

**ST. JOSEPH'S UNIVERSITY**

**BENGALURU-27**



**DEPARTMENT OF COMPUTER SCIENCE**  
**SYLLABUS FOR POSTGRADUATE PROGRAMME**  
**M.Sc. (COMPUTER SCIENCE)**

## **Program Outcomes of MSc Computer Science:**

| <b>PO No.</b> | <b>Program Outcome</b>                                                                                                                                                                             |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PO1</b>    | <b>Advanced Knowledge</b><br>Demonstrate in-depth knowledge of computer science principles, including algorithms, programming, software design, databases, networks, and emerging technologies.    |
| <b>PO2</b>    | <b>Problem Solving and Innovation</b><br>Analyze complex computing problems and design innovative solutions using appropriate tools and techniques.                                                |
| <b>PO3</b>    | <b>Research Skills</b><br>Conduct research and apply modern tools and techniques to explore new areas in computing and information technology.                                                     |
| <b>PO4</b>    | <b>Modern Tool Usage</b><br>Create, select, and apply appropriate techniques, resources, and modern computing tools for problem-solving with an understanding of limitations.                      |
| <b>PO5</b>    | <b>Professional Ethics</b><br>Apply ethical principles and commit to professional ethics, responsibilities, and norms of the computing profession.                                                 |
| <b>PO6</b>    | <b>Teamwork and Leadership</b><br>Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.                                                 |
| <b>PO7</b>    | <b>Communication Skills</b><br>Communicate effectively on complex computing activities with the IT community and with society at large, such as writing reports, documentation, and presentations. |

## SUMMARY OF CREDITS

### FIRST SEMESTER

| THEORY    |                                           |                      |         |    |    |       |
|-----------|-------------------------------------------|----------------------|---------|----|----|-------|
| Code      | Title                                     | Hours<br>Per<br>Week | Credits | IA | SE | Total |
| CS7121    | Object Oriented<br>Programming using JAVA | 4                    | 4       | 50 | 50 | 100   |
| CS7221    | Theory of Computation                     | 4                    | 4       | 50 | 50 | 100   |
| CS7321    | Design and Analysis of<br>Algorithms      | 4                    | 4       | 50 | 50 | 100   |
| CS7421    | Cyber Security                            | 4                    | 4       | 50 | 50 | 100   |
| PRACTICAL |                                           |                      |         |    |    |       |
| MCS1P1    | Object Oriented<br>Programming JAVA Lab   | 6                    | 3       | 25 | 25 | 50    |
| MCS1P2    | Design and Analysis of<br>Algorithm Lab   | 6                    | 3       | 25 | 25 | 50    |

**Total Number of Credits: 22**

## SECOND SEMESTER

| THEORY    |                                      |                |         |    |    |       |
|-----------|--------------------------------------|----------------|---------|----|----|-------|
| Code      | Title                                | Hours Per Week | Credits | IA | SE | Total |
| CS8124    | Advanced Database Management System  | 4              | 4       | 50 | 50 | 100   |
| CS8224    | Machine Learning with Python         | 4              | 4       | 50 | 50 | 100   |
| CS8324    | Advanced Web Technologies            | 4              | 4       | 50 | 50 | 100   |
| CS8424    | Principles of Compiler Design        | 4              | 4       | 50 | 50 | 100   |
| CS8524    | Software Project Management          | 4              | 4       | 50 | 50 | 100   |
| PRACTICAL |                                      |                |         |    |    |       |
| MCS2P1    | ML with Python lab                   | 6              | 3       | 25 | 25 | 50    |
| MCS2P2    | Advanced Web Technologies &ADBMS Lab | 6              | 3       | 25 | 25 | 50    |

**Total Number of Credits: 26**

### THIRD SEMESTER

| THEORY                               |                                                       |                |         |    |    |       |
|--------------------------------------|-------------------------------------------------------|----------------|---------|----|----|-------|
| Code                                 | Title                                                 | Hours Per Week | Credits | IA | SE | Total |
| CS9123                               | Data Analytics with HADOOP                            | 4              | 4       | 50 | 50 | 100   |
| CS9223                               | Mobile Communication and Applications                 | 4              | 4       | 50 | 50 | 100   |
| Department Elective (One of the two) |                                                       |                |         |    |    |       |
| CSDE9323                             | 1) Internet of Things                                 | 4              | 4       | 50 | 50 | 100   |
| CSDE9423                             | 2) Cloud Computing and Information Storage Management | 4              | 4       | 50 | 50 | 100   |
| PRACTICAL                            |                                                       |                |         |    |    |       |
| MCS3P1                               | Mobile Applications Lab                               | 6              | 3       | 25 | 25 | 50    |
| MCS3P2                               | Database Applications Development Lab                 | 6              | 3       | 25 | 25 | 50    |
| MCS9V123                             | Seminar and Comprehensive Viva                        | 4              | 4       | 50 | 50 | 100   |

**Total Number of Credits: 22**

## FOURTH SEMESTER

| THEORY    |                              |                      |         |    |    |       |
|-----------|------------------------------|----------------------|---------|----|----|-------|
| Code      | Title                        | Hours<br>Per<br>Week | Credits | IA | SE | Total |
| CS0122    | Image Processing             | 4                    | 4       | 50 | 50 | 100   |
| CS0222    | Advanced<br>Operating System | 4                    | 4       | 50 | 50 | 100   |
| PRACTICAL |                              |                      |         |    |    |       |
| MCS4P1    | Major Project<br>/Internship | 24                   | 12      | 50 | 50 | 100   |

**Total Number of Credits: 20**

**KEY WORDS: DE – Departmental Elective and OE – Open Elective**

| <b>CORE COURSES (CC)</b>                      |                    |
|-----------------------------------------------|--------------------|
| <b>Course Title</b>                           | <b>Code Number</b> |
| <b>Object Oriented Programming using JAVA</b> | <b>CS7121</b>      |
| <b>Theory of Computation</b>                  | <b>CS7221</b>      |
| <b>Design and Analysis of Algorithms</b>      | <b>CS7321</b>      |
| <b>Cyber Security</b>                         | <b>CS7421</b>      |
| <b>Advanced Database Management System</b>    | <b>CS8124</b>      |
| <b>Machine Learning with Python</b>           | <b>CS8224</b>      |
| <b>Advanced Web Technologies</b>              | <b>CS8324</b>      |
| <b>Principles of Compiler Design</b>          | <b>CS8424</b>      |
| <b>Software Project Management</b>            | <b>CS8524</b>      |
| <b>Data Analytics with HADOOP</b>             | <b>CS9123</b>      |
| <b>Mobile Communication and Applications</b>  | <b>CS9223</b>      |
| <b>Image Processing</b>                       | <b>CS0122</b>      |
| <b>Advanced Operating System</b>              | <b>CS0222</b>      |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)</b>            |                    |
|--------------------------------------------------------------|--------------------|
| <b>Course Title</b>                                          | <b>Code Number</b> |
| <b>1) Internet of Things</b>                                 | <b>CSDE9323</b>    |
| <b>2) Cloud Computing and Information Storage Management</b> | <b>CSDE9423</b>    |

| <b>SKILL ENHANCEMENT COURSE (SEC)</b>            |                    |
|--------------------------------------------------|--------------------|
| <b>Course Title</b>                              | <b>Code Number</b> |
| <b>Object Oriented Programming JAVA Lab</b>      | <b>MCS1P1</b>      |
| <b>Design and Analysis of Algorithm Lab</b>      | <b>MCS1P2</b>      |
| <b>ML with Python lab</b>                        | <b>MCS2P1</b>      |
| <b>Advanced Web Technologies &amp; ADBMS Lab</b> | <b>MCS2P2</b>      |
| <b>Mobile Applications Lab</b>                   | <b>MCS3P1</b>      |
| <b>Database Applications Development Lab</b>     | <b>MCS3P2</b>      |
| <b>Seminar and Comprehensive Viva Voce</b>       | <b>MCS9V123</b>    |
| <b>Major Project /Internship</b>                 | <b>MCS4P1</b>      |

## **SYLLABUS**

### **SEMESTER-I**

|                             |                                               |
|-----------------------------|-----------------------------------------------|
| <b>Semester</b>             | <b>I</b>                                      |
| <b>Paper Code</b>           | <b>CS7121</b>                                 |
| <b>Paper Title</b>          | <b>Object Oriented Programming Using Java</b> |
| <b>Hours per Week</b>       | <b>4</b>                                      |
| <b>Total Teaching Hours</b> | <b>60</b>                                     |
| <b>Credits</b>              | <b>4</b>                                      |

#### **Couse Objectives:**

To introduce the concepts and principles of Java Programming language and to design and implement object-oriented solutions to the simple and complex problems. Also, to give students experience in Java Programming and GUI application design with data base.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                        |
|-----|------------|------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge about Object Oriented Programming.                                                     |
| CO2 | Understand | Have developed a very good understanding on Advanced concepts of Java Programming, syntax and programming conventions. |
| CO2 | Apply      | Be able to program and associate with various logics.                                                                  |
| CO3 | Analyze    | Be able to compare and relate the complexity of coding with the knowledge of testing and debugging.                    |
| CO4 | Evaluate   | Be able to choose appropriate approach to solve the various problems.                                                  |
| CO5 | Create     | Be able to develop complete real world problems with appropriate Java coding knowledge.                                |

## Unit-wise Syllabus

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No. of Hours |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I             | <b>Introduction to Object Oriented Programming and Classes:</b><br>Introduction to Object Oriented Programming- Object-Oriented Programming(OOP) Principles- The Evolution of Java- Declaring Objects - Introducing Methods - Overloading methods – Constructors - Parameterized Constructors - this Keyword. Garbage Collection - the finalize () Method - Introducing Access Control - Understanding static - Introducing nested and inner classes - String class - String Buffer Class - Command Line Arguments | 12           |
| Unit II            | <b>Inheritance in Java:</b> Inheritance Basics, Multilevel Hierarchy, super Keyword, Method Overriding, abstract Keyword, final with Inheritance. Interfaces and Packages: Defining & Implementing Interfaces, Extending Interfaces, Creating Packages, CLASSPATH, Access Protection, Importing Packages. Exception Handling: try-catch-finally, throw, throws, Built-in Exceptions, Custom Exceptions.                                                                                                            | 12           |
| Unit III           | <b>Multithreading:</b> Java Thread Model, Thread Life Cycle, Thread Priorities, Runnable Interface, Thread Synchronization, Inter-Thread Communication. Generics and Collections Framework: Collections Overview, Collection/List/Set/SortedSet/Queue Interfaces, ArrayList, LinkedList, HashSet, Iterator, For-Each.                                                                                                                                                                                              | 12           |
| Unit IV            | <b>GUI Programming with Swing:</b> Swing Basics, Components & Containers, JLabel, ImageIcon, JTextField, Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox, JTable, Swing Menus. Event Handling: Delegation Event Model, Event Classes, KeyEvent, Event Listener Interfaces, Adapter Classes.                                                                                                                                                                                                              | 12           |
| Unit V             | <b>Database Programming using JDBC:</b> Introduction to JDBC, JDBC Drivers & Architecture, Connecting to and Querying a Database, Automatic Driver Recovery, Creating a Statement, Executing a Query, Processing a Result Set. (Note: 6 hours of self-study assigned from above units.)                                                                                                                                                                                                                            | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>60</b>    |

