Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

B.TECH – INFORMATION TECHNOLOGY
CBCS CURRICULUM
VTU R21
PROGRAM CORE

S.No	Course Code	Program Core	L	T	P	C
1	10211IT101	Data Structures	3	0	0	3
2	10211IT102	Computer Organization and Digital Design	3	0	0	3
3	10211IT103	Object Oriented Programming	3	0	0	3
4	10211IT104	Python Programming	3	0	0	3
5	10211IT105	Operating System	3	0	0	3
6	10211IT106	Web Technologies	3	0	0	3
7	10211IT107	Database Management System	3	0	0	3
8	10211IT108	Computer Networks	3	0	0	3
9	10211IT109	Machine Learning	3	0	0	3
10	10211IT110	Cloud Computing	3	0	0	3
11	10211IT111	Java Programming	3	0	0	3
12	10211IT112	Cryptography and Network Security	3	0	0	3
13	10211IT113	Internet of Things	3	0	0	3
14	10211IT114	Finite Automata Compiler Design	3	0	0	3
15	10211IT115	Object Oriented Software Engineering	3	0	0	3
16	10211IT116	Design And Analysis of Algorithm	3	0	0	3
17	10211IT301	Data Structures Lab	0	0	2	1
18	10211IT302	Object Oriented Programming Lab	0	0	2	1
19	10211IT303	Design and Analysis of Algorithm Lab	0	0	2	1
20	10211IT304	Database Management System Lab	0	0	2	1
21	10211IT305	Web Technology Lab	0	0	2	1
22	10211IT306	Python Programming Lab	0	0	2	1
23	10211IT307	Java Programming Lab	0	0	2	1
24	10211IT308	Operating System Lab	0	0	2	1
25	10211IT309	Cloud Computing Lab	0	0	2	1
26	10211IT310	Internet of Things Lab	0	0	2	1
Total Credits						58

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT101	DATA STRUCTURES	3	0	0	3

Course Category: Program Core

a. Preamble :

This course provides an introduction to the basic concepts and techniques of Linear and non linear data Structures and Analyze the various algorithm.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Identify user defined data types, linear data structures for solving real world problems.	K2
CO2	Write modular programs on nonlinear data structures and algorithms for solving engineering problems efficiently.	K3
CO3	Illustrate some of the special trees and Hashing Techniques.	K2
CO4	State what is an undirected graph, directed graph and apply BFS and DFS to traverse a graph	K2
CO5	Demonstrate knowledge of sorting algorithms and their run-time complexity.	K3

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L							
CO2	M		M		L							
CO3	M		M		L							
CO4	M		M		L							
CO5	M		M		L							

H- High; M-Medium; L-Low

d. Course Content :

UNIT I LINEAR DATA STRUCTURE **L – 9**

Introduction - Time and space complexity analysis - Abstract Data Type (ADT) – The List ADT – Array Implementation – Linked List Implementation– the Stack ADT – The Queue ADT – Applications of Stack, Queue and List.

UNIT II TREES **L – 9**

Introduction to trees - Tree Traversal - Binary Trees - Definitions – Expression Tree – Binary Tree Traversals - The Search Tree ADT – Binary Search Trees - AVL Tree.

UNIT III SPECIAL TREES & HASHING **L – 9**

Splay Tree – B-Tree - Priority Queue - Binary Heap –. Hashing - Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing –Rehashing

UNIT IV GRAPH **L – 9**

Introduction to Graphs - Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths –Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm- Kruskal's Algorithm – Breadth first search – Depth-First Search – Undirected Graphs – Biconnectivity.

UNIT V SORTING & SEARCHING **L – 9**

Sorting algorithm- Insertion sort- Selection sort- Shell sort-Bubble sort- Quick sort- Heap sort-Merge sort- Radix sort - Searching – Linear search - Binary search.

Total: 45 Periods

e. Learning Resources

i. Text Books:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition , Pearson Education, 2007.

ii. Reference:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.
2. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Edition, 2005.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structure", Computer Science Press, 1995.

iii. Online resources

1. http://simplenotions.wordpress.com/2009/05/13/java-standard-data-structures-big-o-notation/
2. http://mathworld.wolfram.com/DataStructure.html/.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT102	Computer Organization and Digital Design	3	0	0	3

a. Preamble :

This course provides the basics of Number Systems, Boolean Functions, Simplification of Boolean Functions, Logic Gates, Combinational circuits, Multiplexers and De-multiplexers. Also gives knowledge on basics of organizational and architectural issues of a digital computer, analyze performance issues in processor and memory design of a digital computer, various data transfer techniques in digital and performance improvement using instruction level parallelism.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Able to understand the fundamentals of digital principles and able to design digital circuits by simplifying the Boolean functions.	K3,S3
CO2	Able to design various combinational and sequential circuits.	K3, S3
CO3	Able to Understand the organization and working principle of computer hardware components.	K2, S3
CO4	Able to trace the execution sequence of an instruction through the processor.	K4, S3
CO5	Acquire knowledge about multiprocessor organization and parallel processing also can understand mapping between virtual and physical memory.	K3, S3

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H							M			H
CO2	H	H	H	M			L		M			
CO3	M		H		L	H			M			H
CO4	H	L	M		L		L	L	M	M		H
CO5	M							L		H		

H- High; M-Medium; L-Low

d. Course Content:

UNITI DIGITAL FUNDAMENTALS

Number Systems and Conversions – Boolean Algebra and Simplification – Minimization of Boolean Functions – Karnaugh Map, Code conversion using K-Map, Logic Gates – NAND – NOR Implementation

UNIT II COMBINATIONAL AND SEQUENTIAL CIRCUITS Design of Combinational Circuits – Adder / Subtractor – Encoder – Decoder – MUX / DEMUX – Comparators, Flip Flops – Triggering – Master – Slave Flip Flop – State Diagram and Minimization – Counters – Registers.

UNIT III BASIC STRUCTURE OF COMPUTERS & PARALLEL PROCESSING Functional units – Basic operational concepts – Bus structures – Performance and Metrics – Instruction and instruction sequencing – Addressing modes – ALU design – Fixed point and Floating point operation .

UNIT IV PROCESSORDESIGN

Processor basics – CPU Organization – Data path design – Control design – Basic concepts – Hard wired control – Micro programmed control – Pipeline control – Hazards – Super scalar operation.

UNIT V MEMORY AND I/O SYSTEM

Memory technology – Memory systems – Virtual memory – Caches – Design methods – Associative memories – Input/output system – Programmed I/O – DMA and Interrupts – I/O Devices and Interfaces.

TOTAL: 45 PERIODS

e. Learning Resources

i. Text Books:

1. Morris Mano, "Digital Design", Prentice Hall of India, Fourth Edition 2007.
2.Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, "Computer organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

ii. Reference Books:

1.Charles H. Roth, Jr., "Fundamentals of Logic Design", Jaico Publishing House, Mumbai, Fourth Edition, 1992.
2.William Stallings, "Computer Organization & Architecture – Designing for Performance" 9 th Edition 2012.
3.David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009. 6. John.
4. P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998. N.Yanushkevich, VladP.Shmerko, "Introduction to Logic Design", CRC Press, 2012.

iii. Online resources

1. nptel.ac.in/courses/106103068/pdf/coa.pdf
2. www.svecw.edu.in/Docs%5CITIIBTechIISemLecCOA.pdf
3. www.kinindia.net/29-cs6201-digital-principles-and-system-design-notes/

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT103	Object Oriented Programming	3	0	0	3

Course Category: Program Core

a. Preamble :

This course provides an introduction to Object Oriented Programming concepts using C++. The course emphasis is on the object orientated facilities of C++ and how they can be used to create modular and re-usable code. Object-Oriented Software Development is an approach/paradigm of developing software by identifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain the concepts of object-oriented programming and basic structure of C++ programming	K2, S3
CO2	Apply the concept of constructor and destructor for given problem in C++.	K3, S3
CO3	Demonstrate the template and exception handling for simple and complex programs.	K2, S3
CO4	Construct the C++ program, by using various inheritance concepts and virtual function for given problem.	K3, S3
CO5	Discuss various File IO stream, RTTI, and standards template library.	K2, S3

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M		L							
CO2	M		M		L							
CO3	M		M		L							
CO4	M		M		L							
CO5	M		M		L							

H- High; M-Medium; L-Low

d. Course Content

UNIT I INTRODUCTION 9

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism. Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const and volatile functions - static members – Objects – pointers and objects – constant objects – nested classes – local classes

UNIT II CONSTRUTOR, COMPILE TIME POLYMORPHISM 9

Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructors – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion – explicit constructors

UNIT III INHERITANCE, RUN TIME POLYMORPHISM 9

Inheritance – public, private, and protected derivations – multiple inheritance - virtual base class – abstract class – composite objects Runtime polymorphism – virtual functions – pure virtual functions.

UNIT IV TEMPLATES, EXCEPTION HANDLING 8

Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and unexpected functions – Uncaught exception.

UNIT V RTTI, FILE HANDLING 10

RTTI – typeid – dynamic casting – RTTI and templates – cross casting – down casting.Streams and formatted I/O – I/O manipulators - file handling – random access – object serialization – namespaces - std namespace – ANSI String Objects – standard template library.

Text Books:

- B. Trivedi, “Programming with ANSI C++”, Oxford University Press, 2012.

Reference:

- Goran Svenk, “Object-oriented Programming: Using C++ for Engineering and Technology” Second Edition 2003.
- Balagurusamy, “Object-oriented Programming with C++” Tata McGraw-Hill Education, Fourth Edition 2008
- DEBASISH JANA, “C++ AND OBJECT-ORIENTED PROGRAMMING PARADIGM, Eastern Economy Edition, Second Edition OCT 2005.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT104	Python Programming	3	0	0	3

Course Category: Programme Core

a) Preamble:

This course focused on constructing reasonably self-contained programs, where the input and output either comes from a user or from files, and any "external" functionality comes from imported Python modules.

b) Course Outcomes:

Students undergoing this course are able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Interpret the basic representation of the data structures and sequential programming	K3
CO2	Knowledge of, and ability to use control framework terminologies.	K3
CO3	Ability to work out using the core data structures as lists, dictionaries, tuples, and sets.	K3
CO4	Choose appropriate programming paradigms, interrupt and handle data using files to propose solution through reusable modules.	K2
CO5	Propose possible error-handling constructs for unanticipated states/inputs	K2
CO6	Ability to use concepts of Object-orientedProgramming with python	K2

K2-Understand, K3-Apply

c) Correlation of COs with Program Outcomes :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**M**	**L**	**L**								
CO2			**M**	**L**	**L**							
CO3		**M**	**M**	**M**		**L**						
CO4		**M**	**H**	**M**	**L**	**L**						
CO5			**M**	**L**	**L**		**L**					
CO6			**M**	**H**	**H**		**L**					

H- High; M-Medium; L-Low

d) Course Content:

UNIT -1 INTRODUCTION TO PYTHON PROGRAMMING L-9

Introduction to Python, Demo of Interactive and script mode, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions.

UNIT – 2 CONTROL STRUCTURES AND FUNCTIONS L-9

Selective statements – if, if-else, nested if, if –elif ladder statements Iterative statements - while, for, Nested loops, else in loops, break, continue and pass statements. Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion and Lambda functions.

UNIT-3 COLLECTIONS, STRINGS AND REGULAR EXPRESSIONS L-9

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions Tuples: Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set. Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions. Regular expression: Matching the patterns, Search and replace.

UNIT-4 FILE HANDLING AND EXCEPTIONS L-9

Files: Open, Read, Write, Append and Close. Tell and seek methods Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-Up actions.

UNIT – 5 OBJECT ORIENTED PROGRAMMING WITH PYTHON L-9

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects - OOP, continued: inheritance, polymorphism, operator overloading; abstract classes.

Total: 45 PERIODS

e) Learning Resources

TEXT BOOKS

1. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT105	Operating Systems	3	0	0	3

Course Category: Programme Core

a) Preamble :

In this course will be discussing about Address spaces, system call interface, process/threads, inter process communication, deadlock, scheduling, memory, virtual memory, file systems.

b) Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Explain the operating system program, structures and operations with system calls	K2
CO2	Analyze the process management concept for the given situation.	K3
CO3	Handle the deadlock and get knowledge about CPU scheduling.	K3
CO4	Explain the different storage management for the given situation.	K2
CO5	Explain the mass storage structure and file system Interface.	K2

c) Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	M	M									
CO2	L	H	M	M								
CO3	L	H	M	M								
CO4	L	M	M	M								
CO5	L	M	M	L								

H- High; M-Medium; L-Low

d) Course Content:

UNIT I OPERATING SYSTEMS OVERVIEW L – 9

Operating system overview: Objectives – functions - Computer System Organization-Operating System Structure - Operating System Operations- System Calls, System Programs.

UNIT II PROCESS MANAGEMENT L – 9

Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication. Threads: Multi-threading models – Threading issues.Process Synchronization: The Critical-Section Problem - Semaphores - Classic Problems of Synchronization – Monitors. Case Study: Windows 10 operating system

UNIT III SCHEDULING AND DEADLOCK MANAGEMENT L – 9

CPU Scheduling: Scheduling Criteria - Scheduling Algorithms. Deadlocks: Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock. Case Study: MAC operating system

UNIT IV STORAGE MANAGEMENT **L – 9**

Main Memory: Swapping - Contiguous Memory Allocation, Segmentation, Paging. Virtual Memory: Demand Paging - Page Replacement - Allocation of Frames - Thrashing. Case Study: Android operating system

UNIT V STORAGE STRUCTURE **L – 9**

Mass Storage Structure: Disk Structure - Disk Scheduling - Disk Management. File-System Interface: File Concepts, Directory Structure - File Sharing – Protection. File System. Case Study: Linux operating system

TOTAL: 45 Periods

e) Learning Resources

i. Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition,John Wiley and Sons Inc., 2012.
2. Richard Petersen, "Linux: The Complete Reference", 6th Edition, Tata McGraw-Hill, 2008.

ii. Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall, Wesley, 2014.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
3. Harvey M. Deitel, "Operating Systems", 7th Edition, Prentice Hall, 2003.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 2nd Edition, Tata McGraw- Hill Education, 2007.
5. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
6. UreshVahalia, "UNIX Internals: The New Frontiers" Prentice-Hall, Englewood Cliffs, NJ, USA, 1996. ISBN: 0-13-101908-2.

iii. Online Resources:

1. http://www.tutorialspoint.com/operating_system/
2. http://www.mu.ac.in/myweb_test/MCA%20study%20material/OS%20- %20PDF.pdf
3. http://codex.cs.yale.edu/avi/os-book/OS8/os8c/slide-dir/PDF-dir/ch2.pdf

http://www.freebookcentre.net/CompuScience/Free-Operating-Systems-Books-Download.html

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT106	Web Technologies	3	0	0	3

b. Course Outcomes

Upon completion of this course, the students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Design and develop client side scripting techniques	K2, S3
CO2	Build real world applications using client side and server side scripting languages	K3, S3
CO3	Design and develop an e-governance application using web technology	K2, S3
CO4	Design Database connectivity with JSP	K3, S3
CO5	Design case study for student Information System and Health Management system	K2, S3

e. Course Contents

UNIT I WEB PAGE DESIGNING **9**

HTML - List - Tables - Images - Forms - Frames - Cascading Style sheets,* XML Document type definition - XML Schemas, Document Object model.

