

ST. JOSEPH'S UNIVERSITY

BENGALURU-27



ST. JOSEPH'S INSTITUTE OF INFORMATION TECHNOLOGY

**DEPARTMENT OF COMPUTER SCIENCE AND
APPLICATIONS**

SYLLABUS FOR POSTGRADUATE PROGRAMME

M.Sc. (COMPUTER SCIENCE)

M.Sc. PROGRAM OBJECTIVES

- Provide high quality training to the students through the latest computer technology.
- To trigger their mind in the field of project, provide an ambiance of learning, inculcate interdisciplinary approach in project and in working environment.
- To enable the students to develop their team building and communication skills with the professional approach.

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

CO1	Knowledge	Have acquired a fair knowledge of Software development and various computer Advanced concepts are being in use.
CO2	Understand	Have developed a fair amount of understanding on Advanced concepts and skills to approach to develop a project on his/her own.
CO2	Apply	Be able to implement s/w tools and techniques especially open sources to resolve the interdisciplinary problems.
CO3	Analyze	Be able to compare and relate the techniques to provide required results.
CO4	Evaluate	Be able to select optimal solution to solve the problems.
CO5	Create	Be able to develop complete real-world project applicable to present situation in various entities.

SUMMARY OF CREDITS

FIRST SEMESTER

THEORY						
Code	Title	Hours Per Week	Credits	IA	SE	Total
CS7121	Object Oriented Programming using JAVA	4	4	50	50	100
CS7221	Theory of Computation	4	4	50	50	100
CS7321	Design and Analysis of Algorithms	4	4	50	50	100
CS7421	Cyber Security	4	4	50	50	100
PRACTICAL						
MCS1P1	Object Oriented Programming JAVA Lab	6	3	25	25	50
MCS1P2	Design and Analysis of 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
CS9122	Data Analytics with HADOOP	4	4	50	50	100
CS9222	Mobile Communication and Applications	4	4	50	50	100
Department Elective (One of the two)						
CSDE9322	1) Internet of Things	4	4	50	50	100
CSDE9422	2) Cloud Computing and Information Storage Management	4	4	50	50	100
CS9522	Seminar and Comprehensive Viva Voce	4	4	25	25	50
PRACTICAL						
MCS3P1	Mobile Applications Lab	6	3	25	25	50
MCS3P2	Database Applications Development Lab	6	3	25	25	50

Total Number of Credits: 20

FOURTH SEMESTER

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

Total Number of Credits: 2

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

CORE COURSES (CC)	
Course Title	Code Number
Object Oriented Programming using JAVA	CS7121
Theory of Computation	CS7221
Design and Analysis of Algorithms	CS7321
Cyber Security	CS7421
Advanced Database Management System	CS8121
Machine Learning with Python	CS8221
Advanced Web Technologies	CS8321
Principles of Compiler Design	CS8421
Software Project Management	CS8521
Data Analytics with HADOOP	CS9122
Mobile Communication and Applications	CS9222
Seminar and Comprehensive Viva Voce	CS9522
Image Processing	CS0122
Advanced Operating System	CS0222

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)	
Course Title	Code Number
1) Internet of Things	CSDE9322
2) Cloud Computing and Information Storage Management	CSDE9422

SKILL ENHANCEMENT COURSE (SEC)	
Course Title	Code Number
Object Oriented Programming JAVA Lab	MCS1P1
Design and Analysis of Algorithm Lab	MCS1P2
ML with Python lab	MCS2P1
Advanced Web Technologies &ADBMS Lab	MCS2P2
Mobile Applications Lab	MCS3P1
Database Applications Development Lab	MCS3P2
Major Project /Internship	MCS4P1

SYLLABUS

SEMESTER-I

Semester	I
Paper Code	CS7121
Paper Title	Object Oriented Programming Using Java
Hours per Week	4
Total Teaching Hours	60
Credits	4

Course 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	Introduction to OOP and Classes: OOP Principles, Evolution of Java, Declaring Objects, Introducing Methods, Overloading Methods, Constructors, Parameterized Constructors, this Keyword, Garbage Collection, finalize() Method, Access Control, static Keyword, Nested & Inner Classes, String Class, StringBuffer Class, Command Line Arguments.	12
Unit II	Inheritance in Java: 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	Multithreading: 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	GUI Programming with Swing: 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	Database Programming using JDBC: 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
Total Hours		60