**NOTE: 6 hours of self-study will be assigned from the above units.**

## REFERENCES

- Herbert Schildt, “Java the Complete Reference”, 11th Edition, McGraw-Hill Osborne Media.
- Cay S. Horstmann and Gary Cornell, “Core Java, Vol.2: Advanced Features”, 8th Edition, Prentice Hall.
- Computer Bible Games with Java  
11th Edition: A Java JFC Swing GUI Game Programming
- Beginning Java 8 APIs, Extensions and Libraries: Swing, JavaFX, JavaScript, JDBC and Network Programming APIs (Expert's Voice in Java) 1st Edition

## **BLUEPRINT**

Code number: **CS7121**

Title of the paper: **Object Oriented Programming Using Java**

| Chapter                                                            | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|--------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| Unit I                                                             | 12              | 8                                                                                  |
| Unit II                                                            | 12              | 8                                                                                  |
| Unit III                                                           | 12              | 10                                                                                 |
| Unit IV                                                            | 12              | 20                                                                                 |
| Unit V                                                             | 12              | 20                                                                                 |
| <b>TOTAL</b>                                                       | <b>60</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question) = 50</b> |                 |                                                                                    |

### **MCS1P1-OBJECT ORIENTED PROGRAMMING USING JAVA LAB** (11 sessions 6hrs/week)

#### **Program List**

1. Implement the concept of Overloading methods
2. Implement the concept of control statements and Arrays in the class
3. Implement the concept of class, data members, member functions and access specifiers.
4. Implement the concept of function overloading & Constructor overloading.
5. Implement the static keyword – static variable, static block, static function and static class
6. Implement String and String Buffer classes.
7. Implement this keyword and command line arguments.
8. Implement the concept of inheritance, super, abstract and final keywords in java.
9. Implement package and interface keywords in java
10. Implement Exception Handling in java
11. Implement multithreading – Thread class, Runnable interface, thread synchronization and thread communication.
12. Implement generic concept – generic class and generic interface
13. Implement collections – collection Interfaces and collection classes
14. Implement Swing components and containers
15. Implement Event Handling
16. Implement the operations in JDBC

|                             |                              |
|-----------------------------|------------------------------|
| <b>Semester</b>             | <b>I</b>                     |
| <b>Paper Code</b>           | <b>CS7221</b>                |
| <b>Paper Title</b>          | <b>Theory of Computation</b> |
| <b>Hours per Week</b>       | <b>4</b>                     |
| <b>Total Teaching Hours</b> | <b>60</b>                    |
| <b>Credits</b>              | <b>4</b>                     |

## Objectives

The Course is designed to give theoretical understanding of the subject from the perspective of formal languages and to lay foundations for Compiler Design and Concurrent design. To develop Problem Solving Ability. Through the contents of the course the students will be able to understand Automata Theory, Formal Languages, Computability Theory, Context Free Grammars and Various Machines.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                                             |
|-----|------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Identify key notions of computation, such as algorithm, computability, decidability, reducibility, and complexity, through problem solving. |
| CO2 | Understand | Understand the models of computation, including formal languages, grammars and automata, and their connections.                             |
| CO3 | Apply      | Apply Mathematical Foundations and algorithmic principles in problem solving for modeling and designing of computer and software systems.   |
| CO4 | Analyze    | Analyze and design Finite automata, Pushdown automata, Turing machines, Formal languages, and Grammars.                                     |
| CO5 | Evaluate   | Solve Computational problems and able to prove the basic result of Theory of Computation                                                    |
| CO6 | Create     | Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.     |

## Unit-wise Syllabus

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No. of Hours |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I             | <b>Introduction to set theory concepts and Automata Theory</b><br><b>Set Theory</b><br>Introductory concepts of Set Theory, Automata Theory<br>Introduction to Finite Automata, Definition of Alphabets, Strings, Languages, Sentences , Transition Functions and Extended Transition Functions, Notations to represent Automata<br>Introduction to Central Concept of Automata Theory<br>Deterministic Automata, Non Deterministic Automata, Applications of Finite Automata, Understanding Mealy and Moore Machines                                                                                                    | 14           |
| Unit II            | <b>Finite Automata Problem Solving and Regular Expressions</b><br>Problem solving in DFA and NFA, Conversions from NFA to DFA, Finite automata with Epsilon-transitions<br>Regular Expressions<br>Conversions from Epsilon-NFA to DFA, Equivalence and Minimization of DFA<br>Regular Expressions<br>Introduction to Regular Expressions and Regular Expressions, Applications of Regular Languages<br>Proving languages not to be regular languages, Closure and Decisive properties of regular languages                                                                                                               | 12           |
| Unit III           | <b>Context Free Grammar</b><br><b>Introduction to Grammar</b><br>Introduction to Context Free grammars and Chomsky's Grammar Hierarchy, Derivation and Derivation Tree and Types of Derivation, Applications of Grammar and Ambiguity in grammars and Languages.<br>Various Representation of Grammar<br>Elimination of useless symbols, Epsilon productions and Unit productions, Representation of CNF and GNF. Conversion to CNF and GNF.<br>Context Free Languages<br>Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs, Pumping lemma for CFLs and its use. Closure properties of CFLs. | 14           |
| Unit IV            | <b>Pushdown Automata (PDA) &amp; Applications:</b> Definition of the Pushdown automata and 7 of PDA, Deterministic, nondeterministic and Instantaneous descriptions of PDAs, Language acceptance by final states and by empty stack. PDA Problems.                                                                                                                                                                                                                                                                                                                                                                       | 10           |
| Unit V             | <b>Introduction to Computability Theory</b><br><b>Turing Machines</b><br>The turning machine; Programming techniques for Turning Machines, Extensions to the basic Turning Machines, Turing Machine and Computers<br>Decidability<br>Decidability and Halting Problems<br>Reducibility<br>Undecidable Problems in Language Theory, Simple Undecidable Problem and Mapping Reducibility.                                                                                                                                                                                                                                  | 10           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>60</b>    |

## References

- Introduction to Automata Theory Languages, and Computation, by J.E.Hopcroft, R.Motwani &J.D.Ullman (3rd Edition) – Pearson Education
- Theory of Computer Science (Automata Language & Computations), by K.L.Mishra& N. Chandrashekhar, PHI
- Cohen, “Introduction to Computer Theory”, John Wiley
- “Finite Automata and Formal Languages”, A.M.Padma Reddy
- M. Sipser, Introduction to Theory of Computation, PWS Publishing Corporation, 1997.
- T.C. Martin, Theory of Computation, Tata McGraw-Hill
- H.R. Lewis, C.H. Papadimitrou, Elements of the Theory of Computation, PHI.

## BLUEPRINT

Code Number: **CS7221**

Title: **Theory of Computation**

| Chapter                                                           | Number of Hours | Total marks for which the questions are to be asked (including bonus questions) |
|-------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------|
| Unit I                                                            | 14              | 8                                                                               |
| Unit II                                                           | 12              | 8                                                                               |
| Unit III                                                          | 14              | 10                                                                              |
| Unit IV                                                           | 10              | 20                                                                              |
| Unit V                                                            | 10              | 20                                                                              |
| <b>TOTAL</b>                                                      | <b>60</b>       | <b>68</b>                                                                       |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                 |                                                                                 |

|                             |                                          |
|-----------------------------|------------------------------------------|
| <b>Semester</b>             | <b>I</b>                                 |
| <b>Paper Code</b>           | <b>CS7321</b>                            |
| <b>Paper Title</b>          | <b>Design and Analysis of Algorithms</b> |
| <b>Hours per Week</b>       | <b>4</b>                                 |
| <b>Total Teaching Hours</b> | <b>60</b>                                |
| <b>Credits</b>              | <b>4</b>                                 |

### Objectives

This paper introduces the paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice. It introduces the classic algorithms in the various domains and the different techniques for designing efficient algorithms.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                             |
|-----|------------|-----------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Demonstrate a familiarity with major algorithms and data structures.                                                        |
| CO2 | Understand | Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs |
| CO2 | Apply      | Ability to choose appropriate algorithm design techniques for solving Problems                                              |
| CO3 | Analyze    | Ability to analyze the performance of algorithms                                                                            |
| CO4 | Evaluate   | Be able to evaluate the algorithms based on its time and space complexity.                                                  |
| CO5 | Create     | Developing efficient algorithms for simple computational tasks                                                              |

### Unit-wise Syllabus

| Unit    | Topics                                                                                                                                                                                                                    | No. of Hours |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I  | Introduction: Role of Algorithms in Computing, Analyzing Algorithms, Growth of Functions using Asymptotic Notation, Recurrence Relations. Algorithm Design Paradigms: General Considerations and Representative Problems. | 12           |
| Unit II | Divide and Conquer: Binary Search, Merge Sort, Quick Sort, Arithmetic with Large Integers.                                                                                                                                | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                        | No. of Hours |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit III           | Greedy Method: Minimal Spanning Tree, Shortest Paths, Knapsack Problem. Dynamic Programming: Chained Matrix Multiplication, Optimal Storage on Tapes, Shortest Paths (Dijkstra's & Floyd-Warshall), Optimal Search Trees.                                     | 12           |
| Unit IV            | Backtracking: 8-Queens Problem, Graph Coloring, Hamiltonian Cycles. Branch and Bound: 0/1 Knapsack, Travelling Salesman Problem. Approximation: Graph Coloring, Task Scheduling, Bin Packing.                                                                 | 12           |
| Unit V             | Graph Algorithms: BFS, DFS and Applications, Polynomial Evaluation. Intractable Problems: Basic Concepts, Nondeterministic Algorithms, NP-Completeness, Cook's Theorem, Examples of NP-Hard and NP-Complete Problems. (Note: 6 hours of self-study assigned.) | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                               | <b>60</b>    |

**NOTE: 6 hours of self-study will be assigned from the above units.**

#### **REFERENCES:**

- E. Horowitz and S. Sahani, Fundamentals of Computer Algorithms, Galgotia, New Delhi.
- Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
- S.E. Goodman and S.T. Hedetniemi, Introduction to the Design and Analysis of Algorithms, McGraw Hill.
- G. Brassard, and P. Bratley, Algorithmics, PHI.
- S.K. Basu, Design Methods and Analysis of Algorithms, PHI.