UNIT II SCRIPTING **9**

Java Script - Control statements - Functions - Arrays - Objects - Events - Dynamic HTML with Java Script - Ajax.

UNIT III WEB APPLICATION **9**

Web servers - IIS (XAMPP - LAMPP) and Tomcat Servers - Java Web Technologies - Servlets – Java Server Pages - Java Server Faces - Web Technologies in Netbeans - Building a Web Application in Netbeans – JSF Components - Session Tracking - Cookies.

UNIT IV PHP PROGRAMMING **9**

PHP: Basics - String Processing and Regular Expressions - Form Processing and Business Logic - Using Cookies- Dynamic Content - Operator Precedence Chart.

UNIT V JDBC **9**

Database Connectivity with MySQL - Servlets - JSP - PHP, Case Studies - Student information system – Health Management System

f. Text Books

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet & World Wide Web How to Program”, Fifth Edition, Deitel Series, 2012.

2. Jason Gilmore, “Beginning PHP and MySQL from Novice to Professional”, Fourth Edition, Apress

Publications, 2010.

Reference Books

1. Robert W. Sebesta, “Programming with World Wide Web”, Fourth Edition, Pearson, 2008.

2. David William Barron, “The World of Scripting Languages”, Wiley Publications, 2000.

3. Breitman, Karin, Marco Antonio Casanova, Walt Truszkowski, “Semantic Web: Concepts, Technologies and Applications”, Springer Science & Business Media, 2007.

4. Khan, Badrul Huda et al., “Web-Based Instruction Educational Technology”, 1997

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT107	Database Management System	3	0	0	3

Course Category: Program Core

a. Preamble:

This course provides demands the need for efficient storage and manipulation of data which will be used worldwide and exposed to different applications.

b. Course Outcomes:

At the end of the course, the students are able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Explain the basic concepts of Database Management System	K2
CO2	Write SQL Queries for the given scenario.	K3
CO3	Apply normalization techniques for the given database application.	K3
CO4	Illustrate the concepts of transaction, Concurrency and Recovery techniques in database.	K2
CO5	Describe the concept of physical storage media.	K2
CO6	Explain the various types of databases	K2

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**	**L**	**L**									
CO2	**H**	**M**	**L**		**M**							
CO3	**H**	**M**	**M**		**L**							
CO4	**L**		**L**		**L**							
CO5	**M**											
CO6	**M**											

d. Course Content

UNIT I INTRODUCTION TO DBMS L – 9

Purpose of Database System – Database Schema and Instances- Views of data – Database Languages - Database System Architecture – Database users and Administrator – Entity–Relationship model – E-R Diagrams - Introduction to relational databases –Structure of relational databases.

UNIT II RELATIONAL MODEL L – 9

Basics of the Relational Model- From E/R Diagrams to Relational Designs – Keys and Integrity Constraints - Relational Algebra – Relational Calculus-Tuple –Structured Query language(SQL) Basic and additional Operations – Nested Queries & Join Queries–Embedded SQL- Triggers - View Definitions and Modifications.

UNIT III NORMALIZATION L – 9

Introduction and problem of data redundancy-Features of good Relational database design-Functional Dependencies - Normalization – First Normal Form, Second Normal Form and Third

Normal Form –Advanced Normalization -Boyce/Codd Normal Form, Fourth Normal Form and Fifth Normal Form- Dependencies preservation-Case Studies of database system.

UNIT IV TRANSACTION AND CONCURRENCY L – 9

Transaction Concepts – ACID Properties –Transactions and Schedules- Transaction States - Concurrent Execution- Serializability- Types of Failure-Recoverability -System Recovery – Media Recovery – Types of Locks-Two Phase locking – Deadlock- Detection, Recovery and Prevention.

UNIT V PHYSICAL STORAGE AND DATABASE CONCEPTS L – 9

Overview of Physical Storage Media – Magnetic Disks – RAID – Introduction to Distributed Databases and Client/Server Databases- Statistical Databases- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Object Oriented Databases-XML Databases.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book", Pearson Education, Second Edition, 2008.
3. RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2008.
4. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

ii. References Books:

1. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. S.K.Singh, "Database Systems Concepts, Design and Applications", First Edition, Pearson Education, 2006.
3. C. J. Date ,"An Introduction to Database Systems" – 8th Edition, Addison Wesley, 2004.
4. S.K.Singh, "Database Systems Concepts, Design and Applications", First Edition, Pearson Education, 2006.

iii. Online Resources:

a) http://cs.ulb.ac.be/public/_media/teaching/infoh303/dbmsnotes.pdf
b) http://www.iitg.ernet.in/awekar/teaching/cs344fall11/lecturenotes/september%2012.pdf
c) http://sage.virtual-labs.ac.in/home/pub/1/

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT108	COMPUTER NETWORKS	3	0	0	3

Course Category: Program Core

a. Preamble :

This course is to provide students with an overview of the concepts and fundamentals of computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Describe various techniques for Encoding, decoding and Digital data communication.	K1
CO2	Explain the various keying techniques, digital data communication techniques and its standards.	K2
CO3	Experiment with various error detection and flow control techniques.	K3
CO4	Explain the various concepts of network topologies, components and categories of networks.	K2
CO5	Experiment with various network layer protocols.	K3
CO6	Illustrate the OSI layers, functions and its protocols.	K2
CO7	Experiment with various application layer protocols	K3

c. Correlation of COs with POs :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**H**	**L**		**L**	**L**						
CO2	**H**	**H**	**L**		**L**	**L**						
CO3	**H**	**H**	**H**		**L**		**M**					
CO4	**M**	**M**	**M**		**L**	**L**	**M**					
CO5	**M**	**M**	**H**		**L**	**L**	**M**					
CO6	**H**	**H**	**H**		**L**		**H**					
CO7	**H**	**H**	**H**		**H**		**H**					

H- High; M-Medium; L-Low

d. Course Content :

UNIT I INTRODUCION **L – 9**

Data Communication: Data Communication system components - Network Models - OSI Model - TCP/IP Protocol Suite - Addressing - Data and Signals - Analog And Digital - Transmission Impairment - Data rate and Channel capacity – Performance.

UNIT II PHYSICAL LAYER **L – 9**

Digital Transmission - Digital-To-Digital Conversion - Analog Transmission - Digital-To-Analog Conversion - Transmission Media - Guided Media - Unguided Media: Wireless - Wired LANs: Ethernet - Token ring - Connecting Devices – Switching techniques.

UNIT III DATA LINK LAYER **L – 9**

Link Layer: Types of errors –Error detection- VRC, LRC, CRC techniques - Data Forward and backward error correction - Hamming code. Flow control: stop and wait- sliding window protocol, Error control: Stop and wait ARQ- Go-Back-N ARQ- Selective Repeat ARQ Protocols- Asynchronous and Synchronous Protocol - HDLC frames.

UNIT IV NETWORK LAYER **L – 9**

Logical Addressing - IPv4 Addresses - IPv6 Addresses - Address Mapping – ARP – RARP, BOOTP, and DHCP – ICMP - Unicast Routing Protocols - Intra- and Interdomain Routing - Distance Vector Routing - Link State Routing.

UNIT V TRANSPORT LAYER AND APPLICATION LAYER **L – 9**

Process-to-Process Delivery: UDP – TCP - Congestion Control - Quality of Service - Techniques to Improve QoS – Application layer protocols: REMOTE LOGGING - TELNET -ELECTRONIC MAIL – DNS – SMTP – FTP - HTTP.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books:

1. Behrouz Forouzan, “Introduction to Data Communications and Networking”, Tata McGraw Hill, 5th Edition, 2015.
2. Stallings, “Data and Computer Communications”, PHI, 10th Edition, 2015.

ii.Reference:

1. William Schewber ,“Data Communication”, McGraw Hill, 1987.
2. Tanenbaum , “Computer Networks”, PHI, 5rd Edition, 2011

iii. **Online Resources**

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT109	Machine Learning	3	0	0	3

a. Preamble :

This course is a branch of computing science that deals with the specification, design and implementation of machine learning models, such systems designed to be responsive to the needs of their end-users.

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	To implement a neural network for an application of your choice using an available tool	K2,S3
CO2	To implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results	K2,S3
CO3	To use a tool to implement typical clustering algorithms for different types of applications	K2,S3
CO4	To design and implement an HMM for a sequence model type of application	K2,S3
CO5	To identify applications suitable for different types of machine learning with suitable justification.	K2,S3

c. Course Content

UNIT I INTRODUCTION 9

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning - Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison

UNIT II SUPERVISED LEARNING 9

Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- Neural Networks -Feed-forward Network Functions - Ensemble methods- Bagging- Boosting.

UNIT III UNSUPERVISED LEARNING **9**

Clustering- K-means - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality -Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA.

UNIT IV PROBABILISTIC GRAPHICAL MODELS **9**

Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes classifiers-Markov Models – Hidden Markov Models

UNIT V ADVANCED LEARNING **9**

Sampling – Basic sampling methods – Reinforcement Learning- K-Armed BanditElements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books :

1.Tom Mitchell, "Machine Learning", McGraw-Hill, 1997

2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

ii. REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006

2. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005

3. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008

4. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT110	Cloud Computing	3	0	0	3

Course Category: Program Core

a. Preamble

It aims to provide technology-oriented students with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of mobile applications and its technology.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing	**K2**
CO2	**Apply suitable virtualization concept**	**K3**
CO3	Discover the core issues of cloud computing such as security, privacy and interoperability	**K3**
CO4	Identify the architecture, infrastructure and delivery models of cloud computing	**K2**
CO5	Ability to choose the appropriate technologies, algorithms and approaches for the related issues.	**K3**

c. Correlation of COs with POs :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**		**L**		**L**							
CO2	**M**		**L**		**M**							
CO3	**M**		**M**		**M**							
CO4	**M**				**M**							
CO5	**M**				**M**							

- H- High; M-Medium; L-Low

d. Course Content :

UNIT I INTRODUCTION 9

Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture -IaaS – On-demand Provisioning – Elasticity in Cloud – E.g. of IaaS Providers - PaaS – E.g. of PaaS Providers - SaaS – E.g. of SaaS Providers – Public Private and Hybrid Clouds.

UNIT II VIRTUALIZATION 9

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Desktop Virtualization – Server Virtualization.

UNIT III CLOUD INFRASTRUCTURE 9

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT IV PROGRAMMING MODEL 9

Parallel and Distributed Programming Paradigms – Map Reduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack

UNIT V SECURITY IN THE CLOUD 9

Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

e. Learning Resources

TEXTBOOK

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

REFERENCES

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.

Online Resources

1. http://en.wikipedia.org/wiki/Cloud_computing
2. http://en.wikipedia.org/wiki/Virtualization
3. http://www.porticor.com/2009/08/cloud-computing-programming-models-part-1-of-4/
4. http://en.wikipedia.org/wiki/Cloud_computing_security

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT111	Java Programming	1	0	4	3

d. Course Content

UNIT – I BASICS OF JAVA **9**

History and Features of Java - Difference between JDK,JRE and JVM – Basic Language Elements - Lexical Tokens, Identifiers, Keywords, Literals, Comments ,Primitive Datatypes, Operators Assignments, I/O Operations, Advantage of OOPs - Object and Class - Method Overloading – Keywords – this, super, final, strictfp – call by value – call by reference - Nested classes - Constructor – Arrays

UNIT – II INHERITANCE **9**

Benefits - Types – Inheriting Data Members and Methods - Method Overriding – Polymorphism – Abstract classes and methods – Implementing Interfaces

UNIT – III MULTITHREADING **9**

Multithreading - Life Cycle of a Thread - Creating Thread - Thread Schedular - Sleeping a thread - Joining a thread - Thread Priority - Thread Pooling - Thread Group - Performing multiple task by multiple thread - Runnable class

UNIT – IV **9**

GUI , AWT, APPLET and SWINGS

UNIT – V PACKAGES AND EXCEPTION HANDLING **9**

Packages - Organizing Classes and Interfaces in Packages - Package as Access Protection - Defining Package - Naming Convention For Packages. Exceptions – Types - Control Flow In Exceptions, JVM reaction to Exceptions – try – catch - finally – throw - throws in Exception Handling - In-built and User Defined Exceptions

e. Learning Resources

TEXTBOOK:

1. Herbert Scheldt, “Java – The Complete Reference”, Ninth edition, Oracle press.

REFERENCES:

1. Simon Kendal, “Object oriented Programming using Java”, First Edition, Pearson Education
2. E. Balagurusamy, “Programming with Java – A Primer”, Third edition, McGraw-Hill companies

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT112	Cryptography and Network Security	3	0	0	3

Course Category: Program Core

a. Preamble:

This course describes the explosive growth in computer systems and their interconnections via networks, has increased the dependence of both organizations and individuals on the information stored and communicated using these systems. This, in turn, has led to a heightened awareness of the need to protect data and resources from disclosure, to guarantee the authenticity of data and messages, and to protect systems from network-based attacks and the disciplines of cryptography and network security have matured, leading to the development of practical, readily available applications to enforce network security.

b. Course Outcomes:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Compare various Cryptographic Techniques	K3
CO2	Demonstrate various data encryption techniques.	K3
CO3	Implement Hashing and Digital Signature techniques	K3
CO4	Explain the various Security Application	K2
CO5	Design and implement Secure applications	K3

c. **Correlation of COs with Program Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L								
CO2			M	L	L							
CO3		M	M	M		L						
CO4		M	M	M	L	H						
CO5			M	L	M		L					

H- High; M-Medium; L-Low

d. **Course Content:**

UNIT I FOUNDATIONS OF CRYPTOGRAPHY AND SECURITY 10

OSI Security Architecture - Security Attacks and Services. Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic.. Design Principle of Block ciphers: DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB)

UNIT II BLOCK CIPHER ALGORITHMS AND PUBLIC KEY CRYPTOGRAPHY 9

AES- RC5- Introduction to Number Theory : Prime numbers- Chinese remainder theorem-Fermat and Euler's theorem –RSA- Public Key Management - Diffie-Hellman key Exchange - Elliptic Curve Cryptography.

