that the textfields have the same name as name, id and designation.
- iv. Create a javabean with fields name, id and designation.
- v. On click of the submit button of the HTML, invoke a jsp page which will extract the values that were given by the HTML page and it invokes a servlet.
- vi. The Servlet will make a connection to the database and store the value in the table.
- vii. Connection to the database should have been established using a separate java class.
- viii. You can enhance the program by including more features like deletion, updation and selecting all records.

12. AJAX

- a. Develop a web application to dynamically check for availability of an email-id for registration. If email-id does not exist in the database, „Available!“, else „Not Available!“, should be displayed next to the email textbox. If email-id pattern does not conform to an email-id, display Invalid Email Id. Perform the check when the textbox loses focus.

Consider the following fields for the Profile table:

EMAIL, PASSWORD, NAME, DATEOFBIRTH, GENDER, CITY, PINCODE, MOBILE

Note*: Check should be performed irrespective of uppercase or lowercase data.

Text Books:

1. **Java: The Complete Reference**, Tenth Edition, Herbert Schildt, McGraw-Hill Education, 2017
2. **Java Persistence with Hibernate** by Gavin King, Christian Bauer, Manning publisher, New York-USA.

Reference Books:

1. Introduction to Java Programming, Y. D. Liang, Pearson Education.
2. JAVA 2 Unleashed, Tech Media Publications, New Delhi.
3. JAVA 2(1.3) API Documentations.

CAP-712	ADVANCED INTERNET PROGRAMMING LAB											
Department Teaching the Subject	University Institute of Computing											
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1	1	2	1	2	2
CO2	2	1	2	2	2	1	1	1	2	1	2	2
CO2	2	1	3	2	2	1	1	1	2	1	2	2