## **BLUEPRINT**

Code number: **CS7321**

Title of the paper: **DESIGN AND ANALYSIS OF ALGORITHMS**

| Chapter                                                           | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|-------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| Unit I                                                            | 12              | 8                                                                                  |
| Unit II                                                           | 12              | 8                                                                                  |
| Unit III                                                          | 12              | 10                                                                                 |
| Unit IV                                                           | 12              | 20                                                                                 |
| Unit V                                                            | 12              | 20                                                                                 |
| <b>TOTAL</b>                                                      | <b>60</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                 |                                                                                    |

## **Practical II**

### **MCS1P2-DESIGN AND ANALYSIS OF ALGORITHMS LAB**

**(11 sessions 6hrs/week)**

#### **Program List**

1. Implementing Divide and Conquer MinMax Algorithm find the greatest and the smallest numbers from a given set of numbers.
2. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements.
3. Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements
4. Obtain the Topological ordering of vertices in a given digraph.
5. Compute the transitive closure of a given directed graph using Warshall's algorithm.
6. Implement 0/1 Knapsack problem using Dynamic Programming.
7. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
8. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
9. Print all the nodes reachable from a given starting node in a digraph using BFS method.
10. Check whether a given graph is connected or not using DFS method.

|                             |                       |
|-----------------------------|-----------------------|
| <b>Semester</b>             | <b>I</b>              |
| <b>Paper Code</b>           | <b>CS7421</b>         |
| <b>Paper Title</b>          | <b>Cyber Security</b> |
| <b>Hours per Week</b>       | <b>4</b>              |
| <b>Total Teaching Hours</b> | <b>60</b>             |
| <b>Credits</b>              | <b>4</b>              |

## Objectives

This course deals with how to protect information and information infrastructure in cyberspace, build capabilities to prevent and respond to cyber threats, reduce vulnerabilities and minimize damage from cyber incidents through a combination of institutional structures and cyber laws.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                                                       |
|-----|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.                 |
| CO2 | Understand | Have developed a very good understanding on key terms and concepts in cyber law, intellectual property and cyber-crimes, trademarks and domain theft. |
| CO2 | Apply      | Be able to Interpret and forensically investigate security incidents                                                                                  |
| CO3 | Analyze    | Be able to analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.                                       |
| CO4 | Evaluate   | Be able to design, develop, test and evaluate secure software.                                                                                        |
| CO5 | Create     | Be able to develop policies and procedures to manage enterprise security risks                                                                        |

## Unit-wise Syllabus

| Unit    | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | No. of Hours |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I  | Cryptography: Introduction, Symmetric & Asymmetric Key Cryptography, Conventional Encryption Model, Classical Encryption Techniques, Simplified DES, Block Cipher Principles, DES, Differential & Linear Cryptanalysis, Block Cipher Modes, Public Key Encryption.                                                                                                                                                                                                                          | 12           |
| Unit II | Network Security: Introduction To The Concepts Of Security, Security Approaches, Principles Of Security, Types Of Attacks, Intruders, (IDS and IPS) Intrusion Detection And Prevention System, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec | 14           |
| Unit    | Introduction to Cyber Security: Overview of Cyber Security, Security                                                                                                                                                                                                                                                                                                                                                                                                                        | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                             | No. of Hours |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| III                | Fundamentals:-Authentication Authorization Accountability, Social Media, Social Networking and Cyber Security. Cyber Attack and Cyber Services, Computer Virus – Computer Worms – Trojan horse. Vulnerabilities - Phishing - Online Attacks – Pharming - Phishing – Cyber Attacks - Cyber Threats - Zombie-stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood. |              |
| Unit IV            | Cyberspace and the Law: Cyber Security Regulations, International Law, State & Private Sector in Cyberspace, Cyber Security Standards, Indian Cyberspace, National Cyber Security Policy 2013.                                                                                                                                                                                                     | 10           |
| Unit V             | Cyber Forensics: Handling Preliminary Investigations, Controlling an Investigation, Disk-Based Analysis, Investigating Information-Hiding, Scrutinizing E-mail, Validating E-mail Headers, Tracing Internet Access, Tracing Memory in Real-Time.                                                                                                                                                   | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                    | <b>60</b>    |

#### REFERENCES:

- Thomas R, Justin Peltier, John, Information Security Fundamentals, Auerbach Publications.
- AtulKahate, Cryptography and Network Security 2nd Edition, Tata McGrawHill.
- Stallings, “Cryptography & Network Security - Principles & Practice”, Prentice Hall, 3rd Edition.
- Nina Godbole, SunitBelapure, Cyber Security, Wiley India 1st Edition.

#### **BLUEPRINT**

Code number: **CS7421**

Title of the paper: **Cyber Security**

| Chapter                                                            | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|--------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| Unit I                                                             | 12              | 8                                                                                  |
| Unit II                                                            | 14              | 8                                                                                  |
| Unit III                                                           | 12              | 10                                                                                 |
| Unit IV                                                            | 10              | 20                                                                                 |
| Unit V                                                             | 12              | 20                                                                                 |
| <b>TOTAL</b>                                                       | <b>60</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question) = 50</b> |                 |                                                                                    |

## **SEMESTER-II**

|                             |                                             |
|-----------------------------|---------------------------------------------|
| <b>Semester</b>             | <b>II</b>                                   |
| <b>Paper Code</b>           | <b>CS8124</b>                               |
| <b>Paper Title</b>          | <b>Advanced Database Management Systems</b> |
| <b>Hours per Week</b>       | <b>4</b>                                    |
| <b>Total Teaching Hours</b> | <b>60</b>                                   |
| <b>Credits</b>              | <b>4</b>                                    |

### **Objectives**

This paper covers database design and SQL; it also provides an understanding of relational Database, Parallel Database and Data Warehouse. It emphasis on a practical approach to design a Complete database for various entities.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                         |
|-----|------------|---------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge of the DBMS tools used to design Database                               |
| CO2 | Understand | Have developed a very good understanding of advanced feature to modify the content of the database      |
| CO3 | Apply      | Be able to implement various commands in manipulating and maintaining the Database for various entities |
| CO4 | Analyze    | Able to estimate the query based cost for an efficient and dynamic Database.                            |
| CO5 | Evaluate   | Able to select best tools required for the front end design along with database.                        |
| CO6 | Create     | Able to create complete Database and maintain without anomalies.                                        |

## Unit-wise Syllabus

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No. of Hours |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I             | Database Concepts: Characteristics of Database Approach, Functional Dependency, Normalization. Query Processing & Optimization: General Strategies, Algebraic Manipulation, Optimizing Relational Expressions. Hands-on Practice: SQL Commands with various entities.                                                                                                                                                                                                                                                                                                                                               | 12           |
| Unit II            | Transaction Processing & Concurrency Control: ACID Properties, Transaction Recovery, Lock-Based/Optimistic/Timestamp-Based Concurrency Control, Deadlocks Database Security: Security Issues, Control Measures — Discretionary, Mandatory, Role-Based. Database Recovery: Recovery Concepts, Deferred/Immediate Update, Shadow Paging, ARIES Hands-on Practice - Implementing transaction recovery on a database.                                                                                                                                                                                                   | 12           |
| Unit III           | Parallel Databases: I/O Parallelism, Inter/Intra Query & Operation Parallelism, Design of Parallel Systems (5 Hrs). Distributed Database Concepts Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.<br>Case Study<br>Comparative study between inter and intra operation parallelism                                                                                                                                                                                                                                                     | 12           |
| Unit IV            | Introduction to Data Warehouse<br>OLTP Systems, Differences between OLTP Systems and Data Warehouse, Characteristics of Data Warehouse, Functionality of Data Warehouse, Advantages and Applications of Data Warehouse.<br>Methodology<br>Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Data Warehouse Types.                                                                                                                                                                                                                                                              | 12           |
| Unit V             | <b>Introduction</b><br>Components of Data warehouse Architecture, Dimensional Modeling- Introduction, E-R Modeling, E-R Modeling VS Dimensional Modeling.<br>Data Warehouse Schemas<br>Star Schema, Inside Dimensional Table, Inside Fact Table, Fact Less Fact Table, Granularity, Star Schema Keys, Snowflake Schema, Fact Constellation Schema.<br>Data Warehouse & OLAP<br>Introduction to OLAP, Characteristics of OLAP, Steps in the OLAP Creation Process, Advantages of OLAP, What is Multidimensional Data.<br>OLAP Architectures<br>MOLAP, ROLAP, HOLAP, Data Warehouse and OLAP-Hypercube & Multi cubes. | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>60</b>    |

**Self Study****6 hrs:**

- Data Models, Schemas, Three Schema Architecture and Data Independence; Database Design: ER Modeling – ER diagrams.
- Dimensional Model with Examples.

**REFERENCES:**

- Jeffrey D. Ullman “Principles of Database Systems”, Third Edition, Galgotia Publication Pvt. Ltd.
- R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2008.
- .Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, sixth Edition, McGraw Hill, 2011.
- C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
- Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
- Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

**BLUEPRINT**Code number: **CS8124****Title of the paper: Advanced Database Management Systems**

| <b>Chapter</b>                                                      | <b>Number of Hours</b> | <b>Total marks for which the question are to be asked (including bonus questions)</b> |
|---------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------|
| UNIT I                                                              | 12                     | 8                                                                                     |
| UNIT II                                                             | 12                     | 8                                                                                     |
| UNIT III                                                            | 12                     | 10                                                                                    |
| UNIT IV                                                             | 12                     | 20                                                                                    |
| UNIT V                                                              | 12                     | 20                                                                                    |
| TOTAL                                                               | 60                     | <b>68</b>                                                                             |
| <b>Maximum marks for the paper (Excluding bonus questions) = 50</b> |                        |                                                                                       |

|                             |                                     |
|-----------------------------|-------------------------------------|
| <b>Semester</b>             | <b>II</b>                           |
| <b>Paper Code</b>           | <b>CS8224</b>                       |
| <b>Paper Title</b>          | <b>Machine Learning with Python</b> |
| <b>Hours per Week</b>       | <b>4</b>                            |
| <b>Total Teaching Hours</b> | <b>60</b>                           |
| <b>Credits</b>              | <b>4</b>                            |

## Objectives

This paper enables students to acquire basic knowledge in machine learning techniques and learn to apply the techniques in the area of pattern recognition and data analytics. Also this paper introduces python programming language as a machine learning tool.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                                                                    |
|-----|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge of basic principles of machine learning techniques and have developed a good knowledge of machine learning capabilities of python. |
| CO2 | Understand | Have developed a very good understanding of types of machine learning techniques like supervised and un supervised learning.                                       |
| CO2 | Apply      | Be able to use various machine learning models.                                                                                                                    |
| CO3 | Analyze    | Be able to compare various machine learning models and select a suitable model for a given problem.                                                                |
| CO4 | Evaluate   | Be able to evaluate various models in python and select the appropriate one for a given real time problem                                                          |
| CO5 | Create     | Be able to design and build small machine learning applications which can be used to solve various real time problems.                                             |

## Unit-wise Syllabus

| Unit     | Topics                                                                                                                                                                                                                                  | No. of Hours |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I   | Introduction: Machine Learning Types & Examples. Supervised Learning: Learning from Examples, Multiple Classes, Regression, Model Selection & Generalization, Parametric Methods, Parametric Classification.                            | 12           |
| Unit II  | Dimensionality Reduction: Subset Selection, PCA, Factor Analysis, LDA. Clustering: Mixture Densities, K-Means, Hierarchical, Spectral Clustering. Non-Parametric Methods: Non-Parametric Classification, Distance-Based Classification. | 12           |
| Unit III | Decision Trees: Univariate Trees, Pruning, Rule Extraction. Bayesian Classifier: Conditional Probability, Bayes Theorem, Naive Bayes, Numeric Features with                                                                             | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                              | No. of Hours |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Naive Bayes. Multilayer Perceptron: Training a Perceptron, Boolean Functions, Back Propagation Algorithm, Training Procedures.                                                                                                                                                                                                                                                                                                      |              |
| Unit IV            | Kernel Machines (SVM): Separating Hyperplane, v-SVM, Kernel Tricks, Multiclass & One-class Kernel Machines. Hidden Markov Models: Markov Processes, HMM, Evaluation, State Sequence, Learning Model Parameters. Reinforcement Learning: Single State Case, Temporal Difference Learning, Generalization.                                                                                                                            | 12           |
| Unit V             | Machine Learning with Python: NumPy — Narray, Array Attributes, Creation Routines, Indexing, Broadcasting, Mathematical & Statistical Functions, Matrix Library. Pandas — Series, DataFrame, Descriptive Statistics, Groupby, Merging, I/O Tools. Data Visualization — Matplotlib, Barplot, Histograms, Box Plots, Scatter Plot. Scikit-learn — KNN, SVM, Naive Bayes, Linear Regression, K-Means, PCA, LDA. (Self Study: 6 hours.) | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>60</b>    |

**SELF STUDY –6 hours of self-study will be assigned from the above units.**

### References

- E. Alpaydin, Introduction to Machine Learning. 2nd MIT Press, 2009.
- K. P. Murphy, Machine Learning: A Probabilistic Perspective. MIT Press, 2012.
- P. Harrington, Machine Learning in Action. Manning Publications, 2012
- C. M. Bishop, Pattern Recognition and Machine Learning. Springer, 2011.
- Andreas C. Muller, Sarah Guido, Introduction to Machine Learning with Python

### **BLUEPRINT**

Code number: **CS8224**

Title of the paper: **MACHINE LEARNING WITH PYTHON**

| Chapter                                                           | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|-------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| 10                                                                | 10              | 8                                                                                  |
| 12                                                                | 12              | 8                                                                                  |
| 12                                                                | 12              | 10                                                                                 |
| 16                                                                | 16              | 20                                                                                 |
| 16                                                                | 16              | 20                                                                                 |
| <b>66</b>                                                         | <b>66</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                 |                                                                                    |

### Practical I

## **MCS 2P1-Machine Learning Using Python**

**(11 sessions 6 hr/week)**

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data set
5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
6. Apply K-Means clustering algorithm to cluster a set of data stored in a .CSV file.
7. Implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
8. Implement the parametric Linear Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

|                             |                                  |
|-----------------------------|----------------------------------|
| <b>Semester</b>             | <b>II</b>                        |
| <b>Paper Code</b>           | <b>CS8324</b>                    |
| <b>Paper Title</b>          | <b>Advanced Web Technologies</b> |
| <b>Hours per Week</b>       | <b>4</b>                         |
| <b>Total Teaching Hours</b> | <b>60</b>                        |
| <b>Credits</b>              | <b>4</b>                         |

## Objectives

This paper provides an insight to develop a website using essential tools of Angular and an integration of ASP .NET for interactive web pages. This paper also focuses on back-end support in building queries and introduction of Firebase.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                    |
|-----|------------|----------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge of the tools (Angular) used to design web page with a backend.     |
| CO2 | Understand | Have developed a very good understanding of advanced techniques to develop and test the web pages. |
| CO3 | Apply      | Be able to integrate web based applications with suitable database applications.                   |
| CO4 | Analyze    | Able to test and debug the codes in developing effective websites.                                 |
| CO5 | Evaluate   | Able to compare and implement better codes to reduce the complexity of the web design process.     |
| CO6 | Create     | Able to create and host the web site with domain knowledge.                                        |

## Unit-wise Syllabus

| Unit    | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No. of Hours |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I  | <p>Basic elements of HTML and JavaScript</p> <p>HTML<br/>Basic syntax, Standard structure, Basic text markup, Images, Hyper Links. Lists, Tables, Forms, Frames(attributes for all HTML elements).<br/>Cascading Style Sheets<br/>Introduction, Style syntax, Types of style sheets, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The &lt;span&gt; and &lt;div&gt; tags.<br/>The Basics of JavaScript</p> <p>Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, data types, operators and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Strings, Functions(built-in and user defined), Constructors, DOM, Events and Event Handling.</p> | 12           |
| Unit II | ES6, TypeScript, Angular-CLI and Angular Components<br>ES6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 12           |

| Unit     | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | No. of Hours |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|          | Module system-Classes-Variable declaration-Arrow Functions-Template Strings.<br>Type Script<br>Type safety, inference and intelligence-Interfaces-Decorators.<br>Angular<br>CLI & project structure-Creating a new project-Project settings, bootstrapping-<br>Building and serving-<br>Component-based architecture-Angular building blocks overview-Generating<br>project elements-Root<br>Angular Components<br>Angular Components-Component definition-Component types-Template syntax-<br>Data, property and event Binding-Using directives and pipes-Inputs-Outputs<br>(events)-Component style<br>Advanced Components Data projection, building a wrapper component-<br>Querying view and childrenDynamic components |              |
| Unit III | Providers, Dependency Injection, Observables<br>Providers and Dependency Injection-Understanding the role of the Provider-<br>Understanding the injectortree-Creating and using a class provider (service)-Other<br>provider strategies-Configuring providers.<br>Observables and RxJS<br>Subscription-RxJS Operators-Creating Subjects and Observables<br>HttpClient<br>Http requests (GET, PUT, and POST)<br>Configuring headers-Interceptors-Progress events<br>Angular Router<br>Setting up the router-Navigation-Child routes-Routing params-Lazy loading-Guards<br>and hooks                                                                                                                                          | 12           |
| Unit IV  | Angular Modules, directives and Pipes<br>Angular Modules and Directives<br>Root Module vs. Feature Module-Module definition-Module configurationTypes of<br>directives-Built-in directives-Writing your own directives<br>Pipes-Sync and async Pipes<br>Built-in Pipes-Writing your own pipes, Angular Forms<br>Template-driven forms-Reactive forms<br>Form Builder, Form validation, Custom validators and Async validators<br>State management with ngRxHrs<br>Understanding Redux architecture-ngRx Store-Actions & Reducers-Middleware-<br>Effects and Facades-Action Splitters                                                                                                                                        | 12           |
| Unit V   | UNIT V<br><br><b>ASP.NET Core and API Fundamentals</b><br>Building an API with ASP.NET Core<br>Introduction to REST and HTTP-Designing the API & URIUsing Status Codes-<br>Using Get for Collections<br>Using Query Strings<br>Modifying Data-Implementing POST, PUT & DELETE. Integration of front end and<br>back end.<br><br>Fire Base                                                                                                                                                                                                                                                                                                                                                                                   | 12           |

| Unit               | Topics                                                                                                                                                     | No. of Hours |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Overview, Environment Setup, Data, Arrays, write Data, Write List Data, Write Transactional Data, Read Data, Event Types, Detaching Callbacks and Queries. |              |
| <b>Total Hours</b> |                                                                                                                                                            | <b>60</b>    |

**NOTE: 6 hours of self- study will be assigned from the above units.**

## REFERENCES

- HTML and CSS: Design and Build Websites
- Mastering HTML, CSS & Javascript by Web Publishing
- Angular — The Complete Guide by Maximilian Schwarzmüller.
- The Ng-book — The Complete Book on Angular by Nate Murray, Felipe Coury, Ari Lerner
- The Complete Angular Course: Beginner to Advanced by Mosh Hamedani.
- “Professional ASP.NET MVC 5 (WROX)” by Jon Galloway and Brad Wilson
- “ASP.NET: The Complete Reference” by Matthew Macdonald
- Firebase by Sam Sisavath

## **BLUEPRINT**

Code number: **CS8324**

Title of the paper: **Advanced Web Technologies.**

| Chapter                                                             | Number of Hours | Total marks for which the question are to be asked (including bonus questions) |
|---------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------|
| <b>UNIT I</b>                                                       | <b>12</b>       | <b>8</b>                                                                       |
| <b>UNIT II</b>                                                      | <b>12</b>       | <b>8</b>                                                                       |
| <b>UNIT III</b>                                                     | <b>12</b>       | <b>10</b>                                                                      |
| <b>UNIT IV</b>                                                      | <b>12</b>       | <b>20</b>                                                                      |
| <b>UNIT V</b>                                                       | <b>12</b>       | <b>20</b>                                                                      |
| <b>TOTAL</b>                                                        | <b>60</b>       | <b>68</b>                                                                      |
| <b>Maximum marks for the paper (Excluding bonus questions) = 50</b> |                 |                                                                                |