UNIT III AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements - Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm -SHA 512 – HMAC- Digital Signatures - Authentication Protocols - Digital Signature Standard

UNIT IV NETWORK SECURITY 9

Authentication Applications: Kerberos - X.509 Authentication Service - Electronic Mail Security - PGP - S/MIME - IP Security - Web Security.

UNIT V SYSTEM LEVEL SECURITY 8

Intrusion detection - password management - Viruses and related Threats - Virus Counter measures - Firewall Design Principles - Trusted Systems.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books:

1. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd ed, Pearson, 2007.
2. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI, 4th ed, 2006.

ii. Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition - Prentice Hall of India, 2006.

b. Online Resources:

a. williamstallings.com/Extras/Security-Notes/
b. www.cs.bilkent.edu.tr/~selcuk/teaching/cs519/

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT113	Internet of Things	3	0	0	3

Course Category: Program Core

a. Preamble:

The Internet of Things (IoT) has been called the next Industrial Revolution — it will change the way all businesses, governments, and consumers interact with the physical world.

b. Course Outcomes:

COs	Course Outcomes	Level of learning domain(Based on revised Bloom's taxonomy)
CO1	Identify and design the new models for market strategic interaction.	K2
CO2	Analyze various protocols for IoT.	K2
CO3	Design business intelligence and information security for Web of Things.	K2
CO4	Design a middleware for IoT.	K2
CO5	Analyze and design different models for network dynamics.	K3

c. **Correlation of COs with Program Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L								
CO2			M	L	L							
CO3		M	M	M		L						
CO4		M	M	M	L	H						
CO5			M	L	M		L					

H- High; M-Medium; L-Low

d. **E. Course Content:**

UNIT I INTRODUCTION **10**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– biquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user-Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware forIoT –IoT Information Security.

UNIT II IOT PROTOCOLS **8**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols –Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.

UNIT III WEB OF THINGS **10**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization forWoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards– Cloud Providers and Systems – Mobile Cloud Computing – The

Cloud of Things Architecture.

UNIT IV INTEGRATED **9**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon.

UNIT V APPLICATIONS **8**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) – Springer – 2011.

ii. Reference Books:

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.
2. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012.

c. Online Resources:

https://otalliance.org/initiatives/internet-things

a. https://otalliance.org/initiatives/internet-things
b. http://whitepapers.virtualprivatelibrary.net/internet-of-things.pdf

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT114	Finite Automata Compiler Design	3	0	0	3

b. Course outcomes:

Upon completion of this course, the student should be able to:

• Explain deterministic and non-deterministic machines.

• Comprehend the hierarchy of problems arising in the computer sciences.

• Design a deterministic finite-state machine to accept a specified language.

• Explain how a compiler can be constructed for a simple context free language.

• Determine a language's location in the Chomsky hierarchy (regular sets, context-free, context-sensitive, and recursively enumerable languages).

d. Course Content:

UNIT – I FORMAL LANGUAGE AND REGULAR EXPRESSIONS

Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA.Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

UNIT – II CONTEXT FREE GRAMMARS AND PARSING

Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing, handle pruning, LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

UNIT – III SEMANTICS

Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT – IV SYMBOL TABLE, STORAGE ORGANIZATION

storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. Code optimization Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, optimization techniques.

UNIT – V CODE GENERATION

Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

e. Learning Resources:

Text Books:

1. John E. Hopcroft, Rajeev M & J D Ullman: “Introduction to Automata Theory Languages &Computation”, 3rd Edition, Pearson Education, 2007.
2. Aho, Ullman, Ravisethi: “Compilers Principles, Techniques and Tools”, 2nd Edition, Pearson Education, 2009.

References:

1. Tremblay J P, Sorenson G P: “The Theory & Practice of Compiler writing”, 1st Edition, BSP publication, 2010.
2. Appel W & Andrew G M: “Modern Compiler Implementation in C”, 1st Edition, Cambridge University Press, 2003.
3. Louden: “Compiler Construction, Principles & Practice”, 1st Edition, Thomson Press, 2006.
4. Sipser Michael: “Introduction to Theory of computation”, 1st Edition, Thomson, 2009.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT115	Object Oriented Software Engineering	3	0	0	3

Course Category: Program Core

a. Preamble :

Software engineers are those who contribute by direct participation or by teaching, to the analysis, specification, design, development, certification, maintenance, and testing of software systems

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Discuss about software development process models	K2
CO2	Identify the contemporary issues and discuss about coding standards	K2
CO3	Recognize the knowledge about testing methods and comparison of various testing techniques.	K2
CO4	Use the concept and standards of quality and getting knowledge about software quality assurance group.	K2

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2	**L**											
CO3	**M**			**M**								
CO4	**M**			**M**								

d. Course Content :

UNIT- I INTRODUCTION **L – 9**

Introduction to Software Engineering - Software Development process models – Agile Development - Project & Process - Project management - Process & Project metrics - Object Oriented concepts, Principles & Methodologies.

UNIT- II PLANNING & SCHEDULING **L – 9**

Software Requirements Specification, Software prototyping - Software project planning - Scope - Resources - Software Estimation - Empirical Estimation Models – Planning - Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

UNIT -III ANALYSIS **L – 9**

Analysis Modeling - Data Modeling - Functional Modeling & Information Flow - Behavioral Modeling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modelling with UML.

UNIT -IV DESIGN **L – 9**

Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.

UNIT -V IMPLEMENTATION, TESTING & MAINTENANCE L – 9

Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods-White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance & Reengineering.

TOTAL: 45 Periods

e. Learning Resources

i. Text Books :

1. Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", seventh Edition, McGraw Hill, 2015.
2. Ian Sommerville, "Software Engineering", eighth edition, Pearson Education, New Delhi, 2011.
3. Bill Brykczynski, Richard D. Stutz ,"Software Engineering Project Management", Wiley India Edition, IEEE computer society, 2007.
4. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development (3rd Edition), Pearson Education, 2008.

ii.Reference:

1. Fairley R, "Software Engineering Concepts", second edition, Tata McGraw Hill,New Delhi, 2003.
2. Jalote P, "An Integrated Approach to Software Engineering", third edition, Narosa Publishers, New Delhi, 2013.
3. Grady Booch, James Rumbaugh, Ivar Jacobson - "the Unified Modeling Language User Guide" - Addison Wesley, 1999.
4. Ali Bahrami, "Object Oriented Systems Development" 1st Edition, The McGraw-Hill Company, 1999.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT116	Design and Analysis of Algorithm	3	0	0	3

a. Preamble :

For an engineer, problem solving is not about just solving a problem somehow but about solving the problem in the most effective and efficient way. Two key skills that a software professional needs are (1) to choose suitable data structures to store the information part of the problem, and (2) use of efficient algorithms for developing a programming solution of a given problem. Selection of a particular data structure greatly influences the characteristics of the obtained solution that include efficiency (performance, or speed), space (memory) requirements, scalability, reuse, and robustness (or reliability). The other equally important skill is to choose a suitable problem solving technique to apply to a particular problem. Acquiring these skills, greatly enhances the problem solving skills of the learner.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Explain various asymptotic notations and Compute the efficiency of given algorithms	K3
CO2	Apply the brute force technique to solve the given problem	K3
CO3	Use DAC technique to solve a given problem.	K3
CO4	Compute optimum solutions for the given problem.	K3
CO5	Apply B&B and B&T technique to solve combinatorial problem	K3
CO6	Discuss the improvement of computational efficiency using iterative approaches	K3

c. Correlation of COs with POs :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**M**	**L**	**L**								
CO2			**M**	**L**	**L**							
CO3		**M**	**M**	**M**		**L**						
CO4		**M**	**M**	**M**	**L**	**L**						
CO5		**M**	**M**	**L**	**L**		**L**					
CO6		**M**		**M**	**L**	L						

d. Course Content:

UNIT I INTRODUCTION L – 9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations– Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER L – 9

Brute Force: Closest-Pair Problems- Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and conquer methodology: Merge sort – Quick sort – Binary search.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE L – 9

Dynamic Programming: Computing Binomial Coefficient Warshall's and Floyd' algorithm – Knapsack Problem. Greedy Technique: Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm.

UNIT IV BACKTRACKING AND BRANCH & BOUND L – 9

Backtracking: n-Queens problem-Hamiltonian Circuit Problem - Branch and Bound: Assignment problem-Knapsack Problem- Traveling Salesman Problem

UNIT V ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER L – 9

The Maximum matching in bipartite graph. Limitations of Algorithm Power--Decision Trees- P, NP and NP-Complete Problems.

TOTAL: 45Periods

e. Learning Resources

i.Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

ii. REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
3. "Fundamentals of Computer Algorithms" by Ellis Horowitz, Sartaj Sahmi, Sanguthevar Rajasekaran, University Press, Second Edition 2008.

iii. Online Resources:

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://nptel.ac.in/courses/106101060/
3. https://www.coursera.org/course/algo

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT301	Data Structures Lab	0	0	2	1

a. Preamble :

In this course, programs will be implemented based on lab Course that is related to content which is given in theory and executed in C.

b. Course Outcomes:

Students undergoing this course are able to

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
1	Apply the different data structures for implementing solutions to practical problems	S3
2	Develop recursive programs	S3
3	Develop Programs for Searching and Sorting	S3

c. Correlation with Programme Outcomes :

H- Strong; M-Medium; L-Low

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
)1.	H		M		H							
)2.	H		M		H							
CO3	H	H	M	H								

d. Course Content

LIST OF EXPERIMENTS:

CYCLE I

S. No	Experiment name
1	Implementation of Queue using Array
2	Implementation of singly linked list
3	Infix to postfix conversion
4	Implementation of Binary Search Tree

CYCLE II

5	Implementation of Breadth First Search
6	Implementation of Depth First Search
7	Insertion sort and Bubble sort
8	Heap sort
9	Quick sort
10	Linear search and Binary search

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Stand alone desktops with C/C++ compiler 30 Nos. (or) Server with C/C++ compiler supporting 30 terminals or more.

e. Learning Resources

i. Text Book

- M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2007.

ii. Reference Books

- V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.

- R. F. Gilberg, B. A. Forouzan, “Data Structures”, Second Edition, Thomson India Edition, 2005.
- Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, “Fundamentals of Data Structure”, Computer Science Press, 1995.

iii. **Online Resources**

1. http://www.academictutorials.com/data-structure/
2. http://www.c4learn.com/data-structure/introduction-to-linked-list-c-programming/
3. http://randu.org/tutorials/c/ads.php
4. https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf
5. http://www.zentut.com/c-tutorial/
6. http://www.studytonight.com/data-structures/introduction-to-data-structures

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT302	Object Oriented Programming Lab	0	0	2	1

Course Category: Program Core

a. Preamble:

In this course, programs will be implemented based on lab syllabus that is related to content which is given in theory and executed in C.

b. Course Outcomes:

Students undergoing this course are able To

COs	Course Outcomes	(Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Learn the fundamental programming concepts and methodologies which are essential to building good C/C++ programs.	S3
CO2	Understand dynamic memory management technique, pointers, constructors, destructors.	S3
CO3	Understand the concept of function overloading, operator overloading, virtual functions and polymorphism.	S3
CO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming and inheritance.	S3
CO5	Demonstrate the use of file handling and STL concepts.	S3

c. Course Content

LIST OF EXPERIMENTS:

S. No	Topics
1	Design encapsulated C++ classes with all possible access specifiers.
2	Design a class with static, constant variables.
3	i) Design C++ class for finding distance between 2 points using default arguments. ii) Design C++ class for finding maximum of N numbers using friend function. iii) Write a program to use friend function for addition of all the even elements of array. iii) Design C++ class for calculating the area of different geometrical shapes with function overloading.
4	Write a C++ program to sort a list of numbers in ascending order using local and nested class concept.
5	Design constructor in such a way that (i)if we don't give any int argument it stores 0 as output (ii) if we give one int argument it stores araeOfCircle (iii) if we give two int argument it stores areaOfRectangle

	(iv) if we give three int argument it stores volumeOfCuboid finally write a function to return these values.
6	Design a constructor with that takes two arguments: an ARRAY and a LENGTH; sort the array in ascending order if the ARRAY is given as the first argument but in descending order if the ARRAY is given as the second; and lastly, display the output array.
7	Design a class with dynamic initialization of an object to perform arithmetic operation.
8	Implement type conversion, unary, binary, and assignment operator overloading.
9	Write a Program to sort integer, float, char arrays using template.
10	Design stack and queue classes with necessary exception handling.
11	i) Design C++ Program with virtual Functions and Abstract class. ii) Implementation of diamond problem and virtual base class
12	Design C++ Classes with necessary File Handling Concepts.
13	Write a program to implement the inheritance concepts.
14	Write a program to store the student's details: Name, Rollno, Age, Gender, phone number of multiple students. Use the object array.
15	Write a program to remove the duplicates in array and sort the elements using STL containers.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT303	Design and Analysis of Algorithm Lab	0	0	2	1

d. Course Content:

List of Experiments:

1. Implement Quick Sort algorithm to sort a given set of elements
2. Implement merge sort algorithm to sort a given set of elements
3. Implement Warshall's Algorithm
4. Implement 0/1 Knapsack problem using Dynamic Programming
5. Implement Dijkstra's algorithm to find shortest paths to other vertices
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm
7. Implement Tree Traversals
8. Print all the nodes reachable from a given starting node in a digraph using BFS, DFS method.
9. Implement Sum Of Sub-sets Problem
10. Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation
11. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
12. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
13. Implement N Queen's problem using Back Tracking.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT304	Database Management System Lab	0	0	2	1

Course Category: Program Core

a. **Preamble:**

This course starts from developing a simple query to notification and security level issues that involve views trigger events and reports. Also students are encouraged to do a Minor Project with the help of Visual basic and SQL on their own that tunes out them in finding various procedures that suits the need of the application.

b. Course Outcomes

At the end of the course, the students are able to:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Create database using DDL and retrieve data from database using DML for a given situation.	K3, S3
CO2	Experiment Nested query, Integrity Constraints and Views in database	K3, S3
CO3	Demonstrate trigger, function and procedure using PL/SQL.	K3, S3
CO4	Develop Projects using front end and back end.	K4, S3

K3-Apply, K4-Analyse, S3-Processes

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	H	L						
CO2	H	H	H	M	H							
CO3	L	M	H	M	H	L						
CO4	L	L	L		H		H		L	L		L

d. Course Content

LIST OF EXPRIMENTS

Cycle-1

1. DDL Commands – Table Creation, Altering the table structures, truncating a table and dropping a table.
2. DML Commands – Insert, Select Commands, update & delete Commands.
3. Creating relationship between the databases – Nested Queries & Join Queries
4. Creating a database and to set various possible constraints.
5. Views – Create a Virtual table (Views) based on the result set of an SQL statement.
6. To create PL/SQL functions and to implement the stored procedures in SQL (Function and Procedures).