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 (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	66
Maximum marks for the paper (Excluding bonus question) = 50		

Practical I

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

Semester	I
Paper Code	CS7221
Paper Title	Theory of Computation
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	Set Theory Concepts & Automata Theory: Introductory Set Theory (2 Hrs). Finite Automata: Alphabets, Strings, Languages, Sentences, Transition Functions, Extended Transition Functions, Notations (6 Hrs). Deterministic & Non-Deterministic Automata, Mealy and Moore Machines (6 Hrs).	14
Unit II	Finite Automata Problem Solving & Regular Expressions: DFA/NFA Problem Solving, NFA to DFA Conversion, Epsilon-NFA, Epsilon-NFA to DFA Conversion, DFA Minimization (8 Hrs). Regular Expressions: Introduction & Applications (2 Hrs). Regular Languages: Closure & Decidable Properties (2 Hrs).	12
Unit III	Context Free Grammar: CFG Introduction, Chomsky Hierarchy, Derivation Trees, Ambiguity (4 Hrs). CNF & GNF: Eliminating Useless Symbols, Epsilon & Unit Productions, Conversion to CNF and GNF (8 Hrs). CFL: Pumping Lemma, Closure Properties (2 Hrs).	14
Unit IV	Pushdown Automata (PDA) & Applications: Definition, 7-tuple of PDA, Deterministic/Nondeterministic PDAs, Instantaneous Descriptions, Language Acceptance by Final States and Empty Stack, PDA Problems.	10
Unit V	Computability Theory: Turing Machines — Programming Techniques, Extensions, TM & Computers (6 Hrs). Decidability & Halting Problems (2 Hrs). Reducibility: Undecidable Problems, Simple Undecidable Problems, Mapping Reducibility (2 Hrs).	10
Total Hours		60

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: CS7218

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
TOTAL	60	66
Maximum marks for the paper (Excluding bonus question)= 50		

Semester	I
Paper Code	CS7321
Paper Title	Design and Analysis of Algorithms
Hours per Week	4
Total Teaching Hours	60
Credits	4

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
Total Hours		60

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 (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	66
Maximum marks for the paper (Excluding bonus question)= 50		

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.

Semester	I
Paper Code	CS7421
Paper Title	Cyber Security
Hours per Week	4
Total Teaching Hours	60
Credits	4

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: Security Concepts, Approaches & Principles, Types of Attacks, Intruders, IDS & IPS, Message Authentication, Digital Signatures, Applications of Cryptography. Firewalls: Types, User Management, VPN. Security Protocols: PGP, S/MIME, SSL, TLS, IPSec.	14
Unit III	Introduction to Cyber Security: Overview, Security Fundamentals (Authentication, Authorization, Accountability), Social Media & Cyber Security. Cyber Attacks: Virus, Worms, Trojan Horse, Phishing, Pharming, Denial of Service, SYN Flood,	12

Unit	Topics	No. of Hours
	Server Hardening.	
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
Total Hours		60

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.
- Dan Shoemaker and Wm. Arthur Conklin, Cyber security: The Essential Body Of Knowledge, Delmar Cengage Learning; 1 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 (including bonus questions)
Unit I	12	8
Unit II	14	8
Unit III	12	10
Unit IV	10	20
Unit V	12	20
TOTAL	60	66
Maximum marks for the paper (Excluding bonus question) = 50		

SEMESTER-II

Semester	II
Paper Code	CS8121
Paper Title	Advanced Database Management Systems
Hours per Week	4
Total Teaching Hours	60
Credits	4

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 (5 Hrs). Query Processing & Optimization: General Strategies, Algebraic Manipulation, Optimizing Relational Expressions (5 Hrs). Hands-on Practice: SQL Commands with various entities (2 Hrs).	12
Unit II	Transaction Processing & Concurrency Control: ACID Properties, Transaction Recovery, Lock-Based/Optimistic/Timestamp-Based Concurrency Control, Deadlocks (6 Hrs). Database Security: Control Measures — Discretionary, Mandatory, Role-Based (2 Hrs). Database Recovery: Deferred/Immediate Update, Shadow Paging, ARIES (2 Hrs). Hands-on Practice (2 Hrs).	12
Unit III	Parallel Databases: I/O Parallelism, Inter/Intra Query & Operation Parallelism, Design of Parallel Systems (5 Hrs). Distributed Database Concepts: Distributed Storage, Transactions, Commit Protocols, Concurrency Control, Distributed Query Processing (5 Hrs). Case Study (2 Hrs).	12
Unit IV	Data Warehouse Fundamentals: OLTP Systems, Differences from Data Warehouses, Characteristics, Functionality, Advantages & Applications (6 Hrs). Methodology: Top-Down & Bottom-Up Development, Tools, Data Warehouse Types (6 Hrs).	12
Unit V	Data Warehouse Architecture: Components, Dimensional Modeling, E-R vs Dimensional Modeling (4 Hrs). Schemas: Star Schema, Snowflake Schema, Fact Constellation Schema (4 Hrs). OLAP: Introduction, Characteristics, OLAP Creation Process, Multidimensional Data (4 Hrs). OLAP Architectures: MOLAP, ROLAP, HOLAP, Hypercubes & Multi-cubes (4 Hrs). Self Study: ER Modeling, Dimensional Model with Examples (6 Hrs).	12
Total Hours		60

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: **CS8121**

Title of the paper: **Advanced Database Management Systems**

Chapter	Number of Hours	Total marks for which the question 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	66
Maximum marks for the paper (Excluding bonus questions) = 50		

Semester	II
Paper Code	CS8221
Paper Title	Machine Learning with Python
Hours per Week	4
Total Teaching Hours	60
Credits	4

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
Total Hours		60

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: **CS8221**

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

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
10	10	8
12	12	8
12	12	10
16	16	20
16	16	20
66	66	66
Maximum marks for the paper (Excluding bonus question)= 50		

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.

Semester	II
Paper Code	CS8321
Paper Title	Advanced Web Technologies
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	HTML & CSS: Basic Syntax, Structure, Text Markup, Images, Hyperlinks, Lists, Tables, Forms, Frames (3 Hrs). CSS: Introduction, Style Syntax, Types, Selectors, Font/List/Color Properties, Box Model, Background Images (4 Hrs). JavaScript Basics: Overview, OOP in JS, Data Types, Operators, Control Statements, Arrays, Strings, DOM, Events (5 Hrs).	12
Unit II	ES6: Module System, Classes, Variable Declaration, Arrow Functions, Template Strings (1 Hr). TypeScript: Type Safety, Interfaces, Decorators (2 Hrs). Angular CLI & Project Structure: Bootstrapping, Component Architecture, Root Module (3 Hrs). Angular Components: Definition, Types, Template Syntax, Data/Property/Event Binding, Directives, Pipes, Inputs/Outputs, Component Styles (3 Hrs). Advanced Components: Data Projection, Wrapper Components, Dynamic Components (3 Hrs).	12
Unit III	Providers & Dependency Injection: Role of Provider, Injector Tree, Class Provider, Provider Strategies (4 Hrs). Observables & RxJS: Subscriptions, RxJS Operators, Subjects and Observables (2 Hrs). HttpClient: HTTP Requests (GET, PUT, POST), Headers, Interceptors, Progress Events (3 Hrs). Angular Router: Setup, Navigation, Child Routes, Routing Params, Lazy Loading, Guards (3 Hrs).	12

Unit	Topics	No. of Hours
Unit IV	Angular Modules: Root vs Feature Module, Module Configuration (3 Hrs). Directives & Pipes: Built-in Directives, Custom Directives, Built-in Pipes, Custom Pipes, Angular Forms (3 Hrs). Template-Driven & Reactive Forms: Form Builder, Validation, Custom & Async Validators (3 Hrs). State Management with NgRx: Redux Architecture, NgRx Store, Actions & Reducers, Middleware, Effects and Facades (3 Hrs).	12
Unit V	ASP.NET Core: Introduction to REST & HTTP, Designing API & URI, Status Codes, GET for Collections (4 Hrs). Query Strings & Data Modification: POST, PUT & DELETE, Front-End & Back-End Integration (4 Hrs). Firebase: Overview, Environment Setup, Data Operations — Write, Read, Queries, Event Types, Callbacks (4 Hrs). (Self Study: 6 hours.)	12
Total Hours		60

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: **CS8321**

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

Chapter	Number of Hours	Total marks for which the question 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	66
Maximum marks for the paper (Excluding bonus questions) = 50		

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

Semester	II
Paper Code	CS8421
Paper Title	Principles of Compiler Design
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	Introduction to Compilers: Analysis of Source Program, Phases of Compiler, Simple One-Pass Compiler. Lexical Analysis: Removal of Whitespace & Comments, Constants, Recognizing Identifiers & Keywords, Input Buffering, Specification of Tokens, Recognition of Tokens, Introduction to LEX.	12
Unit II	Symbol Tables: Entries, List Data Structures, Hash Tables, Scope Information. Syntax Analysis: Role of Parser, Context Free Grammar, Writing a Grammar. Top-Down Parsing: Brute Force, Recursive Descent, LL(1). Bottom-Up Parsing: Shift-Reduce, Operator Precedence, LR Parsers.	12
Unit III	Syntax-Directed Definitions: Syntax Tree Construction, S-Attributed Definitions, L-Attributed Definitions, Top-Down Translation. Type Checking: Type Systems, Simple Type Checker. Error Recovery: Detection & Recovery, Ad-Hoc & Systematic Methods, Syntax Analyzer Error Handling, Introduction to YACC.	12
Unit IV	Run-Time Environment: Source Language Issues, Storage Organization, Storage Location Strategies. Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements. Code Optimization: Global Data Flow Analysis, Common Sub-Expression Removal, Loop Invariant Code Motion, Strength Reduction.	12
Unit V	Code Generation: 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
Total Hours		60

REFERENCES:

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

BLUEPRINT

Code number: **CS8421**

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

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	66
Maximum marks for the paper (Excluding bonus question)= 50		

Semester	II
Paper Code	CS8521
Paper Title	Software Project Management
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	Introduction to SPM: Software Projects vs Other Projects, Contract Management, Technical Project Management, Plans, Methods & Methodologies, Categorizing Software Projects, Setting Objectives, Stakeholders, Business Case, Requirement Specification, Management Control. Project Planning: Steps in Project Planning.	12
Unit	Selection of Appropriate Project Approach: Choosing Technologies,	12

Unit	Topics	No. of Hours
II	Technical Plan Contents. Process Models: Waterfall, V-Process, Spiral, Software Prototyping, Incremental Delivery, Agile (DSDM, Scrum, XP), Managing Iterative Processes, Selecting Appropriate Process Model.	
Unit III	Software Effort Estimation: Top-Down & Bottom-Up Estimation, Albrecht Function Point Analysis, Expert Judgment, Staffing Pattern. Activity Planning: Project Schedules, Sequencing & Scheduling Activities, Network Planning Models, Forward/Backward Pass, Critical Path, Activity Float, Activity-on-Arrow Networks.	12
Unit IV	Risk Management: Nature & Types of Risk, Managing Risk, Hazard Identification & Analysis, Risk Planning & Control, Evaluating Risks. Resource Allocation: Nature of Resources, Identifying Requirements, Scheduling Resources, Creating Critical Paths, Counting Cost, Publishing Resource Schedule.	12
Unit V	Managing People & Organizing Teams: Organizational Behavior, Selecting the Right Person, Motivation, Working in Groups, Decision Making, Leadership, Organizational Structures, Stress, Health & Safety. Software Quality: ISO 9126, Practical Quality Measures, Techniques to Enhance Quality, Quality Plans. (Self Study: COCOMO Model, Case Study on Project Planning.)	12
Total Hours		60

REFERENCES

- Hughes, Bob and Cotterell, Mike, Software project Management, 4th Edition, TMH.
- Kathy Schwalbe, Information Technology Project Management, VikasPublishingHouse.
- 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 (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	66
Maximum marks for the paper (Excluding bonus question) = 50		

SEMESTER-III

Semester	III
Paper Code	CS9122
Paper Title	Data Analytics with HADOOP
Hours per Week	4
Total Teaching Hours	60
Credits	4

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

Unit	Topics	No. of Hours
Unit I	Introduction to Big Data: Big Data Platform Challenges, Web Data, Evolution of Analytic Scalability, Analytic Processes & Tools, Analysis vs Reporting, Modern Data Analytic Tools.	12
Unit II	Data Analysis: Regression Modeling, Multivariate Analysis, Bayesian Modeling, Inference & Bayesian Networks, Support Vector & Kernel Methods, Time Series Analysis, Linear Systems, Nonlinear Dynamics, Rule Induction, Neural Networks — Learning & Generalization, Competitive Learning.	12
Unit III	Frequent Itemsets & Clustering: Mining Frequent Itemsets, Market-Based Model, Apriori Algorithm, Handling Large Data Sets, Limited Pass Algorithm, Counting Frequent Itemsets in a Stream. Clustering Techniques: Hierarchical, K-Means, Clustering High Dimensional Data, CLIQUE, PROCLUS, Frequent Pattern Based Clustering.	12
Unit IV	Hadoop & MapReduce: Hadoop Fundamentals, HDFS — Design, Concepts, Blocks, Name Nodes, Data Nodes, Block Caching, HDFS Federation, High Availability. MapReduce: Data Format, Analyzing Data with Hadoop, Scaling Out, Anatomy of a MapReduce Job Run, Failures, Shuffle and Sort.	12
Unit V	Pig Environment: Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, Pig Latin — Structure, Statements, Expressions, Types, Schemas, Functions, Macros. Hive: Installing Hive, Hive Shell, Running Hive, Configuring Hive, Hive Services, Meta Store, Schema on Read vs Write, Updates, Transactions, Indexes.	12
Total Hours		60

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: **CS9122**

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

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	12	14
Unit II	12	20
Unit III	12	20
Unit IV	12	16
Unit V	12	10
TOTAL	60	80
Maximum marks for the paper (Excluding bonus question)= 70		

Semester	III
Paper Code	CSDE9322
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	IoT Overview & History: Evolution of Internet, IoT for General World & Technology Professionals, Tools & Techniques, Embedded Systems, Manufacturing 4.0 (IIoT), IoT Applications — Agriculture, Smart City, Automobile. Open Source Hardware: Arduino, Raspberry Pi, Beaglebone, Intel Galileo, ESP8266.	12
Unit II	Raspberry Pi Setup & Communication Protocols: Installing Raspbian, Connections, Booting, Running Programs, Interfacing LED & Sensors with Raspberry Pi. Communication Protocols: Bluetooth, WiFi, Zigbee, Xbee, NFC, LoRaWAN.	12
Unit III	Advanced Technologies & Application Layer Protocols: IPv6, Sensor Networks, Cloud Computing, M2M, Wearables, CEP. Application Layer Protocols: HTTP, MQTT, CoAP, XMPP, AMQP. Hands-on: MQTT Publishing & Subscribing Clients, Controlling Devices over MQTT from Smartphone.	12
Unit IV	IoT Cloud Services: AWS IoT Architecture, Device Registry, Policy & Security Certificates. Hands-on: Registering Devices, Security Certificates, Building Device Policy. Connecting Raspberry Pi to AWS IoT. IBM Watson IoT Overview, Microsoft Azure IoT Overview, Integrating AWS Services, Rule-Based SQL Query on Sensor Data.	12
Unit V	Security in IoT — Hardware Security: Challenges in Maintaining Sensor Devices, Monitoring & Upgrading Resources. Software & Data Security: Data Preservation, Monitoring & Maintenance, Enhancement of Data Handling. Project Guideline: Project Plan and Approach for IoT Projects.	12
Total Hours		60

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.

BLUEPRINTCode number: **CSDE9322**Title of the paper: **Cloud Computing & Information Storage**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	12	14
Unit II	12	20
Unit III	12	20
Unit IV	12	16
Unit V	12	10
TOTAL	60	80
Maximum marks for the paper (Excluding bonus question) = 70		

Semester	III
Paper Code	CSDE9422
Paper Title	Cloud Computing & Information Storage Management
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	Introduction: Evolution of Cloud Computing, Cloud Essentials, Business & IT Perspectives, Cloud Definition, Vision, Characteristics, Paradigm Shift, Advantages & Disadvantages. Historical Developments: Distributed Systems, Virtualization, Web 2.0, SOC, Utility Computing. Building Cloud Environments: Application Development, Infrastructure & System Development, Cloud Consumers & Providers, Horizontal/Vertical Scaling.	12
Unit II	Cloud Computing Architecture: Cloud Computing Reference Model, Types of Cloud Services — SaaS, PaaS, IaaS. Cloud Deployment Models: Public, Private, Hybrid, Community Cloud, Economics of the Cloud. Virtualization: Using Virtualization Technologies, Load Balancing, Understanding Hypervisors.	12
Unit III	Information Storage in Cloud Computing: Cloud Storage Concepts, Storage as a Service, Cloud Storage Device & Levels, Network/Object/Database Storage Interfaces, Relational & Non-Relational Data Storage, Cloud-Based Storage, Provisioning, Creating Cloud Storage Systems, Backup Solutions, Storage Interoperability, Cloud Storage Providers — Amazon S3, Nirvanix, Google Bigtable, MobileMe.	12
Unit	Cloud Security: Security Challenges, Cloud Data Security, Network & Host	12

Unit	Topics	No. of Hours
IV	Security, Risk Tolerance, Threat Agents, Cloud Security Threats. Security Mechanics: Encryption, Hashing, Digital Signature, PKI, Identity & Access Management, Single Sign-On, Security Groups, Hardened Virtual Server Images, Disaster Recovery & Management.	
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
Total Hours		60

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: **CSDE9422**

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

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	12	14

Unit II	12	20
Unit III	12	20
Unit IV	12	16
Unit V	12	10
TOTAL	60	80
Maximum marks for the paper (Excluding bonus question)= 70		

Semester	III
Paper Code	CS5222
Paper Title	Seminar and Comprehensive Viva Voce
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 3rd 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

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-IV

Semester	IV
Paper Code	CS0122
Paper Title	Image Processing
Hours per Week	4
Total Teaching Hours	60
Credits	4

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.	
Total Hours		60

REFERENCES

- Digital Image Processing: Rafael C. Gonzaleze & Richard E. Woods
- Digital Image Processing and Analysis: B. Chanda, D. Mutta 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)
Unit I	10	14
Unit II	10	16
Unit III	12	20
Unit IV	14	20
Unit V	14	20
TOTAL	60	80
Maximum marks for the paper (Excluding bonus question)= 70		

Semester	IV
Paper Code	CS0222
Paper Title	Advanced Operating System
Hours per Week	4
Total Teaching Hours	60
Credits	4

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	Process Management: Advanced Process Concepts, Inter-Process Communication, Synchronization Mechanisms, Deadlock Detection, Prevention & Recovery.	12
Unit II	Memory Management: Virtual Memory, Paging & Segmentation, Demand Paging, Page Replacement Algorithms, Working Set Model, Memory Mapped Files.	12
Unit III	File Systems & Storage: File System Implementation, Directory Structures, File System Mounting, File Sharing, Protection. Storage Structures: Disk Structure, Scheduling, RAID Levels.	12
Unit IV	Distributed Systems: Distributed System Architecture, Communication, Synchronization, Consistency & Replication, Fault Tolerance, Distributed File Systems.	12
Unit V	Security & Real-Time Systems: OS Security Goals, Threats, Cryptography in OS, Security Mechanisms. Real-Time OS: Real-Time Scheduling, Priority-Based Scheduling, Multimedia & OS.	12
Total Hours		60

BLUEPRINT

Code number: **CS0222**

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

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	12	14
Unit II	12	20
Unit III	12	20
Unit IV	12	16
Unit V	12	10
TOTAL	60	80
Maximum marks for the paper (Excluding bonus question)= 70		

Semester	IV
Paper Code	MCS4P1
Paper Title	Major Project / Internship
Hours per Week	24
Total Teaching Hours	60
Credits	12

- 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.