## **Practical II**

### **MCS2P2- Advanced Web Technologies &ADBMS Lab (11 sessions 6hrs/week)**

#### **Program List**

1. Design a web page using the following elements for a company
  - a. Basic tags, text formatting, image, anchor, lists, table, forms tags
  - b. Create a home page using CSS concepts to add a menu and various text, image and color properties.
  - c. Design two forms that includes all the Java Script Objects(text box, text area, button, radio button, check box)
2. Demonstrate Angular module and components.
3. Demonstrate Angular components.
4. Demonstrate Angular Providers.
5. Demonstrate Angular Dependency Injection.
6. Demonstrate Angular router.
7. Demonstrate Angular Modules.
8. Demonstrate Angular directives and Pipes.
9. Demonstrate Angular forms.
10. Demonstrate Angular State management with ngRx.
11. Demonstrate front end and backend.
12. Database Customization using SQL
13. Creating Databases/Table spaces /constrains/keys
14. Create Objects
15. Moving Data
16. Recovery
17. Locking
18. Preparing Applications for Execution using a front end tool
19. Application Performance Tool

|                             |                                      |
|-----------------------------|--------------------------------------|
| <b>Semester</b>             | <b>II</b>                            |
| <b>Paper Code</b>           | <b>CS8424</b>                        |
| <b>Paper Title</b>          | <b>Principles of Compiler Design</b> |
| <b>Hours per Week</b>       | <b>4</b>                             |
| <b>Total Teaching Hours</b> | <b>60</b>                            |
| <b>Credits</b>              | <b>4</b>                             |

## Objectives

Compiler Design will teach students the fundamental concepts and techniques used for building a simple compiler, To understand the phases of compiler, creation and execution of parse tree with symbol tables, errors encountered by the compiler and code optimization. The discussion will also include the examination of intermediate code states, machine code optimization techniques and support for advanced language features.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                                                                  |
|-----|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge about the role of compiler to translate the source code to object code.                                                          |
| CO2 | Understand | Have developed a very good understanding on the six phases of compiler and increase the efficiency of the compiler in understanding Analysis and synthesis part. |
| CO2 | Apply      | Be able to Write a scanner, parser, and semantic analyzer without the aid of automatic generators                                                                |
| CO3 | Analyse    | Be able to Specify and analyse the lexical, syntactic and semantic structures of advanced language                                                               |
| CO4 | Evaluate   | Be able to Design the structures and support required for compiling advanced language features.                                                                  |
| CO5 | Create     | Be able to create a compiler using the tools YACC and LEX                                                                                                        |

## Unit-wise Syllabus

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                             | No. of Hours |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I             | <b>Introduction to Compilers:</b> Analysis of Source Program, Phases of Compiler, Simple One-Pass Compiler. <b>Lexical Analysis:</b> Removal of Whitespace & Comments, Constants, Recognizing Identifiers & Keywords, Input Buffering, Specification of Tokens, Recognition of Tokens, Introduction to LEX.                                        | 12           |
| Unit II            | <b>Symbol Tables:</b> Entries, List Data Structures, Hash Tables, Scope Information. <b>Syntax Analysis:</b> Role of Parser, Context Free Grammar, Writing a Grammar. <b>Top-Down Parsing:</b> Brute Force, Recursive Descent, LL(1). <b>Bottom-Up Parsing:</b> Shift-Reduce, Operator Precedence, LR Parsers.                                     | 12           |
| Unit III           | <b>Syntax Analysis -:</b> yntax-Directed Definitions: Syntax Tree Construction, S-Attributed Definitions, L-Attributed Definitions, Top-Down Translation. <b>Type Checking:</b> Type Systems, Simple Type Checker. <b>Error Recovery:</b> Detection & Recovery, Ad-Hoc & Systematic Methods, Syntax Analyzer Error Handling, Introduction to YACC. | 12           |
| Unit IV            | <b>Run-Time Environment:</b> Source Language Issues, Storage Organization, Storage Location Strategies. <b>Intermediate Code Generation:</b> Intermediate Languages, Declarations, Assignment Statements. <b>Code Optimization:</b> Global Data Flow Analysis, Common Sub-Expression Removal, Loop Invariant Code Motion, Strength Reduction.      | 12           |
| Unit V             | <b>Code Generation:</b> Design Issues, Target Machine, Run-Time Storage Management, Basic Blocks & Flow Graphs, Next-Use Information, Simple Code Generator, Register Allocation & Assignment, DAG Representation, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code Generator Generators.     | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                    | <b>60</b>    |

## REFERENCES:

- Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, “Compilers :principles,Techniques, and Tools,Pearson Education Asia.
- Dhamdhare D.M., “Compiler Construction: Theory andPractice”, McMillan India Ltd.
- Holub Allen, “Compiler Design in C”, Prentice Hall of India.(2ndRevised Edition)

**BLUEPRINT**

Code number: **CS8424**

Title of the paper: **Principles of Compiler design**

| <b>Chapter</b>                                                    | <b>Number<br/>of<br/>Hours</b> | <b>Total marks for which the questions are to be<br/>asked(including bonus questions)</b> |
|-------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------|
| <b>Unit I</b>                                                     | <b>12</b>                      | <b>8</b>                                                                                  |
| <b>Unit II</b>                                                    | <b>12</b>                      | <b>8</b>                                                                                  |
| <b>Unit III</b>                                                   | <b>12</b>                      | <b>10</b>                                                                                 |
| <b>Unit IV</b>                                                    | <b>12</b>                      | <b>20</b>                                                                                 |
| <b>Unit V</b>                                                     | <b>12</b>                      | <b>20</b>                                                                                 |
| <b>TOTAL</b>                                                      | <b>60</b>                      | <b>68</b>                                                                                 |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                                |                                                                                           |

|                             |                                    |
|-----------------------------|------------------------------------|
| <b>Semester</b>             | <b>II</b>                          |
| <b>Paper Code</b>           | <b>CS8524</b>                      |
| <b>Paper Title</b>          | <b>Software Project Management</b> |
| <b>Hours per Week</b>       | <b>4</b>                           |
| <b>Total Teaching Hours</b> | <b>60</b>                          |
| <b>Credits</b>              | <b>4</b>                           |

### Objectives

This paper introduces the students to the fundamentals of software project management and to give an insight into the project planning phase, selection of an appropriate project approach and an in-depth study of software project models. This paper will get the students to understand the concepts of effort estimation, activity planning, risk management in software projects. The paper formally introduces the students to the concepts of resource management, role of quality in software and build people management skills.

**Course Outcomes:** At the end of the course, the student should

|     |            |                                                                                                                                                                                                                |
|-----|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Knowledge  | Have developed a good knowledge of the fundamentals of the discipline of Software Project Management and the role of Managers in managing projects                                                             |
| CO2 | Understand | Have developed a very good understanding of the different process models, effort estimation techniques, risk analysis techniques, quality assessment methods, managing teams and understanding team structures |
| CO2 | Apply      | Be able to apply the policies for better management of software projects.                                                                                                                                      |
| CO3 | Analyze    | Be able to analyze various techniques and methods of management of all the aspects of a software project and select the best approach.                                                                         |
| CO4 | Evaluate   | Be able to critique the various techniques of software project management                                                                                                                                      |
| CO5 | Create     | To be able to work in a group as a team leader or active team member in an IT project.                                                                                                                         |

### Unit-wise Syllabus

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No. of Hours |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I             | <p><b>INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT</b></p> <p>Introduction, Software project versus other types of projects, contract management and technical project management, activities covered by Software Project Management, plans methods and Methodologies, Categorizing Software Projects, setting objectives stakeholders, business case, requirement specification, Management control.</p> <p>Project planning: Introduction and various steps in project planning.</p>                                                                                                                                                                                                                                    | 12           |
| Unit II            | <p>Selection of Appropriate Project Approach: Choosing Technologies, Technical Plan Contents. Process Models: Waterfall, V-Process, Spiral, Software Prototyping, Incremental Delivery, Agile (DSDM, Scrum, XP), Managing Iterative Processes, Selecting Appropriate Process Model.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                  | 12           |
| Unit III           | <p><b>SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING</b></p> <p>Estimation Techniques top-down estimation, bottom-up estimation, Albrecht function point analysis, expert judgment, staffing pattern.</p> <p>Activity planning: Objectives of plan, project schedules, projects and activities, sequencing and scheduling the activities, network planning models, formulating a network model, adding time dimension, forward pass, backward pass, identifying critical path, activity float, shortening project duration, identifying critical activities, activity-on-arrow networks.</p>                                                                                                                           | 12           |
| Unit IV            | <p>Risk Management: Nature &amp; Types of Risk, Managing Risk, Hazard Identification &amp; Analysis, Risk Planning &amp; Control, Evaluating Risks.</p> <p>Resource Allocation: Nature of Resources, Identifying Requirements, Scheduling Resources, Creating Critical Paths, Counting Cost, Publishing Resource Schedule.</p>                                                                                                                                                                                                                                                                                                                                                                                           | 12           |
| Unit V             | <p><b>MANAGING PEOPLE AND ORGANIZING TEAMS</b></p> <p>Understanding behavior, organizational behavior: a background, selecting the right person for the job, instruction in the best methods, motivation, working in groups, becoming a team, decision making, leadership, organizational structures, stress, health and safety.</p> <p><b>SOFTWARE QUALITY</b></p> <p>Place of software quality in project planning, importance of project quality, defining software quality, ISO 9126, practical software quality measures, techniques to help enhance software quality, quality plans.</p> <p>Self study: COCOMO Model, various process models, case study on project planning and any one of the ISO standards.</p> | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>60</b>    |

## REFERENCES

- Hughes, Bob and Cotterell, Mike, Software project Management, 4th Edition, TMH.
- Kathy Schwalbe, Information Technology Project Management, Vikas Publishing House.
- Kieron Conway, Software Project Management – From Concept to Deployment,
- Kelkar S. A, Information Technology Project Management, A concise study, PHI, 2005

**BLUEPRINT**

Title of the paper: **SOFTWARE PROJECT MANAGEMENT**

| Chapter                                                            | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|--------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| Unit I                                                             | 12              | 8                                                                                  |
| Unit II                                                            | 12              | 8                                                                                  |
| Unit III                                                           | 12              | 10                                                                                 |
| Unit IV                                                            | 12              | 20                                                                                 |
| Unit V                                                             | 12              | 20                                                                                 |
| <b>TOTAL</b>                                                       | <b>60</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question) = 50</b> |                 |                                                                                    |

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### SEMESTER-III

|                             |                                   |
|-----------------------------|-----------------------------------|
| <b>Semester</b>             | <b>III</b>                        |
| <b>Paper Code</b>           | <b>CS9123</b>                     |
| <b>Paper Title</b>          | <b>Data Analytics with HADOOP</b> |
| <b>Hours per Week</b>       | <b>4</b>                          |
| <b>Total Teaching Hours</b> | <b>60</b>                         |
| <b>Credits</b>              | <b>4</b>                          |

#### **Course Objectives:**

The Student should be made to:

- Be Exposed To Big Data
- Learn The Different Ways Of Data Analysis
- Be Familiar With Data Streams
- Learn The Mining And Clustering
- Be Familiar With The Visualization

#### **Unit-wise Syllabus**

| <b>Unit</b> | <b>Topics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Unit I      | Introduction to Big Data: Introduction To Big Data Platform – Challenges Of Conventional Systems – Web Data – Evolution Of Analytic Scalability, Analytic Processes And Tools, Analysis Vs Reporting – Modern Data Analytic Tools.                                                                                                                                                                                                                                                                                                                                                        | 12                  |
| Unit II     | Regression Modeling, Multivariate Analysis, Bayesian Modeling, Inference And Bayesian Networks, Support Vector And Kernel Methods, Analysis Of Time Series: Linear Systems Analysis, Nonlinear Dynamics – Rule Induction – Neural Networks: Learning And Generalization, Competitive Learning.                                                                                                                                                                                                                                                                                            | 12                  |
| Unit III    | FREQUENT ITEMSETS AND CLUSTERING<br>Mining: Frequent Item sets – Market Based Model – Apriori Algorithm – Handling Large Data Sets In Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets In A Stream – Clustering Techniques – Hierarchical – K- Means – Clustering High Dimensional Data – CLIQUE And PROCLUS – Frequent Pattern Based Clustering Methods.                                                                                                                                                                                                                | 12                  |
| Unit IV     | <b>HADOOP and MapReduce</b><br>Hadoop Fundamentals: Data, Data Analysis and storage, Comparison with other systems – Relational Database Management Systems, Grid Computing, Volunteer Computing, History of Apache Hadoop The Hadoop Distributed File system The Design of HDFS, HDFS Concepts – Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability, Map Reduce: Data format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out Working of Map Reduce – Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort | 12                  |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No. of Hours |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit V             | <b>Pig Environment and Hive</b><br>Pig Environment: Execution types, Running Pig programs, Grunt, Pig Latin Editors An Example – Generating Examples, Comparison with databases<br>Pig Latin – Structure, Statements, Expressions, Types, Schemas, Functions, Macros<br>Hive: Installing Hive – The Hive shell, An Example; Running Hive – Configuring hive, Hive services, the Meta store , Comparison with Traditional Databases – Schema on Read Versus Schema on Write, Updates, Transactions and Indexes | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>60</b>    |

## REFERENCES

- Cielen, D., Meysman, A., & Ali, M. (2016). Introducing data science: big data, machine learning, and more, using Python tools. Manning Publications Co.
- Tom White, “Hadoop – The Definitive Guide; Storage and Analysis at Internet scale”, O’Reilly, Shroff Publishers & Distributers Pvt. Ltd., 4th Edition, 2015, ISBN – 978-93-5213-067-2
- Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
- Anand Rajaraman And Jeffrey David Ullman, Mining Of Massive
- Datasets, Cambridge University Press, 2012.
- Bill Franks, Taming The Big Data Tidal Wave: Finding Opportunities In Huge
- Data Streams with Advanced Analytics, John Wiley & Sons, 2012.
- Glenn J. Myatt, Making Sense Of Data, John Wiley & Sons, 2007 Pete Warden,
- Big Data Glossary, O Reilly, 2011.
- Jiawei Han, Micheline Kamber “Data Mining Concepts And Techniques”, Second
- Edition, Elsevier, Reprinted 2008.

## **BLUEPRINT**

Code number: **CS9123**

Title of the paper: **DATA ANALYTICS with HADOOP**

| <b>Chapter</b>                                                    | <b>Number of Hours</b> | <b>Total marks for which the questions are to be asked (including bonus questions)</b> |
|-------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------|
| <b>Unit I</b>                                                     | <b>12</b>              | <b>8</b>                                                                               |
| <b>Unit II</b>                                                    | <b>12</b>              | <b>8</b>                                                                               |
| <b>Unit III</b>                                                   | <b>12</b>              | <b>10</b>                                                                              |
| <b>Unit IV</b>                                                    | <b>12</b>              | <b>20</b>                                                                              |
| <b>Unit V</b>                                                     | <b>12</b>              | <b>20</b>                                                                              |
| <b>TOTAL</b>                                                      | <b>60</b>              | <b>68</b>                                                                              |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                        |                                                                                        |

### SEMESTER-III

|                             |                                              |
|-----------------------------|----------------------------------------------|
| <b>Semester</b>             | <b>III</b>                                   |
| <b>Paper Code</b>           | <b>CS9223</b>                                |
| <b>Paper Title</b>          | <b>MOBILE COMMUNICATION AND APPLICATIONS</b> |
| <b>Hours per Week</b>       | <b>4</b>                                     |
| <b>Total Teaching Hours</b> | <b>60</b>                                    |
| <b>Credits</b>              | <b>4</b>                                     |

#### **Course Objectives:**

- To provide student with fundamental design paradigm and technologies of mobile communication and application.
- Features of 3G, 4G and its comparison.
- Knowledge of mobile application in software intensive systems.
- Synthesize knowledge in the area of mobile communication and application.
- Implementing the Android Studio in developing mobile application.

#### **Unit-wise Syllabus**

| <b>Unit</b> | <b>Topics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit I      | <b>UNIT I</b> (12)<br><br><b>INTRODUCTION</b><br>Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmission, Signals, Antennas, Multiplexing-SDM, FDM, TDM, CDM, Medium Access Control-SDMA, FDMA, TDMA, CDMA.                                                                                                                                                                                                               |
| Unit II     | <b>GSM</b><br>Telecommunications System – GSM – System Architecture, Localization and calling, Hand over and Security, Satellite System, Wireless LAN, Bluetooth, Mobile IP-Goals, Packet Delivery, Registration – Tunneling and Reverse Tunnelling.                                                                                                                                                                                                                           |
| Unit III    | <b>ANDORID OVERVIEW</b><br>A little background about mobile technologies, Different mobile technologies Android, Windows, IOS, Black Berry, series 40, Bada Nokia, Benefits and drawbacks of Smartphone programming, Overview of Android, How it all got started, Why Android different and important, Android Stack overview, Linux kernel, native libraries, App framework, Apps, SDK overview, platforms, tools, versions. Creating and setting up custom Android emulator. |

| Unit               | Topics                                                                                                                                                                                                                                                             |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit IV            | <p><b>ANDROID INSTALLATION</b></p> <p>Install the android SDK, Install base tools, install SDKs and Addons, Install apache Ant, Emulator and Device. Get know Eclipse, Build, install and Run the Application in your Emulator or Device, Project Structure.</p>   |
| Unit V             | <p><b>DESIGNING USER INTERFACE</b></p> <p>Designing by declaration, creating the opening screen, using alternate resources, implementing an about box, applying a theme, adding a menu, adding settings, debugging with log messages, debugging with debugger.</p> |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                    |

Self-Study: IPV4 Features and Ten Interactive Mobile application development with various design tools.

## REFERENCES

- Cielen, D., Meysman, A., & Ali, M. (2016). Introducing data science: big data, machine learning, and more, using Python tools. Manning Publications Co.
- Tom White, “Hadoop – The Definitive Guide; Storage and Analysis at Internet scale”, O’Reilly, Shroff Publishers & Distributers Pvt. Ltd., 4th Edition, 2015, ISBN – 978-93-5213-067-2
- Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
- Anand Rajaraman And Jeffrey David Ullman, Mining Of Massive
- Datasets, Cambridge University Press, 2012.
- Bill Franks, Taming The Big Data Tidal Wave: Finding Opportunities In Huge
- Data Streams with Advanced Analytics, John Wiley & Sons, 2012.
- Glenn J. Myatt, Making Sense Of Data, John Wiley & Sons, 2007 Pete Warden,
- Big Data Glossary, O Reilly, 2011.
- Jiawei Han, Micheline Kamber “Data Mining Concepts And Techniques”, Second
- Edition, Elsevier, Reprinted 2008.

Code number: CS9223

Title of the paper: **Mobile Communication and Applications**

| Chapter                                                    | Number of Hours | Total marks for which the questions are to be asked (including bonus questions) |
|------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------|
| Unit I                                                     | 12              | 8                                                                               |
| Unit II                                                    | 12              | 8                                                                               |
| Unit III                                                   | 12              | 10                                                                              |
| Unit IV                                                    | 12              | 20                                                                              |
| Unit V                                                     | 12              | 20                                                                              |
| TOTAL                                                      | 60              | 68                                                                              |
| Maximum marks for the paper (Excluding bonus question)= 50 |                 |                                                                                 |

|                      |                    |
|----------------------|--------------------|
| Semester             | III                |
| Paper Code           | CSDE9323           |
| Paper Title          | Internet of Things |
| Hours per Week       | 4                  |
| Total Teaching Hours | 60                 |
| Credits              | 4                  |

### **Course Objectives:**

This paper Internet of Things (IoT) focuses on interconnection and integration of the physical world and the cyber space. It helps the student to relate the trends of future networking and leads the third wave of the IT industry revolution. In this paper, first introduces some background and related technologies of IoT. Later the challenges and key scientific problems involved in IoT development are implemented for future research directions.

### **Unit-wise Syllabus**

| Unit     | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No. of Hours |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I   | <p>Internet of Things overview History of IoT:<br/>Evolution of Internet, IoT for the general world, IoT for technology professionals, Tools and techniques needed for IoT, Embedded Systems, Manufacturing 4.0(IIoT), Application of IoT: Agriculture, Smart City and Automobile.</p> <p>Open source and hardware<br/>Different open source and hardware, Arduino, Raspberry Pi, Beaglebone, Intel Galileo, ESP8266</p>                                                                                                                                                                                                                                                                  | 12           |
| Unit II  | <p><b>Setting up first Raspberry Pi and Communication</b></p> <p><b>Protocols Setting of IoT</b></p> <p><b>Hands on Practice:</b><br/>Installing Raspbian in SD card, Making essential connections, Booting up the Raspberry Pi</p> <p>Running simple programs, Programming and Interfacing LED with Raspberry Pi, Interfacing Sensor with Raspberry Pi and analyzing the data</p> <p><b>Overview of Communication protocols used in IoT:</b><br/>Bluetooth, WiFi, Zigbee ,Xbee, NFC, LoRaWAN</p>                                                                                                                                                                                         | 12           |
| Unit III | <p>Advance technologies and application layer protocols:<br/><b>Technologies used to build IoT:</b><br/>IPv6, Sensor networks, Cloud computing, M2M, Wearables, Complex Event Processing (CEP)<br/><b>Application layer protocols for IoT (Overview and detailed discussion on MQTT)</b> HTTP, MQTT, HTTP v/s MQTT, Quality of Service, Retain Flag, CoAP, XMPP, AMQP <b>Hands on Practice:</b><br/>Writing a Python Code for MQTT Publishing Client</p> <p>Publishing sensor data from Raspberry Pi using MQTT analyzing data on Smartphone Writing a Python Code for MQTT Subscribing Client<br/>Controlling devices/appliances connected to Raspberry Pi over MQTT from Smartphone</p> | 12           |
| Unit IV  | <p>IoT Cloud Services AWS IoT :<br/>Understanding AWS IoT Architecture and components, AWS IoT Device registry, policy and security certificates<br/>Hands on Practice- registering a device, creating security certificates and building policy for device<br/>Hands on Practice on Sensors:<br/>Connecting Raspberry Pi to Publish sensor data to AWS IoT IBM Watson IoT Overview<br/>Microsoft Azure IoT Overview</p>                                                                                                                                                                                                                                                                  | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                      | No. of Hours |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Integrating different services of AWS to our existing module.<br>Applying Rule based SQL Query to sensor based data to trigger another service on AWS                                                                                                                                                                                                                                                       |              |
| Unit V             | Security in IoT Hardware Security:<br>Challenges in maintaining sensor devices, monitoring and upgrading the resources. System enhancement with new features.<br>Software and Data Security:<br>Security level in preserving data, Maintaining and monitoring the data.<br>Enhancement of data size and sorting the data required.<br>Project Guideline:<br><br>Project Plan and approach for IoT projects. | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                             | <b>60</b>    |

## REFERENCES:

- The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World
- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

## **BLUEPRINT**

Code number: **CSDE9323**

Title of the paper: **Cloud Computing & Information Storage**

| Chapter                                                            | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|--------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|
| Unit I                                                             | 12              | <b>8</b>                                                                           |
| Unit II                                                            | 12              | <b>8</b>                                                                           |
| Unit III                                                           | 12              | <b>10</b>                                                                          |
| Unit IV                                                            | 12              | <b>20</b>                                                                          |
| Unit V                                                             | 12              | <b>20</b>                                                                          |
| <b>TOTAL</b>                                                       | <b>60</b>       | <b>68</b>                                                                          |
| <b>Maximum marks for the paper (Excluding bonus question) = 50</b> |                 |                                                                                    |

|                             |                                                             |
|-----------------------------|-------------------------------------------------------------|
| <b>Semester</b>             | <b>III</b>                                                  |
| <b>Paper Code</b>           | <b>CSDE9423</b>                                             |
| <b>Paper Title</b>          | <b>Cloud Computing &amp; Information Storage Management</b> |
| <b>Hours per Week</b>       | <b>4</b>                                                    |
| <b>Total Teaching Hours</b> | <b>60</b>                                                   |
| <b>Credits</b>              | <b>4</b>                                                    |

### Course Objectives:

- The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure.
- Overview of cloud computing, cloud systems, Cloud Service Administration, Accessing the Cloud parallel processing in the cloud, distributed storage systems, virtualization, cloud standards, and Migrating to the Cloud.
- Knowledge about the state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

### Unit-wise Syllabus

| Unit     | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No. of Hours |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I   | <b>Introduction</b><br>Evolution of Cloud Computing, Cloud Essentials, Business and IT Perspectives, Cloud Computing Definition, The vision of Cloud Computing, Characteristics of Cloud Computing, Paradigm Shift, Benefits of Cloud Computing, Advantages and Disadvantages of Cloud Computing, Cloud Components, Historical developments: Distributed systems, Virtualization, Web 2.0, Service oriented computing, Utility computing. Building Cloud Computing Environments: Application development, Infrastructure and system development, Computing platforms and technologies, Cloud Consumers and Cloud Providers, Horizontal Scaling, Vertical Scaling, Cloud Service, Cloud Service Consumer. | 12           |
| Unit II  | Cloud Computing Architecture: Introduction, The Cloud Computing Reference Model, Types of Cloud services: Software as a Service, Platform as a Service, Infrastructure as a Service. Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Economics of the Cloud, Open challenges, Virtualization and Cloud Computing, Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors                                                                                                                                                                                                                                                   | 12           |
| Unit III | Information Storage in Cloud Computing: Cloud Storage : Cloud Storage Concepts, Storage as a Service, Cloud Storage Device, Cloud Storage Levels, Network Storage Interfaces , Object Storage Interfaces, Database Storage Interfaces, Relational Data Storage, Non-Relational Data Storage, Working with Cloud-Based Storage, Cloud storage in the Digital Universe, Provisioning Cloud Storage, Creating Cloud Storage Systems, Virtual Storage Containers, Exploring                                                                                                                                                                                                                                  | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                                                                          | No. of Hours |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Cloud Backup Solutions, Cloud Storage Interoperability, Cloud Storage Providers : Amazon S3, Nirvanix, Google Bigtable Datastore, MobileMe Live Mesh                                                                                                                                                                                                                                                                            |              |
| Unit IV            | Cloud Security: Cloud Security Challenges, Cloud Data Security, Network security, Host Security, Risk Tolerance in Cloud, Threat Agents, Cloud Security Threats, Cloud Security Mechanics<br>: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images, Disaster Recovery Planning, Disaster Management. | 12           |
| Unit V             | Cloud Platforms in Industry — Amazon Web Services: Compute, Storage, Communication & Additional Services. Google AppEngine: Architecture, Core Concepts, Application Life Cycle, Cost Model. Microsoft Azure: Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Self-Study: Cloud Applications — Scientific, Business, Social Networking, Media, Online Gaming.                                                 | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>60</b>    |

### Self-Study

**Cloud Applications:** Scientific Applications, Business and Consumer Applications, Social Networking, Media Applications, Multiplayer Online Gaming.

#### References

Rajkumar Buyya , James Broberg , Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, 2011, willey

Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw Hill Edition, Fourth Reprint, 2010

Barrie Sosinsky (2011) Cloud Computing Bible, Wiley, India

Thomas Erl, Zaigham Mahmood, and Ricardo Puttini,” Cloud Computing Concepts, Technology & Architecture”, PRENTICE HALL, 2013

Bloor R., Kanfman M., Halper F. Judith Hurwitz “Cloud Computing for Dummies”, Wiley India Edition,2010

John Rittinghouse & James Ransome, “Cloud Computing Implementation .

### **BLUEPRINT**

Code number: **CSDE9423**

Title of the paper: **Cloud Computing & Information Storage**

| Chapter | Number of Hours | Total marks for which the questions are to be asked<br>(including bonus questions) |
|---------|-----------------|------------------------------------------------------------------------------------|
|---------|-----------------|------------------------------------------------------------------------------------|

|                                                                   |           |           |
|-------------------------------------------------------------------|-----------|-----------|
| Unit I                                                            | 12        | 8         |
| Unit II                                                           | 12        | 8         |
| Unit III                                                          | 12        | 10        |
| Unit IV                                                           | 12        | 20        |
| Unit V                                                            | 12        | 20        |
| <b>TOTAL</b>                                                      | <b>60</b> | <b>68</b> |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |           |           |

**TITLE : MOBILE APPLICATION LAB**

**CODE : MCS3P1**

**Hours / Week: 3 Hrs**

**Credits: 3**

**List of programs**

1. Design an activity that contains user id and password.
2. Creating an Application that displays message based on the screen orientation.
3. Create an application that displays custom designed Opening Screen.
4. Create menu in Application.
5. Play an audio, based on the user event.
6. Read/ write the Local data.
7. Display Map based on the Current location.
8. Create / Read / Write data with database (SQLite).
9. Hello world – windows app
10. Design a Lock Screen in the existing app. Learn to deploy both android Mobile Applications window application ( Any 3 programs).
11. Develop an application that uses GUI components, Font and Colours
12. Develop an application that uses Layout Managers and event listeners.
13. Write an application that draws basic graphical primitives on the screen.

## **TITLE : DATABASE APPLICATION DEVELOPMENT LAB**

**CODE : MCS3P2**

**Hours / Week: 3 Hrs**

**Credits: 3**

### **List of programs**

#### **1. Task Management Application**

To develop a dedicated task management app that allows users to

- Create personal profiles,
- Log in to their accounts securely with a proper authentication process,
- Add multiple tasks within the app,
- Manage multiple task lists, and
- Mark tasks as completed.

#### **2. Railway System**

A railway system, which needs to model the following:

- Stations
- Tracks, connecting stations. All the tracks put together to form a graph.
- Trains, with an ID and a name
- Train schedules recording what time a train passes through each station on its route.
- For each train, for each station on its route, you store Time in, Timeout (same as time in if it does not stop), a sequence number so the stations in the route of a train can be ordered by sequence number.
- Passenger booking consisting of train, date, from-station, to station, coach, seat and passenger name.

#### **3. Blood Donation System**

- A system in which data of patient, data of donor, data of blood bank would be saved and will be interrelation with each other
- DATA OF PATIENT – Patient Name, Patient Id, Patient Blood Group, Patient Disease
- DATA OF DONOR – Donor Name, Donor Id, Donor Blood Group, Donor Medical report, Donor Address, Donor Contact number
- DATA OF BLOOD BANK – Blood Bank Name, Blood Bank Address, Blood bank Donor's name, Blood Bank Contact Number, Blood Bank Address

- Normalize the tables

#### 4. Salary Management System

- Employee list to be maintained having id, name, designation, experience
- Salary details having employee id, current salary
- Salary in hand details having employee id, CTC salary, PF deduction or any other deduction and net salary to be given and also maintain details of total savings of employee
- Salary increments to be given by next year if any depending upon constraints
- Deduction in monthly salary if any depending upon any discrepancy in work and amount to be deducted.

#### 5. College Timetable Manager

The timetable is needed to be scheduled in such a way that the number of different courses with a number of subjects in each, handled by a limited faculty provided with their slots and timings does not overlap.

- Admin Module  
Responsible for taking all the details of the faculty, course, subject, semester and how many hours a day the classes last. The admin generates the timetable according to all these factors.
- Faculty Module  
The faculty gives all of their details to the admin. In the case, at times the faculty could take a leave as well. In such a situation, the faculty is responsible to send the reason, date and on which period the leave is to be taken. The substitute faculty gets the request. The substitute faculty has the facility to either accept or reject the substitute hour. Then this is sent back to the faculty informing about the request. Accordingly, the timetable is modified.
- Time Table Generation Module  
In this module, time table generation is done by considering the maximum and minimum workload for each faculty. This will be generated by the admin and viewed by the faculty who are the users of this system.

#### 6. Develop a basic Chatbot with spreadsheet as a database for your chatbot.

#### 7. Develop any one database application of your choice.

|                                             |                                            |
|---------------------------------------------|--------------------------------------------|
| Semester                                    | III                                        |
| Paper Code                                  | <b>MCS9V123</b>                            |
| Paper Title                                 | <b>Seminar and Comprehensive Viva Voce</b> |
| Number of teaching hours per week           | 4                                          |
| Total number of teaching hours per semester | 60                                         |
| Number of credits                           | 4                                          |

### **Course Objectives:**

1. The objective of comprehensive viva-voce is to assess the overall knowledge of the students' in the relevant field of MSc Computer Science have been acquired over three semesters of study in the postgraduate program.
2. The key objective of this course is to prepare students to face interviews both technical/non-technical and academic/industrial field's.
3. This course will also help students in comprehending their knowledge and refreshing fundamental concepts of all the papers what they have studied in the previous semesters.
4. The students are advised to apply their own intellectual ability in preparing the research article on any one of the current trends in the field of Computer Science.

### **Course Outcomes:**

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

1. Improve their understanding of various topics learnt in previous semesters.
2. Recall and Refresh fundamental concepts which they learn in various topics.
3. Enhance their interview facing skills.
4. Identify a research topic, collect literature, Present seminar & discuss the queries.

**Contents:**

- The viva shall normally cover the subjects taught in all the previous semesters of MSc Programme
- There is a provision of 50 marks seminar in which students have to give a presentation. In place of seminar, it is decided that, students can prepare a Research Article on any one of the topics from recent trends. They are requested to bring the file carrying research article on the same day, when they will come to give viva voce exam in the department.

**Examination :**

Every student will be required to undergo comprehensive viva voce at the end of 3<sup>rd</sup> semester of MSc Programme. The duration of the viva will range from 15-30 min. The examination committee will be constituted by the HOD and consist of at least three faculties.

**Assessment plan with Marks Distribution:**

- 50% weightage internal exam will be based on the research article.
- 50% weightage End semester exam will be based on Viva Voce.
  1. Viva Voce exam will be conducted in the form of an Interview.
  2. Minimum 2 faculty members will be forming the panel to assess candidate during their Viva voce exam.
  3. Minimum 10 questions need to be asked to a student during Viva Voce. Preferably those questions should be as per below given weightage (20 % Questions from recent trends in the industry + 20% Questions on Soft skills + 60 % Questions based on Domain knowledge.)
  4. Grading of the candidates can be done on basis of Rubrics. – 50 Marks

## SEMESTER-IV

|                             |                         |
|-----------------------------|-------------------------|
| <b>Semester</b>             | <b>IV</b>               |
| <b>Paper Code</b>           | <b>CS0122</b>           |
| <b>Paper Title</b>          | <b>Image Processing</b> |
| <b>Hours per Week</b>       | <b>4</b>                |
| <b>Total Teaching Hours</b> | <b>60</b>               |
| <b>Credits</b>              | <b>4</b>                |

### Course Objectives

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study image segmentation techniques
- To study feature extraction techniques
- To study the image compression procedures.

### Unit-wise Syllabus

| Unit     | Topics                                                                                                                                                                                                                                                                                                                                                                                                    | No. of Hours |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I   | Introduction: Fields Using Digital Image Processing, Fundamental Steps, Components of Image Processing Systems. Digital Image Fundamentals: Image Formation Model, Sampling & Quantization, Pixel Relationships. Digital Image Properties: Topological Properties, Histograms, Entropy, Eigen Values, Image Quality Metrics, Noise — Sources & Types.                                                     | 10           |
| Unit II  | Operations on Digital Images: Arithmetic Operations — Addition, Subtraction, Multiplication, Division. Logical Operations — NOT, OR, AND, XOR. Set Operators, Spatial Operations — Single Pixel, Neighborhood, Geometric. Contrast Stretching, Intensity Slicing, Bit-Plane Slicing, Power Law Transforms.                                                                                                | 10           |
| Unit III | Image Enhancement: Spatial & Frequency Domain, Histogram Processing, Spatial Filtering, Smoothing & Sharpening Spatial Filters, DFT, DCT, Haar Transform, Hough Transform, Frequency Filtering, Selective Filtering. Digital Image Restoration: Noise Models, Degradation Models, Image De-blurring, Restoration with Spatial Filtering, Frequency Domain Filtering, Inverse Filtering, Wiener Filtering. | 12           |
| Unit IV  | Image Segmentation: Discontinuity Detection, Edge Linking & Boundary Detection, Thresholding, Region-Oriented Segmentation, Histogram-Based Segmentation, Object Recognition Based on Shape Descriptors. Morphological Image Processing: Dilation & Erosion, Opening & Closing, Medial Axis Transforms, Skeletons, Thinning Boundaries.                                                                   | 14           |
| Unit V   | Feature Extraction: ROI Selection, Histogram-Based Features, Intensity Features, Color & Shape Features, Contour Extraction, Homogenous Region Extraction,                                                                                                                                                                                                                                                | 14           |

| Unit               | Topics                                                                                                                                                                                                                                                            | No. of Hours |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Texture Descriptors, PCA for Feature Selection. Image Coding & Compression: Lossless vs Lossy Compression, Huffman Coding, Bitplane Coding, Arithmetic Coding, Predictive Coding, Lossy Compression using 2D DCT, JPEG 2000 Standard, Baseline JPEG based on DWT. |              |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                   | <b>60</b>    |

## REFERENCES

- Digital Image Processing: Rafael C. Gonzales & Richard E. Woods
- Digital Image Processing and Analysis: B. Chanda, D. Muttu Majumder
- Digital Image Processing: Anil K Jain
- William K. Pratt, Digital Image Processing, John Wiley, 4th Edition, 2007
- Sonka, Fitzpatrick, "Medical Image Processing and Analysis", 1st Edition, SPIE, 2000

## **BLUEPRINT**

Code number: **CS0122**

Title of the paper: **IMAGE PROCESSING**

| Chapter                                                           | Number of Hours | Total marks for which the questions are to be asked (including bonus questions) |
|-------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------|
| <b>Unit I</b>                                                     | <b>10</b>       | <b>8</b>                                                                        |
| <b>Unit II</b>                                                    | <b>10</b>       | <b>8</b>                                                                        |
| <b>Unit III</b>                                                   | <b>12</b>       | <b>10</b>                                                                       |
| <b>Unit IV</b>                                                    | <b>14</b>       | <b>20</b>                                                                       |
| <b>Unit V</b>                                                     | <b>14</b>       | <b>20</b>                                                                       |
| <b>TOTAL</b>                                                      | <b>60</b>       | <b>68</b>                                                                       |
| <b>Maximum marks for the paper (Excluding bonus question)= 50</b> |                 |                                                                                 |

|                             |                                  |
|-----------------------------|----------------------------------|
| <b>Semester</b>             | <b>IV</b>                        |
| <b>Paper Code</b>           | <b>CS0222</b>                    |
| <b>Paper Title</b>          | <b>Advanced Operating System</b> |
| <b>Hours per Week</b>       | <b>4</b>                         |
| <b>Total Teaching Hours</b> | <b>60</b>                        |
| <b>Credits</b>              | <b>4</b>                         |

### Course Objectives

- To make the student understand with various function of Operating system.
- The knowledge of resources management of Operating system.
- The knowledge about various problems and solution is distributed system.
- The knowledge about fault tolerance.

### Unit-wise Syllabus

| Unit     | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | No. of Hours |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Unit I   | INTRODUCTION<br>Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating System - Synchronization Mechanisms – Concept of a Process, Concurrent Processes – The Critical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries – Models of Deadlocks, Resources, System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests, Consumable Resources, and Reusable Resources.                           | 12           |
| Unit II  | DISTRIBUTED OPERATING SYSTEMS<br>Introduction – Issues – Communication network and Primitives, – Theoretical Foundations: Inherent Limitations - Lamport's Logical Clock; Vector Clock; Causal Ordering; Global State; Cuts; Termination Detection. Distributed Mutual Exclusion Non-Token Based Algorithms – Lamport's Algorithm - Token-Based Algorithms Suzuki-Kasami's Broadcast Algorithm – Distributed Deadlock Detection – Issues Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols – Classification (two)- Solutions(two) – Applications. | 12           |
| Unit III | DISTRIBUTED RESOURCE MANAGEMENT<br>Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – Architecture – Algorithm(two) – Protocols - Design Issues.                                                                                                                                                                                                                                                                                                                                                                                                           | 12           |

| Unit               | Topics                                                                                                                                                                                                                                                                                                                                                                        | No. of Hours |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                    | Distributed Scheduling – Issues – Components(two) – Algorithms (two).                                                                                                                                                                                                                                                                                                         |              |
| Unit IV            | FAILURE RECOVERY AND FAULT TOLERANCE<br>Basic Concepts-Classification of Failures – Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Non blocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols. | 12           |
| Unit V             | <b>MULTIPROCESSOR AND DATABASE OPERATING SYSTEMS</b><br>Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling<br>Memory Management – Reliability / Fault Tolerance(two); Database Operating Systems – Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control Algorithms(two).                                | 12           |
| <b>Total Hours</b> |                                                                                                                                                                                                                                                                                                                                                                               | <b>60</b>    |

**Self Study** – Analysis of any open source operating system and study of algorithms in the chapters.

TEXTBOOKS :

- Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.
- Mukesh Singhal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw- Hill, 2001
- Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”, Sixth Edition, Addison Wesley Publishing Co., 2003.

**BLUEPRINT**

Code number: **CS0222**

Title of the paper: **ADVANCED OPERATING SYSTEM**

| <b>Chapter</b>                                                    | <b>Number of Hours</b> | <b>Total marks for which the questions are to be asked (including bonus questions)</b> |
|-------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------|
| <b>Unit I</b>                                                     | <b>12</b>              | <b>8</b>                                                                               |
| <b>Unit II</b>                                                    | <b>12</b>              | <b>8</b>                                                                               |
| <b>Unit III</b>                                                   | <b>12</b>              | <b>10</b>                                                                              |
| <b>Unit IV</b>                                                    | <b>12</b>              | <b>20</b>                                                                              |
| <b>Unit V</b>                                                     | <b>12</b>              | <b>20</b>                                                                              |
| <b>TOTAL</b>                                                      | <b>60</b>              | <b>68</b>                                                                              |
| <b>Maximum marks for the paper (Excluding bonus question)= 70</b> |                        |                                                                                        |

|                             |                                   |
|-----------------------------|-----------------------------------|
| <b>Semester</b>             | <b>IV</b>                         |
| <b>Paper Code</b>           | <b>MCS4P1</b>                     |
| <b>Paper Title</b>          | <b>Major Project / Internship</b> |
| <b>Hours per Week</b>       | <b>24</b>                         |
| <b>Total Teaching Hours</b> | <b>60</b>                         |
| <b>Credits</b>              | <b>12</b>                         |

- The students should choose a Major Project/ Internship at the beginning of the semester with the approval of the HOD.
- The students will be evaluated by the lab in-charge on a weekly basis.
- The questions can be designed with real time application in mind.
- At the end the students should submit a documentation and prepare a presentation to explain the work that has been done.