Model practical Examination-I

Cycle-2

7. To study the basics of front end tools.
8. To implement the forms using front end tool and use oracle for database creation.
9. Triggers – To create a statement that executes automatically as a side effect of a modification to the DB.

10. Menu Design – To Design menus using menu editor in Visual Basic.
11. Reports – To generate data report from existing DB
12. Minor Project (Application Development using Oracle/Mysql)

Model practical Examination-II

f. Learning Resources:

i. Reference Books:

1. Database Management Systems solutions manual, Raghu Ramakrishnan, Johannes Gehrke, Jeff Derstadt, Scott Selikoff and Lin Zhu, third Edition, 2013
2. SQL with Guru99 by Krishna Rungta,Smashwords 2013
3. A Primer on SQL by Rahul Batra, dreamincode.net 2012
4. Learn SQL The Hard Way by Zed A. Shaw, LCodeTHW 2011
5. Developing Time-Oriented Database Applications in SQL, by Richard T. Snodgrass, Morgan Kaufmann 1999

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT305	Web Technology Lab	0	0	2	1

b. Course Outcomes

Ability to design and develop web pages using HTML, CSS, and XML

Ability to design and deploy real world applications using client side and server side scripting languages

d. Course Content:

List of Experiments:

1. Designing static web pages using HTML
2. Designing dynamic web pages using different cascading style sheets
3. Designing XML Schemas
4. Programs using Java Script
5. Programs using Java servlets and JSP
6. Designing web applications using PHP
7. Designing web applications in Net Beans Environment
8. Database Connectivity with MySQL using Java Servlets, JSP, and PHP

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT306	Python Programming Lab	0	0	2	1

Course Category: **Program Core**

b. Course Outcomes:

Students undergoing this course are able to:

COs	Course Outcomes	Level of learning domain (Based onrevised Bloom's)
CO1	To understand the problem solving approaches.	K3
CO2	To learn the basic programming constructs in Python.	K3
CO3	To practice various computing strategies for Python-based solutions to realworld problems.	K3
CO4	To use Python data structures – lists, tuples, dictionaries.	K2
CO5	To do input/output with files in Python.	K2

K2-Understand, K3-Apply

c. Correlation of COs with Program Outcomes :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	L								
CO2			M	L	L							
CO3		M	M	M		L						
CO4		M	H	M	L	L						
CO5			M	L	L		L					
CO6			M	H	H		L					

H- High; M-Medium; L-Low

d. Syllabus Content:

1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Scientific problems using Conditionals and Iterative loops. (Number series, NumberPatterns, pyramid pattern)

3. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
4. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
5. 6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
6. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
7. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
8. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)

e. Learning Resources

TEXT BOOKS

1. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revisedand updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS

1. Martic C Brown, Python: The Complete Reference, 4th Edition, McGraw HillPublishers, 2018.
2. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, 2nd Edition, Wiley India Edition, 2017.
3. Online Resources: https://www.codecademy.com/learn/python

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT307	Java Programming Lab	0	0	2	1

Course Category: Program Core

b. Course Outcomes:

CO [1]. To Understand OOP concepts and basics of Java programming.

CO[2]. To create Java programs using inheritance and polymorphism.

CO[3]. To Implement error-handling techniques using exception handling and multithreading.

CO[4]. To differentiate various collections.

CO[5]. To build files and establish database connection.

CO[6]. To develop GUI using Swing components.

d. Course Contents:

1. Develop Rational number class in Java. Use JavaDoc comments for documentation. Your implementation should use efficient representation for a rational number, i.e. (500 / 1000) should be represented as (½).
2. Develop Date class in Java similar to the one available in java.util package. Use Javadoccomments.
3. Implement Lisp-like list in Java. Write basic operations such as 'car', 'cdr', and 'cons'. If L is a list [3, 0, 2, 5], L.car() returns 3, while L.cdr() returns [0,2,5].
4. Design a Java interface for ADT Stack. Develop two different classes that implement this interface, one using array and the other using linked-list. Provide necessary exception handling in both the implementations.
5. Design a Vehicle class hierarchy in Java. Write a test program to demonstrate polymorphism.
6. Design classes for Currency, Rupee, and Dollar. Write a program that randomly generates Rupee and Dollar objects and write them into a file using object serialization. Write another program to read that file, convert to Rupee if it reads a Dollar, and while leave the value as it is if it reads a Rupee.
7. Design a scientific calculator using event-driven programming paradigm of Java.
8. Write a multi-threaded Java program to print all numbers below 100,000 that are both prime and Fibonacci number (some examples are 2, 3, 5, 13, etc.). Design a thread that generates prime numbers below 100,000 and writes them into a pipe.

Design another thread that generates Fibonacci numbers and writes them to another pipe. The main thread should read both the pipes to identify numbers common to both.

9. Develop a simple OPAC system for library using even-driven and concurrent programming paradigms of Java. Use JDBC to connect to a back-end database.

10. Develop multi-threaded echo server and a corresponding GUI client in Java.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT308	Operating System Lab	0	0	2	1

Course Category: Program Core

a. Preamble :

Operating systems are the fundamental part of every computing device to run any type of software. The increasing use of computing devices in all areas of life (leisure, work), lead to a variety of operating systems. Yet all operating systems share common principles. These principles are important for computer science students in their understanding of programming languages and software built on top of operating systems. The Operating System Laboratory, OS Lab is a course that will teach students about principles of operating systems using a constructivist approach and problem-oriented learning.

b. Course Outcomes:

Upon the successful completion of the course, learners will be able to

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Demonstrate the fundamental UNIX commands & system calls	S3
CO2	Apply the scheduling algorithms for the given problem	S3
CO3	Implement the process synchronous concept using message queue, shared memory, semaphore and Dekker's algorithm for the given situation.	S3
CO4	Experiment an algorithm to detect and avoid dead lock	S3
CO5	Implement the various methods in memory allocation and page replacement algorithm.	S3
CO6	Demonstrate the various operations of file system.	S3

K2-Understand, K3-Apply, S3-Processes

c. Correlation of COs with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**											
CO2	**H**	**M**	**L**			**L**	**L**					**L**
CO3	**H**	**M**	**L**			**L**	**L**					**L**
CO4	**H**	**M**	**L**			**L**	**L**					**L**
CO5	**H**	**M**	**L**			**L**	**L**					**L**
CO6	**M**	**M**										

d. Course Content:

Cycle I

Basics of UNIX Commands

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, and close.
2. Write programs using the I/O System calls of UNIX operating system (open, read, write, etc).
3. Given the list of processes, their CPU burst times. Display/print the Gantt chart for FCFS scheduling algorithm. Compute and print the average waiting time and average turnaround time.

4. Given the list of processes, their CPU burst times and arrival times. Display the Gantt chart for SJF scheduling algorithm. Compute and print the average waiting time and average turnaround time.

Model Practical Examination I

Cycle II

5. Given the list of processes, their CPU burst times and time quantum. Display the Gantt chart for Round robin scheduling algorithm. Compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times. Display the Gantt chart for Priority scheduling algorithm. Compute and print the average waiting time and average turnaround time.
7. Develop application using Inter-Process Communication (using shared memory, pipes or message queues).
8. Implement the Producer-Consumer problem using semaphores (using UNIX system calls)
9. Implement Memory management schemes like paging and segmentation.
10. Implement Memory allocation schemes like First fit, Best fit and Worst fit.

Model Practical Examination II

e. Learning Resources:

i. Reference Books:

1. Universal Command Guide: For Operating Systems – April 15, 2002 ,by Guy Lotgering
2. The Easy Guide to Operating Systems, Larry Miller,2012.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT309	Cloud Computing Lab	0	0	2	1

d. Course Content:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

COURSE CODE	COURSE TITLE	L	T	P	C
10211IT310	Internet of Things Lab	0	0	2	1

b. Course Outcomes:

Student will be aware of Python and Eclipse background.
Student will be get knowledge of Arduino IDE and different types of Arduino Board
Student will be writing programs using Arduino IDE and Arduino Board
Student will be get knowledge of Raspberry Pi

d. Course Content

LIST OF EXPERIMENTS

1. Study and Install Python in Eclipse and WAP for data types in python.
2. Write a Program for arithmetic operation in Python.
3. Write a Program for looping statement in Python.
4. Study and Install IDE of Arduino and different types of Arduino.
5. Write program using Arduino IDE for Blink LED.
6. Write Program for RGB LED using Arduino.
7. Study the Temperature sensor and Write Program foe monitor temperature using
8. Arduino.
9. Study and Implement RFID, NFC using Arduino.
10. Study and implement MQTT protocol using Arduino.
11. Study and Configure Raspberry Pi.
12. WAP for LED blink using Raspberry Pi.
13. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi

B.TECH – INFORMATION TECHNOLOGY
CBCS CURRICULUM
VTU R2021

PROGRAM ELECTIVE

Sl. No	Course Code	Program Specific Elective	L	T	P	C
1	10212IT101	Big Data Analytics	3	0	0	3
2	10212IT102	Software Testing	3	0	0	3
3	10212IT103	Artificial Intelligence	3	0	0	3
4	10212IT104	Digital Image Processing	3	0	0	3
5	10212IT105	Data Science in Python	3	0	0	3
6	10212IT106	R Programming	3	0	0	3
7	10212IT107	Industrial IoT	3	0	0	3
8	10212IT108	Advanced Python Programming	3	0	0	3
9	10212IT109	Edge Computing	3	0	0	3
10	10212IT110	Virtualization	3	0	0	3
11	10212IT111	Mobile Application Development	3	0	0	3
12	10212IT112	Information Coding Techniques	3	0	0	3
13	10212IT113	Data Mining Techniques	3	0	0	3
14	10212IT114	Information Retrieval	3	0	0	3
15	10212IT115	Blockchain Technologies	3	0	0	3
16	10212IT116	Software Quality Assurance	3	0	0	3
17	10212IT117	Social Network Analysis	3	0	0	3
18	10212IT118	Ethical Hacking	3	0	0	3

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT101	Big Data Analytics	3	0	0	3

Course Category: Program Elective

a. Preamble:

This course covers foundational techniques and tools required for data science and big data analytics. The course focuses on concepts, principles, and techniques applicable to any technology environment and industry and establishes a baseline that can be enhanced by further formal training and additional real-world experience.

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO No's	Course Outcomes	(Based on revised Bloom's Taxonomy)
CO1	Work with big data platform	K2
CO2	Analyze the big data analytic techniques for useful business applications.	K2, S3
CO3	Design efficient algorithms for mining the data from large volumes.	K2, S3
CO4	Analyze the HADOOP and Map Reduce technologies associated with big data analytics	K3, S3
CO5	Explore on Big Data applications Using Pig and Hive	K3, S3

c. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2	**M**											
CO3	**M**	**M**								**M**		
CO4	**M**	**M**								**M**		
CO5	**M**	**H**								**M**		

H- High; M-Medium; L-Low **g.**

d. Course Content:

UNIT I INTRODUCTION TO BIG DATA 8

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II MINING DATA STREAMS 9

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III HADOOP 10

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFSBasics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT IV HADOOP ENVIRONMENT 9

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS – Monitoring Maintenance-Hadoop benchmarks- Hadoop in the cloud

UNIT V FRAMEWORKS 9

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zoo Keeper - IBM Info Sphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

Total: 45 Hours

e. Learning Resources

i.Text Books:

1. Big Data: A Revolution That Will Transform How We Live, Work, and Think by Viktor Mayer-Schoenberger & Kenneth Cukier
2. MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems

ii.Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT102	Software Testing	3	0	0	3

Course Category: Program Elective

a. Preamble :

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include the process of executing a program or application with the intent of finding software bugs (errors or other defects).

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Illustrate the concepts in software testing, including software testing objectives, process, criteria, strategies, and methods	K2
CO2	Demonstrate software test automation problems and solutions	K2
CO3	Explain the quality measurement of software using software metrics	K2
CO4	Discuss the various models for software quality assurance	K2
CO5	Illustrate the various testing projects	K2

c. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2		**M**										
CO3				**M**								
CO4	**M**											
CO5	**M**				**M**							
….												
….												
….												

H- High; M-Medium; L-Low

d. Course Content:

UNIT I TESTING FUNDAMENTALS

Principles of testing- Software development life cycle models-Types of testing- White box testing- Black box testing- Integration Testing –System and acceptance testing- Performance testing - Regression testing – Internalization testing – Ad hoc testing – Testing of object oriented systems – Usability and accessibility testing.

UNIT II TEST MANAGEMENT AND AUTOMATION

Introduction – Test Planning – Test Management –Software test automation – Scope of automation – Test automation tools – Generic requirement for test tool/framework – Selecting a test tool – Challenges in automation.

UNIT III SOFTWARE QUALITY METRICS

Software Measurement and Metrics – Measurement Theory – Software quality metrics – Product quality metrics – Software maintenance metrics – Collecting software engineering data.

UNIT IV SOFTWARE QUALITY ASSURANCE

Software quality in business context – Planning for software quality assurance – Product quality and process quality – Software process models – ISO – Capability Maturity Model – CMMi – People CMM – Test Maturity Model.

UNIT V TESTING PROJECTS

Managing Testing projects and groups – Legal consequences of defective software – Managing a testing group – Role of testing group.

TOTAL: 45 periods

e. Learning Resources
i. References:

1. Gopal swamy Ramesh and Srinivasan Desikan, "Software Testing: Principles and Practices", Pearson Education, New Delhi, 2006.
2. Nina S Godbole, "Software Quality Assurance: Principles and Practice", Narosa Publishers, New Delhi, 2004.
3. Glenford J Myers, Corey Sandler, Tom Badgett and Todd M Thomas, "The Art of Software Testing", Wiley, USA, 2004.
4. Ilene Burnstein, "Practical Software Testing", Springer – Verlag, New Delhi, 2003.
5. John D McGregor and David A Sykes, "A Practical Guide to Testing Object-Oriented Software", Addison-Wesley Professional, USA, 2001.
6. Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, New Delhi, 2002.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT103	Artificial Intelligence	3	0	0	3

Course Category: Program Elective

a. Preamble:

Artificial intelligence (AI) is the intelligence exhibited by machines or software. It is also the name of the academic field of study which studies how to create computers and computer software that are capable of intelligent behavior

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent to solve a problem	K2
CO2	Use different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification	K2
CO3	Analyze a problem, and plan according to solve those problems	K2
CO4	Discuss the uncertainty by using various models	K2
CO5	Demonstrate learning from observation using various methods	K2

c. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2		**M**										
CO3			**M**									
CO4		**M**										
CO5		**M**		**M**								

H- High; M-Medium; L-Low

d. Course Content :

UNIT I PROBLEM SOLVING

Introduction – Agents – Problem formulation – uninformed search strategies – heuristics– informed search strategies – constraint satisfaction

UNIT II LOGICAL REASONING

Logical agents – propositional logic – inferences – first-order logic – inferences in firstorder logic – forward chaining – backward chaining – unification – resolution

UNIT III PLANNING

Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING

Uncertainty – review of probability - probabilistic Reasoning – Bayesian networks –inferences in Bayesian networks – Temporal models – Hidden Markov models

UNIT V LEARNING

Learning from observation - Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning

e. Learning resources

TEXT BOOK:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2003.

ii.REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.

ONLINE RESOURCES

http://www.annaunivedu.in/2012/09/cs2351-artificial-intelligence-syllabus.html#ixzz3awNdEdX2

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT104	Digital Image Processing	3	0	0	3

Course Category: Program Elective

a. Preamble :

This course provides an introduction regarding the various image processing techniques

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Mathematical transforms necessary for image processing.	K1
CO2	Image enhancement techniques	K2
CO3	Image restoration procedures.	K2
CO4	Image compression procedures	K2
CO5	Image segmentation and representation techniques.	K2

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		L		L							
CO2	M		L		M							
CO3	M		M		M							
CO4	M				M							
CO5	M				M							

H- High; M-Medium; L-Low

d. Course Content:

UNIT I

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Ele ments ofvisual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals

UNIT II IMAGE ENHANCEMENT

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directio nalSmoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorp hic filtering,Color image enhancement.

UNIT III IMAGERESTORATION

Image Restoration degradation model, Unconstrained restoration Lagrange multiplier and Constrain edrestoration, Inverse filteringremoval of blur caused by uniform linear motion, Wiener filtering, Geometrictransformations-spatial transformations.

UNIT IV IMAGESEGMENTATION

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation RegiongrowingRegion splitting and Merging Segmentation by morphological Waters heds basic concepts –Dam construction

UNIT V IMAGE COMPRESSION

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, VectorQuantization, Transform coding, JPEG standard, MPEG.

Total 45 periods

e. Learning Resources

i) TEXTBOOK

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson, Second Edition, 2004.
2. Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson 2002.

ii) REFERENCE BOOKS

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MAT LAB',Pearson Education, Inc., 2004.
3. D,E. Dudgeon and RM. Mersereau, , Multidimensional Digital Signal Processing', Prentice H allProfessional Technical Reference, 1990.
4. William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2002
5. Milan Sonka et aI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brooke s/Cole, VikasPublishing House, 2nd edition, 1999,

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT105	Data Science in Python	3	0	0	3

d. Course Content

UNIT – I INTRODUCTION TO DATA SCIENCE (9 hours)

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation .

UNIT – II PYTHON FOR DATA SCIENCE (9 hours)

Functions - Types and Sequences – Strings - Reading and Writing CSV files - Dates and Times –Objects - map(), Lambda and List Comprehensions - Python libraries for Data science :NumPy, Pandas

UNIT – III DATA SCIENCE TECHNIQUES (9 hours)

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

UNIT – IV BIG DATA ANALYTICS (9 hours)

Distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce - Apache Hadoop & Hadoop Ecosystem – Moving Data in and out of Hadoop.

UNIT – V DATA VISUALIZATION (9 hours)

Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph - using graphics parameters. Case studies.

Total hours: 45

e. Learning Recourses:

Text Book:

1. Ivan Idris, “Python Data Analysis”, Packt Publishing Limited, 2014

2. Noreen Burlingame and Lars Nielsen, “A Simple Introduction to DATA SCIENCE”, 2012

3.Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, *Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data*, The McGraw-Hill Companies, 2012

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT106	R Programming	3	0	0	3

b. Course Outcomes:

Upon completion of the course, the students should be able to

CO1. Study and use basic fundamental concepts to solve the real world problem using R Programming language.

CO2. Design and implement the solution using scalar, vectors, matrices and statistical Problems in R program.

CO3. Design and implement the program using data frame, list to provide the solution for Various problem.

CO4. Study about factors and tables and to solve statistical problems.

CO5. Minimize and maximize functions, simulation and visualization and statistical analysis Using R.

d. Course Content:

UNIT I INTRODUCTION 9

Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT II CONTROL STRUCTURES AND VECTORS 9

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT III LISTS 9

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT IV MANIPULATION WITH FACTORS AND TABLES 9

Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT V S -CLASSES 9

S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

TOTAL: 45 PERIODS

e. Learning Resources:

Text Books:

1. Roger D. Peng," R Programming for Data Science ", 2012
2. Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011

References:

1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2. Venables , W.N.,and Ripley,"S programming", Springer, 2000.

Web References:

1. https://swayam.gov.in/nd1_noc19_ma33/preview
2. https://data-flair.training/blogs/object-oriented-programming-in-r/
3. http://www.r-tutor.com/elementary-statistics 4. https://www.tutorialspoint.com/r/

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT107	Industrial IoT	3	0	0	3

d. Course Content:

UNIT I – INTRODUCTION TO IIoT

Introduction: Internet of Things (IoT) – Industrial Internet of Things - Sensor Technology and Industrial Applications - Insights from Ford - Sensors to IIoT - Insights from Ford - IIoT Manufacturing Examples - Economics of Sensor Technology - Common Business Cases for Sensors - Insight from Tata Steel - Productivity, Safety, and Security with IIoT -Insights from Tata Steel - IIoT Example for Pandemic Safety

UNIT II – UNDERSTANDING INDUSTRIAL INTERNET OF THINGS (IIOT)

Industrial Internet of Things and Cyber Manufacturing Systems, Application map for Industrial Cyber Physical Systems, Cyber Physical Electronics production.

Artificial Intelligence and Data Analytics for manufacturing

Application of CPS in Machine tools, Digital production, Cyber Physical system Intelligence, Introduction to big data and machine learning and condition monitoring.

UNIT III – MODELING OF CPS AND CMS

Modelling of Cyber Physical Engineering and manufacturing, Model based engineering of supervisory controllers for cyber physical systems, formal verification of system, components, Evaluation model for assessments of cyber physical production systems.

UNIT IV – ARCHITECTURAL DESIGN PATTERNS FOR CMS AND IIOT:

CPS-based manufacturing and Industries 4.0., Integration of Knowledge base data base and machine vision, Interoperability in Smart Automation, Enhancing Resiliency in Production Facilities through CPS. Communication and Networking of IIoT.

UNIT V – APPLICATION OF IIOT:

Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector.

e. Learning Resources

i. Reference Books:

1. Sabina Jeschke, Christian Brecher Houbing Song , Danda B. Rawat Editors Industrial Internet of Things Cyber Manufacturing Systems
2. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821- 140-7, Willy Publications Olivier Hersent, David Boswarthick, Omar Elloumi,
3. The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
4. Inside the Internet of Things (IoT), Deloitte University Press
5. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series
6. Five thoughts from the Father of the Internet of Things; by Phil Wainewright - Kevin Ashton
7. How Protocol Conversion Addresses IIoT Challenges: White Paper By RedLion.
8. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT108	Advanced Python Programming	3	0	0	3

d. Course Content:

UNIT-1: INTRODUCTION

Introduction to Python, use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries.

UNIT- II: OBJECT ORIENTED PROGRAMMING

OOPS Concepts, Classes and objects, Classes in Python, Constructors, Data hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and decorators.

UNIT-III: I/O AND ERROR HANDLING IN PYTHON

Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

UNIT-IV: AN INTRODUCTION TO RELATIONAL DATABASES

SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, creating a GUI that handles an event, working with components.

UNIT-V: IMPLEMENT MACHINE LEARNING ALGORITHMS

Usage of NumPy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT109	Edge Computing	3	0	0	3

d. Course Content:

UNIT I **9**

Introduction to edge computing- edge computing architectures- Big data models for edge computing -Data security and Privacy models.

UNIT II **9**

Networking models and Protocols- Computing and Storage Models- Resource allocation models – Human in the Loop Models.

UNIT III **9**

Distributed big data computing for edge computing – Distributed execution platforms- Collaborative platform and Technologies- Serverless architecture- Simulator and emulators.

UNIT IV **9**

Introduction to Middleware- Need for Edge computing Middleware- Design goals-State of Art Middleware Infrastructures- System Model-Proposed Architecture.

UNIT V **9**

Smart city enabled by Edge computing – Smart healthcare by edge computing- Smart hospitals – Smart Grids- Smart surveillance for public safety by edge computing.

Total: 45 Hours

e. Learning resources:

Textbook:

1. Edge Computing: Models, technologies and applications, Javid Taheri ; Shuiguang Deng IET Digital Library.

Reference Book:

1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor) ISBN: 978-1-119-52498-4. Wiley Series on Parallel and Distributed Computing

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT110	Virtualization	3	0	0	3

Course Category: Program Elective

a. Preamble

It aims to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments. Even something as simple as partitioning a hard drive is considered virtualization because you take one drive and partition it to create two separate hard drives. Devices, applications and human users are able to interact with the virtual resource as if it were a real single logical resource.

b. Course Outcomes :

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Deploy legacy OSs on virtual machines	**K2**
CO2	Understand the intricacies of server, storage, network, desktop and application virtualizations	**K3**
CO3	Design new models for virtualization	**K3**
CO4	Design and develop cloud applications on virtual machine platforms	**K2**
CO5	Design new models for BigData processing in cloud	**K3**

c. Correlation of COs with POs :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**		**L**		**L**							
CO2	**M**		**L**		**M**							
CO3	**M**		**M**		**M**							
CO4	**M**				**M**							
CO5	**M**				**M**							

- H- High; M-Medium; L-Low

d. Course Content :

UNIT- I INTRODUCTION TO VIRTUALIZATION

Basics of Virtualization – Virtualization Types – Model of Virtualization – Layers of Virtualization – Server Machine Virtualization - Application Virtualization – Goals of Virtualization – Taxonomy of Virtual Machines.

UNIT - II VIRTUALIZATION INFRASTRUCTURE

Hardware Virtualization- Virtual Hardware Overview – Virtual Machine Products - Sever Consolidation – Server Pooling - Types of Server Virtualization – Business cases for Sever-Virtualization –Selecting server Virtualization Platform

UNIT - III NETWORK VIRTUALIZATION

Virtual File Systems – Process Virtualization – Layers in Virtualization – Players in Virtualization - Virtualizing the Campus WAN Design – - Routing Protocols- Virtualization Aware Routing - Multi-Topology Routing – Case Studies of Network Virtualization.

UNIT - IV DESKTOP VIRTUALIZATION AND STORAGE VIRTUALIZATION

Desktop Virtualization- Preparing a Virtualization Machine Host- Storage Virtualization - iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – Virtual Information Systems.

UNIT – V SECURITY

Secure Virtual Infrastructure- Protect Virtual Infrastructure-Prepare Business Continuity -Update Management Structure

e. **Learning Resources**

Textbook:

1. Dan Kusnetzky ,"**Virtualization: A Manager's Guide**", O'Reily,2011

Reference Books

1. Danielle Ruest, Nelson Ruest," **Virtualization: A Beginner's Guide**",McGraw Hill, 2009
2. Chris Wolf, Erick M. Halter ,"**Virtualization: From Desktop to the Enterprise**", A Press, 2006

Online Resources

1.http://www.ss.pku.edu.cn/vs/style/resources/Introduction%20to%20Virtualization.pdf
2. http://www.vmware.com/in/virtualization
3.http://bradhedlund.com/2013/01/28/network-virtualization-a-next-generation-modular-platform-for-the-virtual-network/
4.http://en.wikipedia.org/wiki/Desktop_virtualization
5.http://www.vmware.com/files/pdf/cloud/vmware-cloud-solution-security-in-the-cloud-wp-en.pdf

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT111	Mobile Application Development	3	0	0	3

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Explain Basics Mobile Platform	K2
CO2	Develop Android application	K3
CO3	Familiarize in the Graphics used for Android application development	K2
CO4	Test the developed app and publish in market	K3
CO5	Explain the basic behind app development for iOS and Windows	K2

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2	**M**				**H**							
CO3	**M**				**H**							
CO4	**M**				**H**							
CO5	**M**				**H**							

H- High; M-Medium; L-Low

d. Course Content:

UNIT 1: GETTING STARTED WITH MOBILITY L – 9

Mobility landscape- Mobile platform- Mobile apps development, Overview of Android platform- setting up the mobile app development environment along with an emulator- case study on Mobile app development

UNIT II: BUILDING BLOCKS OF MOBILE APPS L – 9

App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities-App functionality beyond user interface - Threads, Async task, Services – states and lifecycle, Notifications, Broadcast receivers, Telephony and SMS

UNIT III: SPRUCING UP MOBILE APPS L – 9

Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record location awareness- native hardware access (sensors such as accelerometer and gyroscope)

UNIT IV: TESTING MOBILE APPS L – 9

Debugging mobile apps- White box testing-Black box testing- test automation of mobile apps- JUnit for Android- Robotium- MonkeyTalk

UNIT V: TAKING APPS TO MARKET **L – 9**

Versioning, signing and packaging mobile apps, distributing apps on mobile market place

TOTAL: 45 Periods

e. Learning Resources

Text Books

1. "Anubhav Pradhan, Anil V Deshpande" Composing Mobile Apps Learn|Explore|Apply using Andriod, Wiley Publications 1st Edition 2014.
2. Jeff. McWherter and Scott Gowell "Professonal Moblie Application Development" John Wiley & Sons Ltd.
3. Mark Gargenta, "Learning ANDROID", Oreilly Publication, First Edition, March 2011.
4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012

Reference Books

1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012

Online Resources

1. http://developer.android.com/develop/index.html
2. http://www.cmer.ca/cmer-ak/course_01.html
3. vjit.ac.in/new/wp-content/.../Mobile-Application-Development.doc
4. http://www.eli.sdsu.edu/courses/fall09/cs696/notes/index.html
5. http://www.slideshare.net/iivanoo/lecture01-11910341

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT112	Information Coding Techniques	3	0	0	3

a. Course Outcomes :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain Information Entropy Fundamentals.	**K2**
CO2	Describe voice and data encoding.	**K2**
CO3	Illustrate the methods to control errors in coding.	**K3**
CO4	Explain the methods to compress data using various formats.	**K2**
CO5	Explain the techniques for audio and video coding.	**K3**

c. Correlation of COs with POs :

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**		**L**		**L**							
CO2	**M**		**L**		**M**							
CO3	**M**		**M**		**M**							
CO4	**M**				**M**							
CO5	**M**				**M**							

- H- High; M-Medium; L-Low

d. Course Content:

UNIT I INFORMATION ENTROPY FUNDAMENTALS

Uncertainty - Information and entropy – Source coding theorem – Huffman coding – Shannon Fano coding – Discrete memory less channels – Channel capacity – Channel coding theorem – Channel capacity theorem.

UNIT II DATA AND VOICE CODING

Differential pulse code modulation – Adaptive differential pulse code modulation – Adaptive sub-band coding – Delta modulation – Adaptive delta modulation – Coding of speech signal at low bit rates (Vocoders – LPC).

UNIT III ERROR CONTROL CODING

Linear block codes – Syndrome decoding – Minimum distance consideration – Cyclic codes – Generator polynomial – Parity check polynomial – Encoder for cyclic codes – Calculation of syndrome – Convolutional codes.

UNIT IV COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman coding – Dynamic Huffman coding – Arithmetic coding – Image compression – Graphics interchange format – Tagged image file format – Digitized documents – Introduction to JPEG standards.

UNIT V AUDIO AND VIDEO CODING

Linear predictive coding – Code excited LPC – Perceptual coding – MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG video standards.

Total: 45

e. Learning Resources

i. Text Books

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, “Multimedia Communications - Applications Networks Protocols and Standards”, Pearson Education, 2002

ii. Reference Books

1. Mark Nelson, “Data Compression Book”, BPB, 1992.
2. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT113	Data Mining Techniques	3	0	0	3

d. Course Content:

UNIT I INTRODUCTION

Data Mining Basics: Introduction, Application areas in data mining, KDD process; Getting to Know Your Data: Data objects and attributes types; Data Pre-processing: Why pre-process data? Data cleaning, Data integration, Data transformation and reduction

UNIT II EXPLORATORY DATA ANALYSIS

Graphical Methods for Data Mining & Exploration: Histograms, Boxplots, Quantile plots, Bagplots, Glyph plots, Scatterplots, Dynamic graphics, Coplots, Dot charts, Plotting points as curves, Biplots.

UNIT III ASSOCIATION AND CORRELATION ANALYSIS

Mining Frequent Patterns: Introduction to Associations & Correlations, Market-basket analysis, Frequent item-set generation using Apriori algorithm, Rule generation; Alternative methods for Generating frequent item sets using FP-Growth algorithm, Evaluation of association patterns; From association analysis to correlation analysis.

UNIT IV CLASSIFICATION

Classification: Introduction, Naive Bayes Classifier, Decision Tree Induction, Nearest Neighbor Classifier; Classification model evaluation techniques, Techniques to improve classification accuracy: Bagging, Boosting, Handling the class imbalance problem.

UNIT V CLUSTERING

Clustering: Overview, K-Means, K Medoid, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Scalable Clustering Algorithms; Visualizing Clusters: Dendogram, Treemaps, Rectangle Plots, Data image - A Brief Introduction to Spatial Data Mining

TOTAL: 45 PERIODS

e. Learning Resources:

TEXT BOOKS:

1. J. Han, M. Kamber, and J. Pei, Data Mining Concepts and Techniques, 3rd Edition, Elsevier, 2011

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT114	Information Retrieval	3	0	0	3

b. COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

Use an open source search engine framework and explore its capabilities

Apply appropriate method of classification or clustering.

Design and implement innovative features in a search engine.

Design and implement a recommender system.

d. Course Content:

UNIT I INTRODUCTION 9

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION 9

Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III TEXT CLASSIFICATION AND CLUSTERING 9

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications

of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM **9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL: 45 PERIODS

e. Learning Resources:

TEXT BOOKS:

Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.

Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, First Edition, 2011.

REFERENCES:

C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.

Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT115	Blockchain Technologies	3	0	0	3

b. COURSE OUTCOMES

CO1: Understand emerging abstract models for Blockchain Technology.

CO2: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

d. Course Content:

UNIT-1 INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic - Hash Function, Properties of a hash function-Hash pointer and Merkle tree (9)

UNIT-2 BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments - Consensus in a Bitcoin network (9)

UNIT-3 BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW) - Hashcash PoW, Bitcoin PoW, Attacks on PoW, monopoly Problem - Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute Contracts - Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos (9)

UNIT- 4 DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance (9)

UNIT- 5 HYPER LEDGER FABRIC & ETHERUM AND BLOCKCHAIN APPLICATIONS

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code-Ethereum:

Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining, DApps, DAO -Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance (9)

TOTAL: 45

e. Learning Resources:

TEXT BOOKS

1. Kalle Rosenbaum, Grokking Bitcoin, MANNING Publication
2. Lorne Lantz & Daniel Cawrey, Mastering Blockchain Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'REILLY Publications

REFERENCES

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT116	Software Quality Assurance	3	0	0	3

Course Category: Program Elective

a. Preamble:

This course covers the principles of software development emphasizing processes and activities of quality assurance.

b. Course Outcomes:

Upon the successful completion of the course, learners will be able to

CO Nos	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
C01	Relate Quality Assurance Plan	K2
C02	Understand how to conduct formal inspections, record and evaluate results of inspection	K3
C03	Apply quality tools and technique in their projects	K3
C04	Establish software development with quality plan	K3
C05	Explain about standard and certification	K2

K2 – Understand, K3 - Apply

c. Correlation of COs with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	M		L		M							
CO3	M	M	L		M							
CO4	M		L		M							
CO5	M											

H- High; M-Medium; L-Low

d. Course Content:

UNIT I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9

The Role of SQA – SQA Plan – SQA considerations – SQA people – Quality Management – Software Configuration Management

UNIT II MANAGING SOFTWARE QUALITY 9

Managing Software Organizations – Managing Software Quality – Defect Prevention – Software Quality Assurance Management

UNIT III SOFTWARE QUALITY ASSURANCE METRICS 9

Software Quality – Total Quality Management (TQM) – Quality Metrics – Software Quality Metrics Analysis

UNIT IV SOFTWARE QUALITY PROGRAM 9

Software Quality Program Concepts – Establishment of a Software Quality Program – Software Quality Assurance Planning – An Overview – Purpose & Scope.

UNIT V SOFTWARE QUALITY ASSURANCE STANDARDIZATION 9

Software Standards–ISO 9000 Quality System Standards - Capability Maturity Model and the Role of SQA in Software Development Maturity – SEI CMM Level 5 – Comparison of ISO 9000 Model with SEI's CMM

TOTAL: 45 periods

e. Learning Resources

Text Books

1. Mordechai Ben-Menachem / Garry S Marliss, "Software Quality", Vikas Publishing House, Pvt, Ltd., New Delhi.
2. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc.

Reference Books

1. Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition, Artech House Publishers 2007
2. Nina S Godbole, "Software Quality Assurance: Principles and Practice", Alpha Science International, Ltd, 2004

Online References

1. www.ou.ac.lk/science/.../277-cpu3147-software-quality-assurance
2. www.site.uottawa.ca/~awilliam/seg3203/May02.ppt
3. www.slideshare.net/.../sdpm-lecture-8-software-quality-assurance
4. ceng482.cankaya.edu.tr/.../CENG%20482_W1_publish_RLSD.pdf

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT118	Ethical Hacking	3	0	0	3

Course Category: Program Elective

a. Preamble:

This Ethical hacking course is used to investigate the importance of ethical hacking and its implementation in organizations.

b. Course Outcomes:

COs	Course Outcomes	Level of learning domain(Based on revised Bloom's taxonomy)
CO1	nd hacking attacks and protect data assets	K2
CO2	To get knowledge on various scanning methodologies and Enumeration Techniques	K2
CO3	Defend a computer against a variety of security attacks using various tools	K2
CO4	Practice and use safe techniques on the World Wide Web	K2
CO5	To get familiarized with the different phases in penetration testing.	K3

d. Course Content:

UNIT I INTRODUCTION TO HACKING 9

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines.

UNIT II SCANNING AND ENUMERATION 9

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

UNIT III SYSTEM HACKING 9

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Counter measures – Escalating Privileges – Executing Applications – Key loggers and Spyware.

UNIT IV PROGRAMMING FOR SECURITY PROFESSIONALS 9

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

UNIT V PENETRATION TESTING 9

Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing – Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools

TOTAL: 45 PERIODS

h. Learning Resources

i. Text Books:

1. Ec-Council, "Ethical Hacking and Countermeasures: Attack Phases", Delmar Cengage Learning, 2009.
2. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2012.

ii.**References:**

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013.
2. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

B.TECH – INFORMATION TECHNOLOGY
CBCS CURRICULUM
VTU R2021
OPEN ELECTIVE COURSES

Sl. No	Course Code	Program Specific Elective	L	T	P	C
1	10213IT201	C++ Programming and Lab	2	0	2	4
2	10213IT202	SQL Fundamentals and Lab	2	0	2	4
3	10213IT101	Scripting Languages	3	0	0	3
4	10213IT102	Programming in java	3	0	0	3
5	10213IT103	Artificial Intelligence	3	0	0	3
6	10213IT104	Python Programming	3	0	0	3
7	10213IT105	Computer Networks	3	0	0	3
8	10213IT106	Data Structures	3	0	0	3
9	10213IT107	Database Management System	3	0	0	3

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT201	C++ Programming and Lab	2	0	2	4

d. Course Content:

List of Experiments:

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.

2. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.

3. Implement the concept of friend function in the following program: Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.

4. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).Implement this program using abstract class concept.

5. Write a C++ to illustrate the concepts of file I/O operations.

6. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.

7. Write a C++ program to allocate memory using new operator.

8. Write a C++ program to create an array of pointers. Invoke functions using array objects.

9. A Bank gives 4% interest on current account and 6% interest on savings account. An additional 3% interest is provided for savings duration of 5 years and above. Using dynamicinitialization of constructor write banking program using C++

10. Write a C++ program to create a class called COMPLEX and implement the following overloading functions ADD that return a COMPLEX number. a. ADD (a, s2) - where a is an integer (real part) and s2 is a complex number. b. ADD (s1, s2)-where s1 & s2 are complex numbers.

11. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consists of roll no., name (a string of 30 or lesser no.of characters) and marks.

12. Write a Program to display names, roll no‘s, and grades of 3 students who have appeared in the examination. Declare the class of name, roll no‘s and grade. Create an array of class objects. Read and display the contents of the array.

13. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT202	SQL Fundamentals and Lab	2	0	2	4

UNIT 1: BASIC CONCEPTS

Introduction to Databases – Database design-Process of database design - ER Model – ER diagram- Identifying entities, attributes and its relationships - Relational Algebra – Relational Calculus- Keys and Integrity Constraints

UNIT II: DDL, DML AND JOINS

Data definition language-Data Manipulation Language- SQL Syntax Rules -Retrieving Data using the SQL SELECT Statement -The WHERE Statement- SQL Operators - SQL Data Types - Sub queries and Nested queries - LIKE and MIN- Joining Tables - Types of Join –Clauses – Conditions – Aliases.

UNIT III: NORMALIZATION

Functional Dependencies - Normalization – First Normal Form, Second Normal Form and Third Normal Form –Advanced Normalization -Boyce/Codd Normal Form

UNIT IV: PL/SQL PROCEDURES

Control structure, stored procedures, Triggers - View Definitions and Modifications, SQL Injections and SQL Hosting.

UNIT V: FORM DESIGN AND DATABASE CONNECTIVITY

Forms and menu design (using visual basic) – database connectivity: JDBC, ODBC - Report generation- Case Studies.

Learning Resources

i. Text Book

1. SQL: The Complete Reference, 3 rd Edition, James R.Groff, Paul.N.Weinberg. Andrew J.Oppel, McGraw – Hill Education

ii. References

1. SQL QuickStart Guide: The Simplified Beginner's Guide To SQL , ClydeBank Technology .

2. SQL: The Ultimate Beginners Guide: Learn SQL Today, Steve Tale .

3. Learning SQL: Master SQL Fundamentals 2nd Edition by Alan Beauli**.**

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT101	Scripting Languages	3	0	0	3

Course Outcomes:

- Comprehend the differences between typical scripting languages and typical system and application programming languages.
- Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.
- Acquire programming skills in scripting language.

UNIT - I

Introduction: Ruby, Rails, the structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and webservices RubyTk – Simple Tk Application, widgets, Binding events, Canvas, scrolling

UNIT - II

Extending Ruby: Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

UNIT - III

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT - IV

Advanced Perl Finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT - V

TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. TK: TK-Visual Tool Kits, Fundamental Concepts of TK, TK by example, Events and Binding, Perl-TK.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.

2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly

3. "Programming Ruby" The Pramatic Progammers guide by Dabve Thomas Second edition

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J.Lee and B. Ware (Addison Wesley) Pearson Education.

2. Perl by Example, E. Quigley, Pearson Education.

3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.

4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.

5. Perl Power, J.P. Flynt, Cengage Learning.

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT102	Programming in Java	3	0	0	3

Course Category: Program Core
Course Outcomes:

CO [1]. To Understand OOP concepts and basics of Java programming.

CO[2]. To create Java programs using inheritance and polymorphism.

CO[3]. To Implement error-handling techniques using exception handling and multithreading.

CO[4].To differentiate various collections.

CO[5].To build files and establish database connection.

CO[6].To develop GUI using Swing components.

Course Content:

1. Develop Rational number class in Java. Use JavaDoc comments for documentation. Your implementation should use efficient representation for a rational number, i.e. (500 / 1000) should be represented as (½).

2. Develop Date class in Java similar to the one available in java.util package. Use Javadoccomments.

3. Implement Lisp-like list in Java. Write basic operations such as 'car', 'cdr', and 'cons'. If L is a list [3, 0, 2, 5], L.car() returns 3, while L.cdr() returns [0,2,5].

4. Design a Java interface for ADT Stack. Develop two different classes that implement this interface, one using array and the other using linked-list. Provide necessary exception handling in both the implementations.

5. Design a Vehicle class hierarchy in Java. Write a test program to demonstrate polymorphism.

6. Design classes for Currency, Rupee, and Dollar. Write a program that randomly generates Rupee and Dollar objects and write them into a file using object serialization. Write another program to read that file, convert to Rupee if it reads a Dollar, and while leave the value as it is if it reads a Rupee.

7. Design a scientific calculator using event-driven programming paradigm of Java.

8. Write a multi-threaded Java program to print all numbers below 100,000 that are both prime and Fibonacci number (some examples are 2, 3, 5, 13, etc.). Design a thread that generates prime numbers below 100,000 and writes them into a pipe. Design another thread that generates Fibonacci numbers and writes them to

another pipe. The main thread should read both the pipes to identify numbers common to both.

9. Develop a simple OPAC system for library using even-driven and concurrent programming paradigms of Java. Use JDBC to connect to a back-end database.

10. Develop multi-threaded echo server and a corresponding GUI client in Java.

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT103	Artificial Intelligence	3	0	0	3

Course Category: Program Elective

a. Preamble:

Artificial intelligence (AI) is the intelligence exhibited by machines or software. It is also the name of the academic field of study which studies how to create computers and computer software that are capable of intelligent behavior

b. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent to solve a problem	K2
CO2	Use different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification	K2
CO3	Analyze a problem, and plan according to solve those problems	K2
CO4	Discuss the uncertainty by using various models	K2
CO5	Demonstrate learning from observation using various methods	K2

c. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**											
CO2		**M**										
CO3			**M**									
CO4		**M**										
CO5		**M**		**M**								

H- High; M-Medium; L-Low

d. Course Content :

UNIT I PROBLEM SOLVING

Introduction – Agents – Problem formulation – uninformed search strategies – heuristics– informed search strategies – constraint satisfaction

UNIT II LOGICAL REASONING

Logical agents – propositional logic – inferences – first-order logic – inferences in firstorder logic – forward chaining – backward chaining – unification – resolution

UNIT III PLANNING

Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING

Uncertainty – review of probability - probabilistic reasoning – Bayesian networks –inferences in Bayesian networks – Temporal models – Hidden Markov models

UNIT V LEARNING

Learning from observation - Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning

b. Learning resources

TEXT BOOK:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2003.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.

ONLINE RESOURCES

http://www.annaunivedu.in/2012/09/cs2351-artificial-intelligence-syllabus.html#ixzz3awNdEdX2

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT104	Python Programming	3	0	0	3

Course Category: Program Elective

a. Preamble:

This course focused on constructing reasonably self-contained programs, where the input and output either comes from a user or from files, and any "external" functionality comes from imported Python modules.

b. Course Outcomes:

Students undergoing this course are able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Explain various operators used in python.	K3
CO2	Apply the string handling functions to solve the given problem	K3
CO3	Use image processing techniques with python programming to solve a given problem.	K3
CO4	Describe Object oriented concepts with python	K2
CO5	Discuss the functions of networking with python	K2

K2-Understand, K3-Apply

c. Correlation of COs with Program Outcomes :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**M**	**L**	**L**								
CO2			**M**	**L**	**L**							
CO3		**M**	**M**	**M**		**L**						
CO4		**M**	**M**	**M**	**L**	**L**						
CO5			**M**	**L**	**L**		**L**					

H- High; M-Medium; L-Low

d. Course Content:

UNIT I INTRODUCTION L- 9

installing Python; basic syntax, interactive shell, editing, saving, and running a script- variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages;

UNIT II CONDITIONAL STATEMENT & STRING HANDLING L- 9

Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation - Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.

UNIT III IMAGE PROCESSINGWITH PYTHON L-9

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions- Simple Graphics and Image Processing: "turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing Simple image manipulations with 'image' module (convert to bw, greyscale, blur, etc).

UNIT IV OBJECT ORIENTED PROGRAMMING WITH PYTHON L- 9

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects - OOP, continued: inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block

UNIT V NETWORKINGWITH PYTHON L- 9

Multithreading, Networks, and Client/Server Programming; introduction to HTML, interacting with remote HTML server, running html-based queries, downloading pages; CGI programming, programming a simple CGI form.

Total: 45 PERIODS

e. Learning Resources

Text Book:

1. "Learning Python: Powerful Object-Oriented Programming: 5th Edition Shroff; Fifth edition (24 July 2013)

Reference Books

1. "Python Essential Reference". Addison-Wesley Professional; 4 edition (July 19, 2009) by David M.Baezly
2. "Python Cookbook" O'Reilly Media; 3 edition (June 1, 2013) by David M.Baezly.

Online Resources:

https://www.codecademy.com/**learn**/**python**
www.**learnpython**.org/

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT105	Computer Networks	3	0	0	3

COURSE OUTCOMES:

Students undergoing this course are able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
C01	Describe various modes of communication and devices	K2
C02	Illustrate the function of layers	K2
C03	Various switching formats and connecting services	K2
C04	Describe various form of security	K2
C05	Apply various protocols and explain about their applications	K3

COURSE CONTENT

UNIT I INTRODUCTION L-9+T-3

Networks Applications, Network devices: Hub, Switches, Bridges, Routers, Gateways, Network card, Line configuration - point to point- Multipoint, Topology - Mesh - Star- Tree-Bus-Ring-Hybrid: Categories of Networks: LAN, WAN, MAN.

UNIT II FUNCTIONS OF LAYERS L-9+T-3

Transmission Modes: Simplex, Half duplex, Full duplex - OSI Model - Functions of layers – Signals: Analog Signals & Digital Signals, Transmission Media: guided media- twisted pair cable, coaxial cable, fiber optic cable, un-guided media.

UNIT III SWITCHING TECHNIQUES L-9+T-3

Types of error: single bit error, Burst error, Switching **Techniques:** Circuit Switching, Packet Switching, and Message Switching - Connection Oriented & Connectionless Services.

UNIT IV CRYPTOGRAPHY L-9+T-3

Presentation Layer: Translation-direct method and indirect method - encryption/decryption-conventional methods: character level encryption, bit level encryption - public key method: DES algorithm, RSA algorithm, Authentication, Data Compression.

UNIT V PROTOCOLS L-9+T-3

Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW –.Case Study: ATM, TCP/IP – Overview. **TOTAL: 45+15 = 60 hours**

LEARNING RESOURSES:

TEXT BOOKS

1. Behrouz Forouzan, "Data Communication and Networks", McGraw Hill, 2012
2. Andrew S. Tanenbaum , Computer Networks, Prentice Hall of India,2011.

REFERENCE BOOKS BOOKS

- James F. Kurose and Keith W. Ross Pearson "**Computer Networking: A Top-Down Approach**"Addison-Wesley, Boston MA , Ó2008. ISBN 0 - 321 - 49770 – 8
- Bruce A. Hallberg" **Networking: A Beginner's Guide**" McGraw-Hill / Osborne, 2003 ISBN 0 - 07 - 222563 – 7
  - William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education, 2007.
  - Nader F. Mir, "Computer and Communication Networks", First Edition, Pearson Education, 2007
  - Douglas E. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2003.
  - Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, Pearson Education, 2002.

ONLINE LEARNING:

1. www.sciencedirect.com/science/journal/13891286
2. www.functionx.com/**networking**/
3. nptel.iitm.ac.in/video.php?subjectId=106105081
4. www.cisco.com/in/Network_Security

http://www.technolamp.co.in/2010/08/computer-networks-tanenbaum-powerpoint.html

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT106	DATA STRUCTURES	3	0	0	3

a. Preamble:

This course provides an introduction to the basic concepts and techniques of Linear and nonlinear data Structures and Analyze the various algorithm.

d. Course Outcomes:

Upon the successful completion of the course, students will be able to:

COs	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Identify user defined data types, linear data structures for solving real world problems.	K2
CO2	Write modular programs on nonlinear data structures and algorithms for solving engineering problems efficiently.	K3
CO3	Illustrate some of the special trees and Hashing Techniques.	K2
CO4	State what is an undirected graph, directed graph and apply BFS and DFS to traverse a graph	K2
CO5	Demonstrate knowledge of sorting algorithms and their run-time complexity.	K3

A. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L							
CO2	M		M		L							
CO3	M		M		L							
CO4	M		M		L							
CO5	M		M		L							

H- High; M-Medium; L-Low

B. Course Content :

UNIT I LINEAR DATA STRUCTURE **L – 9**

Introduction - Time and space complexity analysis - Abstract Data Type (ADT) – The List ADT – Array Implementation – Linked List Implementation– the Stack ADT – The Queue ADT – Applications of Stack, Queue and List.

UNIT II TREES **L – 9**

Introduction to trees - Tree Traversal - Binary Trees - Definitions – Expression Tree – Binary Tree Traversals - The Search Tree ADT – Binary Search Trees - AVL Tree.

UNIT III SPECIAL TREES & HASHING **L – 9**

Splay Tree – B-Tree - Priority Queue - Binary Heap –. Hashing - Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing –Rehashing

UNIT IV GRAPH **L – 9**

Introduction to Graphs - Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths –Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm- Kruskal's Algorithm – Breadth first search – Depth-First Search – Undirected Graphs – Biconnectivity.

UNIT V SORTING & SEARCHING **L – 9**

Sorting algorithm- Insertion sort- Selection sort- Shell sort-Bubble sort- Quick sort- Heap sort- Merge sort- Radix sort - Searching – Linear search - Binary search.

Total: 45 Periods

C. Learning Resources

i. Text Books:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition , Pearson Education, 2007.

ii. Reference:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.
2. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Edition, 2005.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structure", Computer Science Press, 1995.

iii. Online resources

1. http://simplenotions.wordpress.com/2009/05/13/java-standard-data-structures-big-o-notation/
2. http://mathworld.wolfram.com/DataStructure.html/.

COURSE CODE	COURSE TITLE	L	T	P	C
10213IT107	Database Management System	3	0	0	3

a. **Preamble:**

This course provides demands the need for efficient storage and manipulation of data which will be used worldwide and exposed to different applications.

b. Course Outcomes:

At the end of the course, the students are able to:

COs	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Explain the basic concepts of Database Management System	K2
CO2	Write SQL Queries for the given scenario.	K3
CO3	Apply normalization techniques for the given database application.	K3
CO4	Illustrate the concepts of transaction, Concurrency and Recovery techniques in database.	K2
CO5	Describe the concept of physical storage media.	K2
CO6	Explain the various types of databases	K2

c. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**	**L**	**L**									
CO2	**H**	**M**	**L**		**M**							
CO3	**H**	**M**	**M**		**L**							
CO4	**L**		**L**		**L**							
CO5	**M**											
CO6	**M**											

d. Course Content

UNIT I INTRODUCTION TO DBMS L – 9

Purpose of Database System – Database Schema and Instances- Views of data – Database Languages - Database System Architecture – Database users and Administrator – Entity– Relationship model – E-R Diagrams - Introduction to relational databases –Structure of relational databases.

UNIT II RELATIONAL MODEL L – 9

Basics of the Relational Model- From E/R Diagrams to Relational Designs – Keys and Integrity Constraints - Relational Algebra – Relational Calculus-Tuple –Structured Query language(SQL) Basic and additional Operations – Nested Queries & Join Queries–Embedded SQL- Triggers - View Definitions and Modifications.

UNIT III NORMALIZATION L – 9

Introduction and problem of data redundancy-Features of good Relational database design-Functional Dependencies - Normalization – First Normal Form, Second Normal Form and Third Normal Form –Advanced Normalization -Boyce/Codd Normal Form, Fourth Normal Form and Fifth Normal Form- Dependencies preservation-Case Studies of database system.

UNIT IV TRANSACTION AND CONCURRENCY L – 9

Transaction Concepts – ACID Properties –Transactions and Schedules- Transaction States - Concurrent Execution- Serializability- Types of Failure-Recoverability -System Recovery – Media Recovery – Types of Locks-Two Phase locking – Deadlock- Detection, Recovery and Prevention.

UNIT V PHYSICAL STORAGE AND DATABASE CONCEPTS L – 9

Overview of Physical Storage Media – Magnetic Disks – RAID – Introduction to Distributed Databases and Client/Server Databases- Statistical Databases- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Object Oriented Databases-XML Databases.

TOTAL: 45 Periods

e. Learning Resources

iv. Text Books:

5. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
6. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, “Database Systems: The Complete Book”, Pearson Education, Second Edition, 2008.
7. RamezElmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.
8. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

v. References Books:

5. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
6. S.K.Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006.
7. C. J. Date ,”An Introduction to Database Systems” – 8th Edition, Addison Wesley, 2004.
8. S.K.Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006.

vi. Online Resources:

d) http://cs.ulb.ac.be/public/_media/teaching/infoh303/dbmsnotes.pdf
e) http://www.iitg.ernet.in/awekar/teaching/cs344fall11/lecturenotes/september%2012.pdf
f) http://sage.virtual-labs.ac.in/home/pub/1/

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B.TECH – INFORMATION TECHNOLOGY

CBCS CURRICULUM
VTU R21
CLOUD COMPUTING SPECIALIZATION COURSES

Sl. No	Course Code	Program Core	L	T	P	C
1	10212IT121	Introduction to Virtualization and Cloud Computing	3	0	0	3
2	10212IT122	Cloud Computing: Tools and Techniques	3	0	0	3
3	10212IT123	Hadoop Platform and Application Framework	3	0	0	3
4	10212IT124	Big Data Essentials: HDFS, MapReduce	3	0	0	3
5	10212IT125	AWS Fundamentals	3	0	0	3
6	10212IT301	Cloud Deployment Models Lab	0	0	2	1
7	10212IT302	Virtualization and Cloud Computing Lab	0	0	2	1
8	10212IT303	Cloud Computing Architecture Lab	0	0	2	1

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT121	Introduction to Virtualization and Cloud Computing	3	0	0	3

UNIT I: Introduction: Cloud computing in a nutshell, Layers and types, Features, Deployment models, Challenges and tasks, Migration into a cloud.

UNIT II: Cloud Services: Web based applications, Pros and Cons of cloud services: Platform as a service Infrastructure as a service - service - software as a service, Discovering cloud services, development services and tools, cloud maturity levels, clouds.

UNIT III: Virtual Machines: Provisioning and manageability, migration, provisioning in the cloud context, Management of VM Anatomy of cloud infrastructures - Scheduling techniques.

UNIT IV: Map Reduce Paradigms: Introduction, GFS Architecture, HDFS Architecture, Hbase, Google big Tables, Amazon's key value pair storage and Microsoft's Azure infrastructure, Map reduce programming model and implementations.

UNIT V: Monitorzing And Management: Federated cloud computing, SLA Management: Types - Lifecycle - Automated policy management in cloud. Cloud Computing Framework: Amazon EC3, S3 storage services, Aneka framework, Google App Engine, Eucalyptus cloud computing platform, IBM Bluemix.

TEXT BOOKS: 1. Rajkumar Buyya, James Broberg and Andrzej Goscinskj, "Cloud Computing: Principles and Paradigms", John willey and Sons, New Delhi, 2011.

REFERENCE BOOKS: 1. Judith Hurwitz, Marcia Kaufman, Fern Halper and Daniel Kirsch," Hybird Cloud for Dummies", Willey Publications, New Delhi, 2012.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT122	Cloud Computing: Tools and Techniques	3	0	0	3

Course Contents:

Module-I: Cloud Computing Overview

OriginsofCloudcomputing–Cloudcomponents-Essentialcharacteristics–On-demandself-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

Module-II: Cloud Insights

Architectural influences–High-performance computing, Utility and Enterprise grid computing, Cloud scenarios–Benefits: scalability, simplicity, vendors, security, Limitations– Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

Module-III: Cloud Architecture-Layers and Models

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption.

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

Module-IV: Cloud Simulators – CloudSim and Green Cloud

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture (User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

Module-V: Introduction to VMWare Simulator

Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stoppinga virtual machine.

Text & References:

Textbooks:

- Cloudcomputingapracticalapproach-AnthonyT.Velte,TobyJ.VelteRobertElsenpeter,TATAMcGraw-Hill ,New Delhi–2010
- Cloud Computing: Web- Based Applications That Change the Way You Work and Collaborate Online-Michael Miller-Que 2008

References:

- Cloud computing for dummies- JudithHurwitz,RobinBloor,MarciaKaufman,FernHalper,WileyPublishing, Inc, 2010
- CloudComputing(PrinciplesandParadigms),EditedbyRajkumarBuyya,JamesBroberg,Andrzej Goscinski,JohnWiley&Sons, Inc. 2011

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT123	Hadoop Platform And Application Framework	3	0	0	3

UNIT-1 HADOOP BASICS

Hadoop Stack Basics, the Apache Framework: Basic Modules, Hadoop Distributed File System (HDFS), the Hadoop "Zoo", Hadoop Ecosystem Major Components,

UNIT-2 HADOOP STACK

Overview of the Hadoop Stack, The Hadoop Distributed File System (HDFS) and HDFS2, MapReduce Framework and YARN, The Hadoop Execution Environment, YARN, Tez, and Spark, Hadoop Resource Scheduling, Hadoop-Based Applications, Apache Pig, Apache HIVE, Apache HBASE

UNIT-3 HADOOP DISTRIBUTED FILE SYSTEM (HDFS)

Overview of HDFS Architecture, The HDFS Performance Envelope, Read/Write Processes in HDFS, HDFS Tuning Parameters, HDFS Performance and Robustness, Overview of HDFS Access, APIs, and Applications, HDFS Commands, Native Java API for HDFS. REST API for HDFS

UNIT-4 MAP/REDUCE

Introduction to Map/Reduce, The Map/Reduce Framework, A MapReduce Example: Wordcount in detail, MapReduce: Intro to Examples and Principles, MapReduce Example: Trending Wordcount, MapReduce Example: Joining Data, MapReduce Example: Vector Multiplication, Computational Costs of Vector Multiplication

UNIT-5 APACHE SPARK

Introduction to Apache Spark: Architecture of Spark - Setup PySpark on Cloudera VM, Resilient Distributed Datasets and Transformations: Resilient Distributed Datasets - Spark Transformation - Wide Transformation - Job Scheduling - Actions, Caching and Shared Variables: Directed Acyclic Graph (DAG) Scheduler -Actions in Spark - Memory Caching in Spark - Broadcast Variables - Accumulators

Text Book

1. White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.

Reference Book

2. Chuck P. Lam, Mark W. Davis, and AjitGaddam, Hadoop in Action, Second Edition

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT124	Big Data Essential : HDFS, MapReduce	3	0	0	3

UNIT I: INTRODUCTION TO BIG DATA AND HADOOP

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II: HDFS (HADOOP DISTRIBUTED FILE SYSTEM)

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III: MAPREDUCE

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV: HADOOP ECO SYSTEM PIG

Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction

UNIT V: DATA ANALYTICS WITH R MACHINE LEARNING:

Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Text Books

• Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

• Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015. References

• Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT125	AWS Fundamentals	3	0	0	3

UNIT I – AWS CLOUD TECHNICAL ESSENTIALS

Introduction to AWS – Management Console – Creating an AWS account – AWS IAM – Amazon S3 simple storage service – Other Services-Back bone of AWS (EC2)

UNIT II – SECURITY RISK OF AWS

Developing and managing applications on AWS- Security on AWS-AWS Shared Responsibility Model-demonstrations of Amazon GuardDuty, AWS Secrets Manager, and cross-account access.

UNIT III – AWS DATABASE SERVICES

Introduction-Advantages-Types-AWS RDS-AWS Redshift-AWS Aurora-Amazon AWS DynamoDB-Amazon AWS ElastiCache

UNIT IV – AWS IAM AND APPLICATION SERVICES

What is IAM-Working-components-features-principles-security best practices-IAM identities-AWS SQS-Aws SWF-AWS SNS-Elastic Transcoder-AWS Kinesis

UNIT IV – STORAGE SERVICES

Amazon S3 concepts-Storage Classes-Versioning-Cross region replication-Life cycle management-CloudFront CDN-Storage gateway-AWS Snowball-S3 transfer acceleration

Text books:

1. “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud” by Mark Wilkins Released July 2019 Publisher(s): Addison-Wesley Professional ISBN: 9780135301104

2. “Amazon web services in action” by Andreas Witting, Michael Wittig, Hanning publisher

References:

1. “Learning AWS – design build and deploy responsive applications using AWS cloud components”, by Aurobindo Sarkar, Amit shah, PACKT enterprise

2. “AWS administration – the definitive guide” by Yohan Wadia, PACKT enterprise

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT301	Cloud Deployment Models Lab	0	0	2	1

1. Creating AWS S3 bucket
2. Message queue service using AWS SNS and SQS
3. Creation of ChatBot using Amazon Lex
4. Install KVM emulator(Virtual Machine Manager) in Linux and Create Nested Virtual Machine(VM under another VM)
5. Configure and run integrated software packages from virtual appliances(VMWARE marketplace)
6. How to activate AWS Educate account
7. Create virtual IT infrastructure cost of company and make component wise comparison using AWS TCO calculator
8. Create Software Application developement environment in AWS:Cloud9

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT302	Virtualization and Cloud Computing Lab	0	0	2	1

1. Create type 2 virtualization in VMWARE. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2. Adding a New Virtual Disk to a Virtual Machine. Convert basic disc to dynamic disc and vice versa
3. a. Shrink and extend virtual disk
   b. Create, Manage, Configure and schedule snapshots
   c. Create Spanned, Mirrored and Striped volume
   d. Create RAID 5 volume
4. Sharing and data transfer between the virtual machines
5. a. Desktop Virtualization using VNC
   b. Desktop Virtualization using Chrome Remote Desktop
6. Create type 2 virtualization on ESXI 6.5 server
7. Access ESXI server from another VM and create multiple OS on top of ESXI 6.5 server
8. Create ESXI server as Bare metal OS
9. Create a VLAN in CISCO packet tracer
10. Install KVM in Linux
11. Create a VPN from one virtual machine to another virtual and pass data secure way
12. Create Nested Virtual Machine (VM under another VM)

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT303	Cloud Computing Architecture Lab	0	0	2	1

CYCLE-1

1. Desktop Virtualization using Chrome Remote Desktop.
2. Create Nested Virtual Machine(VM under another VM)
3. Secure IOT integration with Cloud
4. Create EC2 Linux instance on Amazon AWS and create SSH client configuration through PUTTY.

CYCLE-2

5. Create WINDOWS Server instance in AWS and Microsoft Azure.
6. Create MySQL database through AWS RDS. Connect AWS RDS through MySQL workbench from any remote location.
7. Setup Wordpress web application through Amazon AMI
8. Create a PHP based web application using Elastic Beanstalk

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B.TECH – INFORMATION TECHNOLOGY
CBCS CURRICULUM
VTU R21
B.Tech IT Honors in Artificial Intelligence Courses

Sl. No	Course Code	Program Specific Elective	L	T	P	C
1.	10212IT126	Artificial Intelligence	3	0	0	3
2.	10212IT127	Neural Networks	3	0	0	3
3.	10212IT128	Pattern Recognition	3	0	0	3
4.	10212IT129	Language Processing	3	0	0	3
5.	10212IT130	Deep Learning	3	0	0	3
6.	10212IT304	Pattern Recognition Lab	0	0	2	1
7.	10212IT305	Language Processing Lab	0	0	2	1
8.	10212IT306	Deep Learning Lab	0	0	2	1

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT126	Artificial Intelligence	3	0	0	3

Course Content:

UNIT I PROBLEM SOLVING

Introduction – Agents – Problem formulation – uninformed search strategies – heuristics– informed search strategies – constraint satisfaction

UNIT II LOGICAL REASONING

Logical agents – propositional logic – inferences – first-order logic – inferences in firstorder logic – forward chaining – backward chaining – unification – resolution

UNIT III PLANNING

Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING

Uncertainty – review of probability - probabilistic Reasoning – Bayesian networks –inferences in Bayesian networks – Temporal models – Hidden Markov models

UNIT V LEARNING

Learning from observation - Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning

Learning resources

TEXT BOOK:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education, 2003.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press, 2004.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers, 1998.

ONLINE RESOURCES

http://www.annaunivedu.in/2012/09/cs2351-artificial-intelligence-syllabus.html#ixzz3awNdEdX2

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT127	Neural Networks	3	0	0	3

UNIT 1 INTRODUCTION

Introduction and Role of Artificial Neural Networks-Fundamentals of Biological Neural Networks-Basic Principles of ANN Design-Basic Network Structures-The Perceptron's Input-Output Principles-The Adaline (ALC)- The Perceptron-The Basic Structure-The Single-Layer Representation Problem-The Limitations of the Single-Layer Perceptron-Many-Layer Perceptrons-Perceptron Case Study: Identifying Autoregressive Parameters of a Signal (AR Time Series Identification).

UNIT 2 BACK PROPAGATION

The Back Propagation Learning Procedure - Derivation of the BP Algorithm - Modified BP Algorithms - Back Propagation Case Study: Character Recognition - Back Propagation Case Study: The Exclusive-OR (XOR) Problem (2-Layer BP) - Back Propagation Case Study: The XOR Problem — 3 Layer BP Network - Average Monthly High and Low Temperature Prediction Using Backpropagation Neural Networks

UNIT 3 HOPFIELD NETWORKS

Introduction - Binary Hopfield Networks - Setting of Weights in Hopfield Nets — Bidirectional Associative Memory (BAM) Principle -Walsh Functions - Network Stability - Summary of the Procedure for Implementing the Hopfield Network - Continuous Hopfield Models - The Continuous Energy (Lyapunov) Function - Hopfield Network Case Study: Character Recognition - Hopfield Network Case Study: Traveling Salesman Problem - