ANDHRA PRADESH STATE COUNCIL FOR HIGHER EDUCATION
FOUR YEAR B.SC. (HONS) SYLLABUS UNDER CBCS W.E.F. 2020-2021

DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

S.No.	Semester (Paper No.)	Title	Hours (Theory + Practical)	Credits	Internal Marks (IA + Field Work)	Semester End Examination
Semester VII Higher Order Thinking Courses						
1	VII (701)	Mathematical Foundations in Computer Science	4 + 2	4 + 1	25	75
2	VII (702)	Computer Organization and Architecture	4 + 2	4 + 1	25	75
3	VII (703)	Data Communications and Computer Networks	4 + 2	4 + 1	25	75
4	VII (704)	Object Oriented Software Engineering	4 + 2	4 + 1	25	75
5	VII (705)	Artificial Intelligence	4 + 2	4 + 1	25	75
6	VII (706)	Principles of Machine Learning	4 + 2	4 + 1	25	75
Semester VII Skill Based Courses						
7	VII (707)	MEAN Stack Development	4 + 2	4 + 1	25	75
8	VII (708)	Advanced Java Programming	4 + 2	4 + 1	25	75
9	VII (709)	IoT Applications Development and Programming	4 + 2	4 + 1	25	75
10	VII (710)	Mobile Application Development	4 + 2	4 + 1	25	75

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-HOTC-701	Mathematical Foundations for Computer Science	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Apply mathematical logic to solve problems.
2. Understand sets, relations, functions, and discrete structures.
3. Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.
4. Formulate problems and solve recurrence relations.
5. Model and solve real-world problems using graphs and trees.

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT - I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT - II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Groups, Lattices as Partially Ordered Sets, Boolean algebra.

UNIT - III

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion- Exclusion.

UNIT - IV

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of generating functions, Recurrence relations, Solving recurrence relations by substitution and Generating functions, the method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

UNIT - V

Graphs: Basic Concepts, Isomorphisms and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

III. References

Text Book(s)

1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay, R. Manohar, McGraw Hill education (India) Private Limited. (UNITS - I, II)
2. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott, Abraham Kandel, Theodore P. Baker, Pearson , 2nd ed. (Units - III, IV, V)
3. Discrete Mathematics by R.K. Bisht and H.S.Dhami, Oxford University Press

Reference Books

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGraw Hill education (India) Private Limited.
2. Discrete Mathematics, D.S. Malik & M.K. Sen, Revised edition Cengage Learning.
3. Elements of Discrete Mathematics, C. L. Liu and D. P. Mohapatra, 4th edition, McGraw Hill education (India) Private Limited.
4. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.

IV. Suggested Co-Curricular Activities

1. Assignments
2. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
3. Presentation by students on applications related to Graph Theory

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Programming illustration of various propositional logic operations
2. Programming illustration of sets and their operations
3. Implementation of Graphs
4. Illustration of Graph operations including BFS and DFS
5. Implementation of Binary Trees
6. Implementation of various operations on Binary Trees

7. Implementation of Spanning Tree algorithms
8. Illustration of Euler circuits and Hamiltonian circuits
9. Illustration of chromatic number and its applications
10. Illustration of algebraic structures

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	**CS2020-HOTC-702**	**Computer Organization and Architecture**	**100+50**	**4 + 2**	**3+ 2**

I. Course Outcome:

1. Understanding of Boolean Algebra and Simplification of Boolean Functions
2. Understanding the digital logic gates, Combinational Logic and Sequential Logic
3. Understanding of Microprocessor Architecture and Micro-operations
4. Understanding of CPU and Binary Arithmetic

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)

UNIT-I

Information Representation: Number Systems - Binary, Octal, Decimal, and Hexa-Decimal; Number Base Conversions; Binary Arithmetic; Complements: (r-1)'s Complement, r's Complement, Subtraction using Complements; Floating Number-Fixed-point Representation, Floating-point Representation; Binary Codes for Decimal Digits: BCD Code, Excess-3 Code, 84-2-1 Code, 2421 Code, Reflected Code; Error Detection Code; Character Representation – ASCII, EBCDIC.

UNIT-II

Boolean Algebra, Logic Gates and simplification: Boolean Algebra-Basic Definitions, Postulate, Basic Theorems and Properties of Boolean Algebra; Boolean Functions, Canonical and Standard Forms: Minterms and Maxterms, SOP, POS Conversion Between Canonical Forms, Standard Form of a Boolean Function; Other Logical Operations; Digital Logic Gates, Implementation of Boolean Functions, Simplification using boolean Algebra and Karnaugh Maps (K-Map) Method.

UNIT-III

Combinational and Sequential Logic Circuit: Overview of Combinational Logic; Combinational Logic Design Procedure; Design of Some Standard Combinational Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Code Conversion; Decimal Adder, BCD Adder, Magnitude Comparator, Decoders, Encoder, Multiplexers, De-multiplexer, Flip-F7lops: RS Flip Flop, Clocked RS, JK Flip Flop, Master Slave JK Flip Flop, D Type Flip Flop, T Type Flip Flop, State Table, State Diagram, State Equations, Flip Flop Characteristic Tables; Flip Flop Excitation Tables; Design of Sequential Circuits.

UNIT-IV

Register Transfer and Micro Operations: Register Transfer Language (RTL); Register Transfer; Bus Transfer; Memory Transfers; Arithmetic Microoperations; Logic Microoperations, List of Logic Microoperations, Addressing Modes, Data Transfer.

UNIT-V

Central Processing Unit (CPU): Introduction; General Register Organization; Control Word; Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expression. Instruction Format – Three Address Instructions, Two Address Instructions, One Address Instructions, Zero Address Instructions. Parallel Processing; Pipelining – Arithmetic Pipeline, Instruction Pipeline,

REFERENCES

1. Mansaf Alam & Bashir Alam: Digital Logic Design. PHI
2. M. Morris Mano: Digital Logic and Computer Design. Pearson
3. M. Morris Mano: Computer System Architecture. Pearson
4. William Stalling: Computer Organization and Architecture. Prentice Hall
5. Rajaraman & T. Radhakrishnan: Computer Organization and Architecture. PHI
6. Donald D. Givone: Digital Principles and Design. McGraw Hill

III. Suggested Co-Curricular Activities

1. Assignments
2. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
3. Presentation by students on applications related to Graph Theory

IV. Practical (Laboratory) Syllabus:

1. Implementation of HALF Adder, FULL ADDER
2. Implementing Binary-to-Gray, Gray-to-Binary code conversions
3. Implementing 3*8 line DECODER
4. Implementing 8*3 line ENCODER
5. Implementing 4*1 and 8*1 Multiplexer
6. Verify the excitation tables of various FLIP-FLOPS
7. Design the 8-bit arithmetic logic unit
8. Implementing Half Subtractor, Full Subtractor

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-HOTC-703	Data Communication and Computer Networks	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Explain the concepts of networking, application areas and classification of reference models
2. Understand the transmission environment, technologies, and the topologies
3. Demonstrate various protocols including TCP and UDP
4. Implement various network security mechanisms

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

INTRODUCTION: Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay. THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the publicswitched telephone networks, mobile telephone system.

UNIT-II

THE DATA LINK LAYER: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer on theinternet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple accessprotocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth.

UNIT-III

THE NETWORK LAYER: Network layer design issues, routing algorithms, Congestion controlalgorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

UNIT-IV

THE TRANSPORT LAYER: Transport service, elements of transport protocol, Simple TransportProtocol, Internet transport layer protocols: UDP and TCP.

UNIT-V

THE APPLICATION LAYER: Domain name system, electronic mail, World Wide Web: architecturaloverview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple NetworkManagement Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

III. References

Text Book(s)

1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India

Reference Books

1. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
2. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars, Group discussions, Quiz, Debates etc.(on related topics).
3. Presentation by students on Network Security
4. Case Studies of Various Cryptographic Algorithms

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Introduction to networking tools and Linux
2. Introduction to Packet Tracer tool from Cisco
3. Study different types of network cables
4. Study different types of networks in detail
5. Study the basics of TCP/IP using various networking tools available in Linux
6. Create a network topology using packet tracer

7. Configure routing using packet tracer
8. Study network security algorithms
9. Implements DNS using packet tracer
10. Implement SMTP connectivity

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-HOTC-704	Object Oriented Software Engineering	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. understand the differences between the structured paradigm and the object-oriented paradigm in software development
2. Understand the concepts, principles, and state-of-the-art methods in software architectures and its relationship to other areas of software engineering, specifically requirements, OO analysis and design, and implementation.
3. design, manage and implement a computer-based software system using the OO software engineering approach in a group setting

II. **Syllabus :***(Total Hours: 90including Teaching, Lab and Field training, Unit tests etc.)*

UNIT-I

Introduction to Object-Oriented Programming: Overview of software engineering, Introduction to Object-Oriented Programming (OOP) concepts (classes, objects, inheritance, polymorphism), Unified Modelling Language (UML) basics, Introduction to software development process and software development life cycle (SDLC)

UNIT-II

Requirements Analysis and Design: Requirements analysis and specification, Use cases and scenarios, Object-oriented analysis and design (OOAD), Design patterns, UML modelling techniques (class diagrams, sequence diagrams, state machine diagrams, activity diagrams)

UNIT-III

Software Construction and Testing: Software construction basics, Object-oriented design principles, Object-oriented programming languages (Java, C++, Python), Software testing basics (unit testing, integration testing, system testing), Test-driven development (TDD)

UNIT-IV

Software Maintenance and Evolution: Software maintenance basics, refactoring techniques Software version control, Code review and inspection, Software evolution and reengineering

UNIT-V

Advanced Topics in Object-Oriented Software Engineering: Model-driven engineering (MDE), Aspect-oriented programming (AOP), Component-based software engineering (CBSE), Service-oriented architecture (SOA), Agile software development and Scrum methodologies.

III. References

Text Book(s)

1. An Introduction to Object-Oriented Analysis and Design and the Unified Process, 3rd Edition, Craig Larman, Prentice-Hall.
2. Programming in Java by Sachin Malhotra, Oxford University Press

Reference Books

1. Requirements engineering: processes and techniques, G.Kotonya and, I.Sommerville, 1998, Wiley
2. Design Patterns, E.Gamma, R. Helm, R. Johnson, and J. Vlissides
3. The Unified Modeling Language Reference Manual, J. Rumbaugh, I.Jacobson and G. Booch, Addison Wesley

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Create a software requirement specification using UML diagrams

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. To perform the Requirement analysis of the specified problem and draw a flow chart
2. Understanding of System modeling: Data model i.e. ER – Diagram and draw the ERDiagramwith generalization, specialization and aggregation of specified problem statement

3. Understanding of System modeling: Functional modeling: DFD level 0 i.e. Context Diagramand draw it
4. Understanding of System modeling: Functional modeling: DFD level 1 and DFD level 2 and draw it.
5. Understanding different actors and use cases in detail of the specified problem statement anddraw it using Rational Rose software any other available software.
6. To perform the user's view analysis: Use case diagram and draw it using Rational Rose or any other available software.
7. To draw the structural view diagram: Class diagram of specified problem statement usingRational Rose or any other available software.
8. To draw the behavioral view diagram: State-chart diagram, Activity diagram of specified problem statement using Rational Rose any other available software.
9. To understand testing and perform Boundary value analysis and Equivalence class testing.
10. To draw Flow graph, DD paths, calculation of cyclomatic complexity and find out all theindependent paths from the DD paths graph.
11. Case study: Prepare SRS for a given problem statement

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-HOTC-705	Artificial Intelligence	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Acquaint with the field of Artificial Intelligence.
2. Categorize an AI problem based on its characteristics and its constraints.
3. Understand and implement search algorithms.
4. Analyze the complexity of a given problem and find suitable optimizations.
5. Demonstrate practical experience by implementing and experimenting with the learnt algorithms.

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT- 1

Problems and Search: What is Artificial Intelligence, The AI Problems, and Underlying Assumption, what is an AI Technique?

Problems, Problems Spaces, and Search: Defining the problem as a state space search, production systems, problems characteristics, issues in the design of search programs.

UNIT- II

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis

UNIT- III

Knowledge Representation Issues: Representations and Mapping, Approaches to Knowledge Representation, The frame problem. Using Predicate Logic: Representing simple facts in logic, Representing Isa relationships, predicates, Resolution

UNIT- IV

Representing Knowledge using Rules: Procedural Vs Declarative knowledge, Logic Programming, Forward Vs Backward Reasoning, Matching, Control Knowledge

UNIT- V

Symbolic Reasoning under Uncertainty: Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation issues, Augmenting a Problem solver, implementation: DFS, BFS.

Statistical Reasoning: Probability and Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory.

III. REFERENCES:

Text Books:

1. Russell, S., & Norvig, P. Artificial intelligence: a Modern approach. Third Edition. Pearson new international edition. 2014.

Reference Books:

1. Artificial Intelligence, Second Edition, Elaine Rich, Kevin Knight, Tata McGraw-Hill Edition.

2. Other web sources suggested by the teacher concerned and the college librarian including reading material

IV **Suggested Co-Curricular Activities**

1. Expert lectures by related industrial experts.
2. Assignments, Seminars, Group discussions, Quiz, Debates etc. (on related topics).
3. Preparation of videos on tools and techniques in related field.
4. Collection of material / videos on various applications of AI

V. Practical Syllabus with Python/LISP/PROLOG Lab

1. Write a Program to Implement Breadth First Search
2. Write a Program to Implement Depth First Search
3. Write a Program to Implement Tic-Tac-Toe game.
4. Write a Program to implement 8-Puzzle problem
5. Write a Program to Implement Water-Jug problem
6. Write a Program to Implement Travelling Salesman problem
7. Write a Program to Implement Towers of Hanoi problem
8. Write a Program to implement 8-Queens problem

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-HOTC-706	Principles of Machine Learning	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the features of machine learning to apply on real world problems.
2. Characterize the machine learning algorithms as supervised learning and unsupervised learning, apply and analyze the various algorithms of supervised and unsupervised learning.
3. Analyze the concept of neural networks for learning linear and non-linear activation functions.
4. Identify an appropriate clustering technique to solve real world problems.
5. Choose a suitable machine learning model, implement and examine the performance of the chosen model for a given real world problems.

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I:

Introduction: What is Machine Learning, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning

UNIT -II:

Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Generalization error bounds: VC Dimension, Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

UNIT -III:

Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors.

UNIT -IV:

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional : K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal components analysis (PCA)

UNIT -V:

Machine Learning in Practice Design, Analysis and Evaluation of Machine Learning experiments, Feature selection Mechanisms, other issues: Imbalanced data, missing values, Outliers.

III. References

Text Books:

1. Ethem Alpaydin, Introduction to Machine Learning , MIT Press, Prentice Hall of India, Third Edition 2014

Reference Books:

1. Machine learning, Dr. S. Sridhar and M. Vijaya Lakshmi, Oxford University Press, 2021.
2. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition,1997.
3. Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, Academic Press, 4th edition, 2008, ISBN:9781597492720
4. Charu C. Aggarwal, Data Classification Algorithms and Applications , CRC Press, 2014
5. Charu C. Aggarwal, DATA CLUSTERING Algorithms and Applications, CRC Press, 2014

IV. Suggested Co-Curricular Activities

1. Arrange expert lectures in the area of Machine learning.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Presentation by students on applications of Machine learning.
5. Preparation of videos on tools and techniques in related field.
6. Collection of material/installation procedure/various operational methods related to relevant area and organizing them in a systematic way in a file.
7. Visits to local universities and research organizations etc.

V. Practical (Laboratory) Syllabus with Python / R-Programming (*30 hrs*)

1. Implement Decision Tree learning.
2. Implement Logistic Regression.
3. Implement classification using Multilayer perceptron.

4. Implement classification using SVM
5. Implement K-means Clustering to Find Natural Patterns in Data.
6. Implement K-mode Clustering
7. Implement Hierarchical clustering.
8. Implement Principle Component Analysis for Dimensionality Reduction.
9. Implement Multiple Correspondence Analysis for Dimensionality Reduction.
10. Implement Gaussian Mixture Model Using the Expectation Maximization
11. Implement k-nearest neighbors algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
12. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-SBC-707	MEAN Stack Development	100+50	4 + 2	4 + 1

I. Course Outcomes: Studentsaftersuccessfulcompletionofthecoursewillbeableto:

1. Understand the advanced Java Script Concepts
2. Develop Node.js: a server-side JavaScript run-time Application
3. Implement Express.js: a server-side JavaScript framework running on top of Node.js.
4. Implement Angular: a browser-independent MVC JavaScript UI framework.
5. Develop MongoDB-a schema-less (document-oriented) NoSQL database.
6. Apply Deployment Techniques & Working with cloud platform

II. **Syllabus :***(Total Hours: 90including Teaching, Lab, and Field training, Unit tests etc.)*

UNIT-I

Basic Web DevelopmentFramework,Node.js-to-Angular Stack Components

JavaScript Primer: Defining Variables, Understanding JavaScript Data Types, Operators, Looping, Creating Functions, Variable Scope, JavaScript Objects, Manipulating Strings, Working with Arrays, Adding Error Handling, Events and Document Object Model, Handling JSON data, Understanding JSON Callbacks.

UNIT-II

Learning Node.js: Getting Started with Node.js, Understanding Node.js, Installing Node.js, Working with Node Packages, Concurrency and event loop fundamentals,Creating a Node.js Application, Using Events, Listeners, Timers, and Callbacks in Nodes.js: Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks.

Handling Data I/O in Node.js: Working with JSON, Using the Buffer Module to Buffer Data, Using the Stream Module to Stream Data, Compressing and Decompressing Data with Zlib

UNIT-III

Understanding HTTP Services in Node.js: Processing URLs, Processing Query Strings and Form Parameters, Understanding Request, Response, and Server Objects. Implement HTTP Clients and Servers in Node.Js

Building REST services using Node JS REST services, Installing Express JS, Express Node project structure, Building REST services with Express framework, Routes, filters, template engines – Jade, ejs.

UNIT-IV

Understanding NoSQL and MongoDB: Why NoSQL? , Understanding MongoDB, MongoDB Data Types, MongoDB Basics and Communication with Node JS Installation, CRUD operations, Sorting, Projection, Aggregation framework, MongoDB indexes, Connecting to MongoDB with Node JS, Introduction to Mongoose, Connecting to MongoDB using mongoose, Defining mongoose schemas, CRUD operations using mongoose.

UNIT-V

Building Single Page Applications with AngularJS Single Page Application – Introduction, Two-way data binding(Dependency Injection), MVC in Angular JS, Controllers, Getting user input, Loops, Client side routing – Accessing URL data, Various ways to provide data in Angular JS – Services and Factories, Working with filters, Directives and Cookies, The digest loop and use of $apply.

III. References

Text Book(s)

1. *Simon Holmes* , "**Getting MEAN with Mongo, Express, Angular, and Node**", Second Edition, Manning Publications; 1 edition
2. **Node.js, MongoDB and Angular Web Development**, *Brad Dayley, Brendan Dayley, Caleb Dayley,* Pearson Education Inc., 2nd Edition, 2018

Reference Books

1. *Jeff Dickey*, "**Write Modern Web Apps with Mean Stack**", Peachpit press, 2015
2. *Ken Williamson*, "**Learning Angular JS**", O′Reilly; 1 edition

3. *Mithun Satheesh*, "**Web development with MongoDB and Node JS**", Packt Publishing Limited; 2nd Revised edition.
4. **Web Links:** https://www.geeksforgeeks.org/introduction-to-mean-stack/

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Building chat application using web socket.
5. Build real time dashboard in MEAN stack using websocket
6. Develop a CURD APP for College Student Database

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Installing the Node.js and its dependencies
2. Creating a Node.js application
3. Implementing http services in Node.js
4. Implementing socket services in Node.js
5. Create registration and login forms with validations using Jscript query
6. Jscript to retrieve student information from student database using database connectivity.
7. Building MongoDB environment and managing collection
8. Manipulating MongoDB documents from Node.js
9. Develop and demonstrate Invoking data using Jscript from Mongo DB.
10. Implementing Express in Node.js
11. Implement the following in Angular JS
    a) Angular JS data binding.
    b) Angular JS directives and Events.
    c) Using angular JS fetching data from MySQL.
12. Understanding Angular and Creating a basic Angular application
13. Create an Online fee payment form using JScript and MongoDB.

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	**CS2020-SBC-708**	Advanced Java Programming	**100+50**	**4 + 2**	**4 + 1**

I. Course Outcomes:

1. Understand J2EE Architecture.
2. Lean core concepts of J2EE programming.
3. Ability to J2EE concepts to real-world enterprise application development
4. Learn the concepts of Servlets, Java Server Pages, Database Connectivity, Enterprise Java Beans, and Java Mail APIs

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)

UNIT –I

J2EE Overview & Multi-tier Architecture: Overview of J2SE, J2EE, Advantages of Java, Birth of J2EE, Why J2EE; Distributed Systems, The Tier, J2EE Multi-tier architecture, Implementation of Client-tier, Web-tier, EJB-tier, and EIS-tier, Challenges; J2EE best practices: Enterprise Application Strategy, The Enterprise Application - Client, Session Management, Web-tier and JSPs, EJB-tier, MVC, The Myth of Using Inheritance, Maintainable Classes, Performance Enhancement, Power of Interfaces, Threads, and Notification

UNIT –II

Java Servlets & JDBC: Overview of HTML, XML, and XHTML, Java and XML, Parsing XML, Java Servlets and CGI Programming, A Simple Java Servlet, Anatomy of Servlet, Life Cycle of the Servlet, Deployment Descriptor, Reading data from client, reading HTTP request headers, working with cookies, Tracking sessions. Overview of JDBC, JDBC Drivers, JDBC Packages, JDBC Process, Database Connection, Statement, ResultSet, Transaction Processing, Servlet program with JDBC.

UNIT –III

Java Server Pages: Overview of JSP, JSP versus Servlet, JSP Tags: Variables and Objects, Directives, Scripting Elements, Standard Actions, Implicit Objects, Scope, Java Server Pages with Beans, Tomcat, User Sessions, Cookies, Session Objects, JSP with JDBC, Creating Custom JSP Tag Libraries.

UNIT –VI

Enterprise Java Beans: The EJB Container, EJB Classes, EJB Interfaces and Deployment Descriptions: Anatomy, Environment elements, referencing EJB, Sharing resources, Security elements, Query elements, Relationship elements, Assembly elements. Session Java Beans - stateless vs stateful, Entity Java Beans - Container-managed persistence, Bean-managed persistence. Message-driven Beans, JAR, WAR, EAR Files.

UNIT –V

JavaMail, CORBA and RMI: JavaMail API and Java Activation Framework, Protocols, Exceptions, Send Email Message, Retrieving Email Messages, Deleting Email Message. CORBA : The Concept of Object Request Brokerage, Java IDL and CORBA, The IDL Interface. Java RMI: Remote Method Invocation Concept, Server Side, and Client Side

REFERENCES

1. Jim Keogh: J2EE : The Complete Reference. Mc Graw Hill
2. H. Schildt: Java 2: The Complete Reference. Mc Graw Hill
3. Kogent Solutions Inc.: Java Server Programming Java EE 7 (J2EE 1.7), Black Book, Dreamtech Press
4. Subrahmanyam Allaramaju et al.: Professional JSP J2EE 1.3 Edition. Wrox Press
5. K. Qian et al.: Java Web Development Illuminated. Narosa
6. Robert W. Sebesta: Programming the World Wide Web. Pearson

III. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Development, deployment, and management of multi-tier, web-enabled, component-based and server-centric enterprise applications

IV. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Write a Java program to retrieve the information from the given URL?
2. Write a java Program to create a servlet to read information from client Registration page
3. Write a java Program to create a JSP page to display a simple message along with current Date
4. Write a java Program to create a User request page in JSP
5. Write the following (JDBC)
    i) Connect database to Java program
    ii) Program to create database table using Java
    iii) Program to insert, update, delete & select records

iv) Program to delete record from database
v) Program to execute batch of SQL statements
vi) Program to execute SQL select query

6. Write the following (EJB)
   i) Create stateless bean component
   ii) Create stateless bean client
7. JavaMail Example - Send Mail in Java using SMTP
8. Java RMI - Create and execute the server application program

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	CS2020-SBC-709	IoT Applications Development and Programming	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the Basic Concepts of Internet of Things
2. Learnt various Sensors and their associative protocols
3. Learnt the Single Board Computers for development of IoT
4. Build the IoT devices with the Node-RED without Complex coding
5. Develop various IoT real-time applications

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Overview of the Internet of Things (IoT) and Sensors: Sensors - Energy-based, Signal Output, Mode of Operation, Electronic Sensors. Connectivity - Bluetooth, Zigbee, Wi-Fi, LoRa, Wired Communication. Machine Intelligence, Active Management, Sensor Fusion, Smart Devices-Human-Computer Interaction, Context Awareness, Actuators, IoT and Smart City Applications-Automobile Sensors, Smart Home Sensors, Smart Transportation Sensors.

UNIT-II

IoT Sensors and Their Interfacing Protocols: Vision and Imaging Sensors- Line Scan Cameras, 3D Depth Cameras, **Sensors That Measure Temperature**-Thermocouples, Resistance Temperature Detector (RTD), Temperature Thermistor Sensors, Semiconductor Temperature Sensors, Radiation Sensors; Proximity Sensors, Pressure Sensors, Position Sensors, Photoelectric Sensors, Particle Sensors, Types of Particle Sensors-Metal Detectors, Level Sensors, Leak Detectors, Humidity Sensors, Gas and Chemical Sensors, Gas Detectors, Carbon Monoxide (MQ7) Detectors, Flame Detectors, **Sensor Communication Protocols**

UNIT-III

Programming Single Board Computers: Arduino Programming, Raspberry Pi-Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, Basics of Linux and its use, Introduction to Raspberry Pi GPIO Access, Interfacing DHT, Interfacing Pi cam to Raspberry Pi zero w, Pi Camera Specifications, Pi Camera Access, Interfacing PIR Sensor

Python: File Concepts, Spreadsheet Concepts, Communication Concepts, Wired and Wireless Programming Concepts

UNIT-IV

Node-RED: Node-RED Features, Installation of Node-RED, Node-RED Architecture, Node-RED Flow Editor, Basic Function Nodes, Node-RED Library, Node-RED Applications; MQTT Protocols**,** Google Sheets Programming (gspread), Firebase Programming, **Matplotlib**-Getting Started, Bar Graphs, Scatter Plot, Spectrum Representation, Coherence of Two Signals, Cross-Correlation Graph, Autocorreleation Graph, Changing Figure Size in Different Units, Scale Pie Charts, **Style Sheets**- FiveThirtyEight Style Sheet, Solarized Light Style Sheet

UNIT-V

Wireless Connectivity in IoT: Introduction, Low-Power Wide-Area Networks (LPWANs), RFID Protocol, XBEE Radios with Arduino, Bluetooth with Arduino, Arduino with a GSM Modem, Arduino with Firebase Cloud Connectivity

The Internet of Things through the Raspberry Pi: Introduction, Cluster Computing with Raspberry Pi Zero W-Message Passing Interface (MPI), Networking with RP is for Simple MPI Scripts, Simple MPI Programming

III. References

Text Book(s)

1. **Internet of Things Using Single Board Computers**, *G. R. Kanagachidambaresan*, Apress, 2022.
2. **Practical Node-RED Programming**, *Taiji Hagino*, Packt Publishing, 2021

Reference Books

1. **Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python,** *Colin Dow***,** Packt Publishing, 2021
2. **Programming the Internet of Things: An Introduction to Building Integrated, Device-to-Cloud IoT Solutions,** *Andy King***,** O'Reilly Media, 2021
3. **Web Links:** https://onlinecourses.nptel.ac.in/noc19_cs65/preview

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Case Studies:
   a) A Simple Web Service–Based Home Automation Using a Flask Server
   b) Home Electrification and Node-RED
   c) Supply Chain Management: Industry 4.0 and MQTT-Applications, Introduction, Working Principle, Publisher Source Code, Subscriber Source Code
   d) Programming Water-Quality Sensors
   e) IoT-Based Shrimp Farming

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Write a Python code to perform List Operations
2. Write a Python Program to work with Files
3. Write a Python Program to work with Google Sheets
4. Write a Python Program to perform Socket Operations
5. Write a program to switch light on when the input is 1 and switch the light off when the input is 0 using Raspberry pi
6. Install Node-RED and Flow-based Programming Development Environment
7. Create Basic Flows with Major Nodes
8. Develop a Node-Red Flow for various Case Studies
9. Implement Node-RED in the Cloud Calling a Web API from Node-RED
10. Create a To Do Application with Node-RED Handling Sensor Data on the Raspberry Pi

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11. Develop a Dashboard with various 2D Graphs with Matplotlib
12. Install MySQL database in Raspberry pi.
13. Write a program to work with basic MySQL queries by fetching data from database in Raspberry pi.
14. Arduino with Firebase Cloud Connectivity
15. Visualize Data by Creating a Server-side Application in the Firebase

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VII	**CS2020-SBC-710**	Mobile Application Development	**100+50**	**4 + 2**	**4 + 1**

I. Course Outcomes:

1. Learn to set up a new Material App using Android Studio.
2. Understand the Widget tree and learn to use pre-made Flutter, widgets for user interface design.
3. Learn to incorporate Image and Text Widgets to create simple user interfaces.
4. Learn to customize pre-built Flutter widgets.
5. Adding App Icons for iOS and Android builds.
6. Learn to run Flutter apps on iOS Simulator, Android Emulator and physical iOS and Android devices.

II. **Syllabus:** (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)

UNIT-I

Introduction: Frameworks and Tools for Mobile App Development, Characteristics of Mobile Applications, History of Mobile Application Frameworks and Tools, Introduction to Android, iOS, and Flutter. Client-Server Architecture:1-tier, 2-tier, 3-tier, types of Connection, Synchronization, Mobile Device Types, Mobile Device Components, Types of Mobile Applications

UNIT-II

Mobile Application Development using Flutter: to set up a new Material App using Android Studio, Creating UI with Flutter: Using Hot Reload and Hot Restart to quickly refresh the app UI and understand when to use each, using the Pubspec.yaml file to incorporate, dependencies, custom assets and fonts, an introduction to the Widget build() method, using layout widgets such as Columns, Rows, Containers and Cards, incorporating Material icons using the Icons class

UNIT-III

Building Apps with State: Understanding the difference between Stateful and Stateless widgets and when they should each be used, understanding how callbacks can be used to detect user interaction in button widgets, declarative style of UI programming and how Flutter widgets react to state changes, importing dart libraries to incorporate additional functionality, variables, data types and functions work in Dart, building flexible layouts using the Flutter Expanded widget, relationship between setState(), State objects and Stateful Widgets.

UNIT-IV

Using the Dart package manager: to use Dart package manager to incorporate Flutter compatible packages into your projects, functions in Dart and the arrow syntax, to refactor widgets and understand Flutter's philosophy of UI as code. Structuring Flutter Apps: to use Dart Constructors to create customisable Flutter widgets, apply common mobile design patterns to structure Flutter apps.

UNIT-V

Security: User to Mobile Client Security Issues, Mobile Client Security Issues, Client-Server Communications Security Issues, Existing Web Architectures and Back-End Systems Security Issues, Mobile Application Development Management

REFERENCES

1. Lee, H. Schneider, and R. Schell: Mobile Applications: Architecture, Design, and Development. Pearson
2. Marco L. Napoli: Beginning Flutter: A Hands on Guide to App Development. Wiley
3. Bill Phillips & Brian Hardy: Android Programming the Big Nerd Ranch Guide. Big Nerd Ranch
4. Brian Fling: Mobile Design and Development. O'Reilly

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Mobile application Project Ideas
   i) Tic Tac Toe Game
   ii) Online voting system
   iii) Photo Management Application
   iv) Online Exam Application

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

S.No.	Semester (Paper No.)	Course Title	Hours (Theory + Practical)	Credits	Internal Marks (IA + Field Work)	Semester End Examination
Semester VIII Higher Order Thinking Courses						
1	VIII (801)	Mobile ADHOC and Sensor Networks	4 + 2	4 + 1	25	75
2	VIII (802)	Information Security and Cryptography	4 + 2	4 + 1	25	75
3	VIII (803)	Compiler Design	4 + 2	4 + 1	25	75
4	VIII (804)	Digital Image Processing	4 + 2	4 + 1	25	75
5	VIII (805)	Big Data Technologies	4 + 2	4 + 1	25	75
6	VIII (806)	Data Mining Concepts & Techniques	4 + 2	4 + 1	25	75
Semester VIII -Skill Based Courses						
7	VIII (807)	Advanced DBMS	4 + 2	4 + 1	25	75
8	VIII (808)	Python Programming	4 + 2	4 + 1	25	75
9	VIII (809)	Cloud Computing	4 + 2	4 + 1	25	75
10	VIII (810)	Digital Forensics	4 + 2	4 + 1	25	75

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-HOTC -801	Mobile Ad Hoc and Sensor Networks	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the concept of ad-hoc and sensor networks, their applications and typical nodeand network architectures.
2. Describe the MAC protocol issues of ad hoc networks.
3. Identify and describe routing protocols for ad hoc wireless networks with respect to TCPdesign issues.
4. Explain the concepts of network architecture and MAC layer protocol for WSN.
5. Familiar with the OS used in Wireless Sensor Networks and buildbasic modules.

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Introduction to Ad Hoc Wireless Networks: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless channel, Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issuesand Challenges of MANETs, Ad Hoc Wireless Internet

UNIT-II

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc WirelessNetworks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MACProtocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT-III

Routing Protocols for Ad Hoc Wireless Networks: Issues in Designing a Routing Protocol, Classifications of Routing Protocols-Table driven protocols- Destination Sequenced Distance Vector (DSDV), Wireless RoutingProtocol (WRP), On-demand routing protocol-Dynamic Source Routing (DSR), Ad Hoc On-Demand DistanceVector Routing (AODV), Hybrid routing protocols-Zone Routing Protocol (ZRP)

UNIT-IV

Transport layer and Security Protocols for Ad hoc Wireless Networks: Introduction, issues in designing a Transport Layer Protocol for Ad Hoc Wireless Networks. Classification of Transport Layer Solutions. TCP over ad hoc Wireless Networks, Other Transport Layer Protocol for ad hoc Wireless Networks.

Security protocols: Security in ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges inSecurity Provisioning, Network Security Attacks, Key Management, Secure Routing in ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT-V

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clusteringof Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer,Routing layer, Transport layer, High-level application layer support, Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, CONTIKIOS, Node-level Simulators – NS2 and its extension tosensor networks, COOJA, TOSSIM

III. References

Text Book(s)

1. *C. Siva Ram Murthy and B. S. Manoj*, "**Ad Hoc Wireless Networks Architectures andProtocols**", Prentice Hall, PTR, 2004.
2. *Holger Karl, Andreas willig, "***Protocol and Architecture for Wireless Sensor Networks***",* John Wiley publication, Jan 2006.

Reference Books

1. *Feng Zhao, Leonidas Guibas,* **"Wireless Sensor Networks: an information processing approach"**, Elsevier publication, 2004.
2. *Charles E. Perkins*, "**Ad Hoc Networking**", Addison Wesley, 2000.
3. I*.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci,* **"Wireless sensor networks: a survey , computer networks"**, Elsevier, 2002, 394 - 422.
4. *Internet of Things by Surya Durbha and Jyoti Joglekar, Oxford University Press*
5. **Web Links:** https://archive.nptel.ac.in/courses/106/105/106105160/

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Presentationbystudentsonvarious Network Simulators
5. Case Studies of Various Applications of Ad hoc and Sensor Networks

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

All the experiments should be done on any Network Simulator like NS-2/NS-2/OMNET++/OPNET etc.

1. Study various network simulators used for wireless Ad-Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small Wireless network simulation script.
3. Study various trace file formats of network simulators.
4. Implement and compare various MAC layer protocols.
5. Generate tcl script for udp and CBR traffic in WSN nodes.
6. Generate tcl script for TCP and CBR traffic in WSN nodes.
7. Implement and compare AODV and DSR routing algorithms in MANET for various parameters.
8. Implement DSDV routing algorithms in MANET.
9. Calculate and compare average throughput for various TCP variants.
10. Implement and compare various routing protocols for wireless sensor networks.
11. Study Ethereal / Wireshark software and analyze dump files.

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-HOTC-802	Information Security and Cryptography	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Demonstrate the knowledge of cryptography, network security concepts and applications.
2. Develop security mechanisms to protect computer systems and networks.
3. Apply security principles in system design.
4. Apply methods for authentication, access control, intrusion detection and prevention.
5. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Information Security: Introduction, History of Information security, What is Security, CIA Triad, CNSS Security Model, Components of Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Security Systems Development Life Cycle.

Security Attacks (Interruption, Interception, Modification and Fabrication), Vulnerability, Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms.

UNIT-II

Cryptography: Concepts and Techniques, Conventionalsubstitution and transposition ciphers, One-time Pad, Block Cipher and Stream Cipher, Symmetric and Asymmetric key cryptography, Steganography

Symmetric key Ciphers: DES structure, DES Analysis, Security of DES, variants of DES, Block cipher modes of operation, AES structure, Analysis of AES, Key distribution.

UNIT-III

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.Digital Signatures, Authentication Protocols, Digital signature Standard.

UNIT-IV

Program Security: Secure programs, Non-malicious Program errors, malicious codes virus, Trap doors, Salami attacks, Covert channels, Control against program.

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT-V

Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus andrelated threats, Countermeasures, Firewall design principles, Types of firewalls

Wireless Security, Honeypots, Traffic flow security.

III. References

Text Book(s)

1. **Principles of Information Security**: *Michael E. Whitman, Herbert J. Mattord,* CENGAGELearning, 4th Edition.
2. **Cryptography And Network Security Principles And Practice**, Fourth or FifthEdition, *William Stallings,* Pearson
3. **Security in Computing**, Fourth Edition, by *Charles P. Pfleeger*, Pearson Education

Reference Books

1. **Modern Cryptography**: **Theory and Practice**, by *Wenbo Mao,* Prentice Hall.
2. **Network Security Essentials**: **Applications and Standards**, by *William Stallings*. Prentice Hall.
3. **Principles of Information Security**, *Whitman,* Thomson.

4. **Cryptography and Network Security** :*Forouzan Mukhopadhyay*, Mc Graw Hill, 2nd Edition
5. **Web Links:** https://onlinecourses.nptel.ac.in/noc22_cs90/preview
https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Presentationbystudentsonemerging Cyber frauds
5. Case Studies of Various Cryptographic Algorithms

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Write a Java Program to implement Caeser Cipher
2. Write a Java Program to implement Playfair Cipher
3. Write a Java Program to implement Rail Fence Cipher
4. Write a Java Program to implement Hill Cipher with 2 x 2 Matrix
5. Write a Java Program to implement DES algorithm
6. Write a Java Program to implement RSA algorithm
7. Write a Java Program for Diffie-Hellman Key Exchange
8. Write a Java Program to Generate SHA-512 Hash of a file
9. Write a Java Program to implement Digital Signature with a File
10. Configuring S/MIME for email communication
11. Setup a honeypot and monitor the honeypot on the network
12. Demonstrate how to provide secure data storage, secure data transmission and forcreating digital signatures (GnuPG)
13. Perform wireless audit on an access point or a router and decrypt WEP and WPA (Net Stumbler)
14. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-HOTC-803	Compiler Design	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Demonstrate the functioning of a Compiler and to develop a firm and enlightened grasp of concepts such as higher-level programming, assemblers, automata theory, and formallanguages, language specifications.
2. Develop language specifications using context free grammars (CFG).
3. Apply the ideas, the techniques, and the knowledge acquired for the purpose of developingsoftware systems.
4. Constructing symbol tables and generating intermediate code.
5. Apply the skills on devising, selecting and using tools and techniques towards compilerdesign

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Introduction to Compilation and Lexical analysis

Overview of the Compiler and its Structure: Language processor, Applications of language processors, Definition-Structure-Working of compiler, the science of building compilers, Difference between interpreter and compiler. Compilation of source code into target language, Types of compilers

Lexical Analysis: The Role of the Lexical Analyzer, Specification of Tokens, Recognition of Tokens, Input Buffering, elementary scanner design and its implementation (Lex), Applying concepts of Finite Automata for recognition of tokens.

UNIT-II

Syntax Analysis

Understanding Parser and CFG (Context Free Grammars), Role of Parser, Parse Tree - Elimination of Ambiguity, Left Recursion and Left Factoring of grammar

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Syntax Analysis-Top Down: Top Down Parsing - Recursive Descent Parsing - Non Recursive Descent Parsing - Predictive Parsing - LL (1) Grammars.

Syntax Analysis-Bottom Up: Shift Reduce Parsers- Operator Precedence Parsing -LR Parsers, Construction of SLR Parser Tables and Parsing, CLR Parsing, LALR Parsing

UNIT-III

Semantics Analysis& Intermediate Code Generation

Syntax Directed Definition – Evaluation Order - Applications of Syntax Directed Translation- Syntax Directed Translation Schemes - Implementation of L attributed Syntax DirectedDefinition.

Intermediate Code Generation: Variants of Syntax trees - Three Address Code- Types – Declarations - Procedures - Assignment Statements - Translation of Expressions - Control Flow - Back Patching- SwitchCase Statements.

UNIT-IV

Error Recovery and Run-Time Environments

Error Recovery Error Detection & Recovery, Ad-Hoc and Systematic Methods Source Language Issues, Storage Organization. Stack Allocation of Space, Access to Nonlocal Data on the Stack, Parameter Passing; Symbol Tables; Language Facilities for Dynamic Storage Allocation; Dynamic Storage Allocation Techniques, Heap Management

UNIT-V

Code Generation and Optimization:

Code Generation: Issues in the Design of a Code Generator, the Target Language, Addresses in the TargetCode, Basic Blocks and Flow Graphs,

Code Optimization: Optimization of Basic Blocks, A Simple CodeGenerator, Machine dependent optimization, Register Allocation and Assignment; The DAG Representation of Basic Blocks; Peephole Optimization; Generating Code from DAGs; Design of specifications for compilers, Machine independent optimization Error detection of recovery

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III. References

Text Book(s)

1. *A. V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman*, **Compilers: Principles, techniques, &tools**, Second Edition, Pearson Education, 2007.
2. *K. D. Cooper and L. Torczon*, **Engineering a compiler**, Morgan Kaufmann, 2nd edition, 2011.
3. *Steven S.Muchnick*, **Advanced Compiler design implementation"** Elsevier Science India, 2003.
4. *Compiler Design by Muneeswaran, Oxford University Press*

Reference Books

1. *Andrew A.Appel* , **Modern Compiler Implementation in Java**, Cambridge University Press; 2ndedition, 2002.
2. *Allen Holub*, **Compiler Design in C**, Prentice Hall, 1990
3. *TorbengidiusMogensen*, **Basics of Compiler Design**, Springer, 2011.
4. *Charles N, Ron K Cytron, Richard J LeBlanc Jr*., **Crafting a Complier**, Pearson Education, 2010.
5. **Web Links:** https://onlinecourses.nptel.ac.in/noc20_cs13/preview

IV. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. PresentationbystudentsonOnline Compilers and its Architecture
5. Implement the back end of the compiler which takes the three-address code and produces the 8086 assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, jump etc.

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Implementation of a Lexical Analyzer using tools like Flex or Lex to recognize and tokenize input programs.
2. Building a Syntax Analyzer using a parser generator like Bison or YACC to verify the syntactical correctness of the input program.

3. Write a LEX program to recognize valid arithmetic expression. Identifiersin the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
4. Write a LEX program to eliminate comment lines in a C program andcopy the resulting program into a separate file
5. Write YACC program to recognize all strings for which starts with nnumber of ‘a’s followed by n number of ‘b’s.
6. Write YACC program to recognize valid identifier, operators and keywords in the given text (C program) file.
7. Implementation of calculator using lex and YACC.
8. Write a C Program to develop an operator precedence parser for a given language.
9. Convert the BNF rules into YACC form and write code to generate abstract syntax tree.
10. Construct a recursive descent parser for an expression.
11. Construct a Shift Reduce Parser for a given language.
12. Implement Intermediate code generation for simple expressions

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-HOTC -804	Digital Image Processing	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the basic concepts of a digital image and image transforms.
2. Enhance images through spatial domain techniques.
3. Enhance images through frequency domain techniques.
4. Learn various image segmentation techniques.
5. Analyze various image compression techniques.

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I: (10 hours)

Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

UNIT -II: (10 hours)

Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT -III: (10 hours)

Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.

UNIT -IV: (10 hours)

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

UNIT -V: (10 hours)

Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.

III. References

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, " Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

IV. Suggested Co-Curricular Activities

1. Arrange expert lectures in the area of Image Processing.
2. Assignments related to medical image processing, character recognition, signature recognition, remote sensing image processing, etc.
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Presentation by students on recent trends of Image processing.

VI. Practical (Laboratory) Syllabus with Matlab/ Octave/ Scilab *(30 hrs.*)

1. Simulation and Display of an Image, Negative of an Image (Binary & Gray Scale)
2. Implementation of Relationships between Pixels.
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm.

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-HOTC-805	Big Data Technologies	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand what is Big Data? Characteristics of Big Data, applications and challenges of Big Data.
2. Understand Hadoop frame work and eco system.
3. Learn the architecture of HDFS.
4. Analyse Big Data and problem solving using Map Reduce programming.
5. Demonstrate Hive Big Data hbase components of Hadoop

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT I

INTRODUCTION TO BIG DATA: Introduction – Classification of digital data: Structured, Semi structured and unstructured data, Big Data and its importance, Four V's in Big data, Drivers for Big data, Challenges of Big data, Big data analytics and Big data applications.

UNIT II

INTRODUCTION HADOOP: Big Data – Apache Hadoop & Hadoop Ecosystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce, Data Serialization.

UNIT- III

HADOOP ARCHITECTURE: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, TaskTrackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering – Monitoring & Maintenance.

UNIT-IV

HIVE AND HIVEQL: - Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting and Aggregating, Map Reduce Scripts, Joins & Subqueries,

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UNIT-V

HBase concepts- Advanced Usage, Schema Design, Advance Indexing - Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

III. References:

Text Books:

1. Big Data Black Book(Covers Hadoop 2, Map Reduce, Hive, Yarn, Pig & Data Visualization) - Dream Tech Publications
2. Big data and Analytics - Seema Acharya and Subhashini Chellappan - Wiley publications.

Reference Books:

1. "Understanding Big data", Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
2. "Big Data Analytics", G. Sudha Sadasivam and R. Thirumahal, Oxford University Press 2020.
3. "HADOOP: The definitive Guide" , Tom White, O Reilly 2012.
4. "Big Data Analytics with R and Haoop", Vignesh Prajapati, Packet Publishing 2013.
5. "Oracle Big Data Handbook", Tom Plunkett, Brian Macdonald et al, Oracle Press, 2014.

IV **Suggested Co-Curricular Activities**

1. Arrange expert lectures by IT experts working professionally in the area of Big data
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.
4. Presentation by students on various applications of Big data.
5. Problem solving exercises.

V. Practical (Laboratory) Syllabus *(30 hrs*)

1. HDFS: Setup a hdfs in a single node to multi node cluster, perform basic file system operation on it using commands provided, monitor cluster performance
2. Write various Map Reduce programs to count the number of times a single word has occurred in a given paragraph.
3. Implement the following file management tasks in Hadoop:
   I. Adding files and directories, List the files and directories
   II. Retrieving files

III. Deleting files
IV. Copying files from one folder to another in HDFS
V. Copying files from Local File System to HDFS

4. Write a Map Reduce program to add two matrices.
5. Write a Map Reduce program to multiply a matrix with a Vector.
6. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm
7. Write a Map Reduce program that mines weather data (NCDC). Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: ftp://ftp.ncdc.noaa.gov/pub/data/noaa/.
8. Find average, max and min temperature for each year in NCDC data set
9. Stop word elimination problem:

   Input: 1. A large textual file containing one sentence per line
   2. A small file containing a set of stop words (One stop word per line)

   Output:

   1. A textual file containing the same sentences of the large input file without the words appearing in the small file.

10. Write a MapReduce Application to implement Combiners
11. Write a MapReduce Application to implement Reduce-side Join
12. Write a MapReduce Application to implement Map-side Join
13. Hbase: Setup of Hbase in single node and distributed mode, write program to write some data into hbase and query it.

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	**CS2020-HOTC-806**	**Data Mining Concepts & Techniques**	**100+50**	**4 + 2**	**4 + 1**

I. Course Outcome: Students who complete this course will be able to:

1. Compare various conceptions of data mining as evidenced in both research and application.
2. Characterize the various kinds of patterns that can be discovered by association rule mining.
3. Evaluate mathematical methods underlying the effective application of datamining.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)

UNIT - I

Data Warehousing: Introduction, What is Data Warehouse? Definition, Multidimensional Data Model, **OLAP** Operations, Warehouse Schema, Data Warehouse Architecture, Warehouse Server, Metadata, OLAP Engine, Data Warehouse Backend Process, Other Features

Data Pre-processing, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation

UNIT - II

Data Mining: What is Data Mining? Data Mining: Definitions, KDD vs Data Mining, DBMS vs DM, Other Related Areas, DM Techniques, Other Mining Techniques, Issues and Challenges in DM, DM Applications- Case Studies

Association Rules: What is an Association Rule?, Methods to Discover Association Rules, A Priori Algorithm, Partition Algorithm, Pincer-Search Algorithm, Dynamic Itemset Counting Algorithms, FP-Tree Growth Algorithm, Discussion on Different Algorithms, Incremental Algorithms, Border Algorithms, Generalized Association Rule, Association Rules with Item Constraints

UNIT - III

Clustering Techniques: Clustering Paradigms, Partitioning Algorithms, k-Medoid Algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, BIRCH, CURE, Categorical Clustering Algorithms, STIRR, ROCK, CACTUS,

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UNIT – IV

Decision Trees: What is a Decision Tree?, Tree Construction Principle, Best Split, Splitting Indices, Splitting Criteria, Decision Tree Construction Algorithms, CART, ID3, C4.5, Decision Tree Construction with Presorting, Rainforest, Approximate Methods, CLOUDS, BOAT, Pruning Techniques, Integration of Pruning and Construction, Ideal Algorithm

UNIT – V

Other Techniques: What is a Neural Network?, Learning in NN, Unsupervised Leaning, Data Mining Using NN: A Case Study, Genetic Algorithms, Rough Sets, Support Vector Machines
Web Mining: Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Text Mining, Unstructured Text, Episode Rule Discovery for Texts, Hierarchy of Categories, Text Clustering

TEXT BOOKS

1. Data Mining Techniques, Arun K Pujari, University Press
2. Data Mining: Concepts and Techniques, 3rd Edition, Jiawei Han, Micheline Kamber, Jian Pei

IV **Suggested Co-Curricular Activities**

1. Arrange expert lectures by IT experts working professionally in the area of Big data
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.
4. Presentation by students on various applications of Data Mining.
5. Problem solving exercises.

V. Practical (Laboratory) Syllabus *(30 hrs*)

1. Regression Analysis
2. Association Rule Discovery
3. Classification
4. Clustering

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	**CS2020-SBC-807**	**Advanced Database Management Systems**	**100+50**	**4 + 2**	**4 + 1**

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the basic concepts and terminology related to DBMS and Relational Database Design
2. Comprehend the design and implement Distributed Databases.
3. Understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports
4. Perform the cost based and rule based analysis for improving query performance

II. **Syllabus:** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Formal review of relational database concepts, Functional dependencies, Closure, Correctness of FDs

UNIT-II

3NF and BCNF, 4NF and 5NF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

UNIT-III

Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serialisability

UNIT-IV

Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, Concurrency Control on B+ trees, Optimistic Concurrency Control and the concepts related to Global and Local transactions in Distributed transactions.

UNIT-V

T/O based techniques, Multiversion approaches, Comparison of Concurrency Control methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

III. References

Text Book(s)

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Reference Books

1. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book", Pearson, 2011.

IV. Suggested Co-Curricular Activities

1. Performance tuning approaches by subject matter experts
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Creating different kinds of indexes in Oracle and MySQL databases and compare the performance
5. Case study on the need for 2PLand transactional controls

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Running Basic SQL commands
2. Understanding the use of Intermediate SQL
3. Running Advanced SQL related to data mining (Slicing and Dicing)
4. Creation of ER and EER diagrams for an organization
5. Database Design and Normalization for a given organization
6. Accessing Databases from Programs using JDBC
7. Analyzing query performance using explain plans
8. Creation of indexes for better query performance.
9. Running different query evaluation plans
10. Experimenting on DBMS locks and session management

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DOMAIN SUBJECT: COMPUTER SCIENCE/ INFORMATION TECHNOLOGY (IT)

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	**CS2020-SBC-808**	Python Programming	**100+50**	**4 + 2**	**4 + 1**

I. Course Outcomes:

1. Develop and execute simple Python programs.
2. Structure a Python program into functions.
3. Using Python lists, tuples to represent compound data
4. Develop Python Programs for file processing

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT I

Introduction to Python, Python, Features of Python, Execution of a Python, Program, Writing Our First Python Program, data types in Python. Python Interpreter and Interactive Mode; Values and Types: int, float, boolean, string, and list; Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules and Functions, Function Definition and use, Flow of Execution, Parameters and Arguments

UNIT II

Operators in Python, Input and Output, Control Statements. Boolean Values and operators, Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Composition, Recursion

UNIT III

Arrays in Python, Strings and Characters. Strings: String Slices, Immutability, String Functions and Methods, String Module; Lists as Arrays. Illustrative Programs: square root, gcd, exponentiation, sum an array of numbers, Linear Search, Binary Search.

UNIT IV

Functions, Lists and Tuples. List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple as Return Value; Dictionaries: Operations and Methods; Advanced List Processing - List Comprehension; Illustrative Programs: Selection Sort, Insertion Sort, Merge sort, Histogram.

UNIT V

Files and Exception: Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages; Illustrative Programs: Word Count, Copy File.

TEXT BOOKS

1. Mark Lutz, Learning Python
2. Tony Gaddis, Starting Out with Python
3. Kenneth A. Lambert, Fundamentals of Python
4. James Payne, Beginning Python using Python 2.6 and Python 3

III. Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments
3. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
4. Develop the operations on files

IV. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Write Python Program to reverse a number and also find the Sum of digits in the reversed number. Prompt the user for input.
2. Write Python code to check if a given year is a leap year or not.
3. Write Python code to determine whether the given string is a Palindrome or not using slicing.
4. Write Python program to add two matrices and also find the transpose of the resultant matrix.
5. Write Python program to swap two numbers without using Intermediate/Temporary variables. Prompt the user for input.
6. Consider a Rectangle Class and Create Two Rectangle Objects. Write Python program to Check Whether the Area of the First Rectangle is Greater than Second by Overloading Operator.
8. Write Python program to count the number of times an item appears in the list.
9. Write Python program to convert uppercase letters to lowercase and vice versa.
10. Write Python program to sort numbers in a list in ascending order using Bubble Sort by passing the list as an argument to the function call.
11. Write Python program to Calculate Area and Perimeter of different shapes using Polymorphism.
12. Write the following searching programs
    i) Linear Search
    ii) Binary Search
13. Write the following sorting techniques
    i) Selection Sort
    ii) Insertion Sort
    iii) Merge sort

14. Write Python program to find number of words, vowels, consonants and lines in a given file.

Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	CS2020-SBC-809	Cloud Computing	100+50	4 + 2	4 + 1

I. Course Outcomes: Students after successful completion of the course will be able to:

1. Compare the strengths and limitations of cloud computing
2. Identify the architecture, infrastructure, and delivery models of cloud computing
3. Apply suitable virtualization concept.
4. Choose the appropriate cloud player, Programming Models, and approach.
5. Address the core issues of cloud computing such as security, privacy, and interoperability
6. Design Cloud Services and Set a private cloud

II. Syllabus: *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service. Cloud scenarios – Benefits: scalability, simplicity, vendors, security. Limitations – Sensitive information - Application development – Security concerns - privacy concern with a third party - security level of third party - security benefits Regularity issues: Government policies.

UNIT-II

Virtualization: Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost - limitations

Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization, Data virtualization – Network virtualization Microsoft Implementation: Microsoft Hyper V, VMware features and infrastructure – Virtual Box - Thin client, Cloud

deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT-III

Infrastructure as a Service (IaaS): IaaS service providers – Amazon EC2, GoGrid, Rack Space, Windows Azure infrastructure services – Amazon EC service level agreement – Recent developments – Benefits

UNIT-IV

Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Force.com – Oracle APEX cloud - Services and Benefits

UNIT-V

Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platform – Benefits – Operational benefits - Economic benefits – Evaluating SaaS

III. References

Text Book(s)

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christenvecctiola, S Tammaraiselvi, TMH

Reference Books

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter TATA McGraw- Hill , New Delhi - 2010
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
3. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
4. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press
5. AWS, Azure and Saleforceweb tutorials

IV. Suggested Co-Curricular Activities

1. Training of students by Skill Development Centers
2. Assignments, Seminars, Group discussions, Quiz, Debates etc.(on related topics).

3. Case Studies on operations that can be performed on IaaS, PaaS and SaaS providers

V. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Setup virtual machines on a single computer using VMWare and VirtualBox
2. Create a network using multiple virtual machines on a single host using VMware
3. Setup a client server interaction on a single host using VMware
4. Create an AWS account and create an EC2 instance with a C compiler
5. Connect to EC2 instance and run some C programs on EC2 instance
6. Install a web server on an EC2 instance and provide access to it using Security Group rules
7. Create a virtual cloud on EC2 platform
8. Connect to Force.com and create a data entry form using Salesforce APEX
9. Create a new account on Saleforce.com and create leads, quotes and contracts
10. Analyze the services available on Oracle APEX and create sample web applications

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Semester	Course Code	Course Title	Marks (T+P)	Hours (T+P)	Credits (T+P)
VIII	**CS2020-SBC-810**	Digital Forensics	**100+50**	**4 + 2**	**4 + 1**

V. Course Outcomes: Students after successful completion of the course will be able to:

1. Understand the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing.
2. Understand the file system storage mechanisms of the operating systems.
3. Use tools for faithful preservation of data on disks for analysis.
4. Find data that may be clear or hidden on a computer disk.
5. Learn the use of computer forensics tools used in data analysis, such as searching, absolute disk sector viewing and editing, recovery of files, password cracking, etc.
6. Understand how to present the results of disk data analysis in a court proceeding as an expert witness.

VI. **Syllabus :** *(Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)*

UNIT-I

Introduction to Digital Forensic: Definition of Computer Forensics, Cyber Crime, Evolution of Computer Forensics, Objectives of Computer Forensics, Roles of Forensics Investigator, Forensics Readiness, Steps for Forensics

Computer Forensics Investigation Process: Digital Forensics Investigation Process-Assessment Phase, Acquire the Data, Analyze the Data, Report the Investigation

Digital Evidence and First Responder Procedure: Digital Evidence, Digital Evidence Investigation Process. First Responders Toolkit, Issues Facing Computer Forensics, Types of Investigation, Techniques in digital forensics

UNIT-II

Understanding Storage Media and File System: The Booting Process, LINUX Boot Process, Mac OS Boot Sequence, Windows 10 Booting Sequence, File System, Type of File Systems.

Windows Forensics: Introduction to Windows Forensics, Windows Forensics Volatile Information, Windows Forensics Non- Volatile Information, and Recovering deleted files and partitions, Windows Forensics Summary.

Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools: **FTK Imager:**

Digital Forensics Road map: Static Data Acquisition from windows using FTK Imager, Live Data Acquisition using FTK Imager

Installation of KALI Linux, RAM Dump Analysis using Volatility, Static Data Acquisition from Linux OS

UNIT-III

Recovering Deleted Files and Partitions: Digital Forensics Tools, Overview of EnCase Forensics, Deep Information Gathering Tool: Dmitry Page, Computer Forensics Live Practical by using Autopsy and FTK Imager

Network Forensics: Introduction to Network Forensics, Network Components and their forensic importance, OSI internet Layers and their Forensic importance, Tools Introduction Wireshark and TCPDUMP, Packet Sniffing and Analysis using Ettercap and Wireshark, Wireshark Packet Analyzer, Packet Capture using TCP DUMP

Website Penetration: WHOIS, nslookup

UNIT-IV

Logs & Event Analysis: Forensic Analysis using AUTOPSY: Linux and Windows, Forensics and Log analysis, Compare and AUDIT Evidences using Hashdeep Page

Data carving using Bulk Extractor: Kali Linux and Windows, Recovering Evidence from Forensic Images using Foremost

Application Password Cracking: Introduction to Password Cracking, Password Cracking using John the Ripper, Password Cracking using Rainbow Tables, PDF File Analysis, Remote Imaging using E3 Digital Forensics

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UNIT-V

Wireless and Web Attacks: Wi-Fi Packet Capture and Password Cracking using Aircrack-ng, Introduction to Web Attacks, Website Copier: HTTRACK, SQL Injection, Site Report Generation: Netcraft, Vulnerability Analysis: Nikto, Wayback Machine, Image Metadata Extraction using Imago

Email Forensics Investigation: Email Forensics Investigations, **Mobile Device Forensics:** Mobile Forensics

Preparation for Digital Forensic investigation: Investigative reports, expert witness and cyber regulations, Introduction to Report Writing, Forensic Reports & Expert Witness

VII. References

Text Book(s)

1. **Digital Forensics**, *Dr.Jeetendra Pande, Dr. Ajay Prasad,* Uttarakhand Open University, Haldwan 2016
2. *Nilakshi Jain, Dhananjay Kalbande,* **"Digital Forensic: The fascinating world of Digital Evidences"** Wiley India Pvt Ltd 2017.
3. *Cory Altheide, Harlan Carvey***"Digital forensics with open source tools**" Syngress Publishing, Inc. 2011.
4. *Chris McNab*, **Network Security Assessment**, By O'Reilly.
5. *Cyber Forensics by Dejey and Murugan, Oxford University Press*

Reference Books

1. *Jason Luttgens, Matthew Pepe, Kevin Mandia*, **"Incident Response and computer forensics",** 3rd Edition Tata McGraw Hill, 2014.
2. *Clint P Garrison,***"Digital Forensics for Network, Internet, and Cloud Computing A forensicevidence guide for moving targets and data"** , Syngress Publishing, Inc. 2010
3. **Web Links:** https://onlinecourses.swayam2.ac.in/nou22_cs05/preview

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VIII. Suggested Co-Curricular Activities

5. Training of students by related industrial experts.
6. Assignments
7. Seminars, Group discussions, Quiz, Debates etc.(on related topics).
8. Case Studies: Vulnerability Assessment of Your College Website

IX. Practical (Laboratory) Syllabus: *(30 hrs.)*

1. Study of Computer Forensics and different tools used for forensic investigation
2. How to Recover Deleted Files using Forensics Tools
3. Study the steps for hiding and extract any text file behind an imagefile/ Audio file (Steganography)
4. How to Extract Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software
5. Data Acquisition using FTK imager
6. How to make the forensic image of the hard drive using EnCase Forensics/Autopsy
7. How to Restoring the Evidence Image using EnCase Forensics/Autopsy
8. How to Collect Email Evidence in Victim PC
9. How to Extracting Browser Artifacts
10. How to View Last Activity of Your PC
11. Find Last Connected USB on your system (USB Forensics)
12. Comparison of two Files for forensics investigation by Compare IT software
13. Live Forensics Case Investigation using Autopsy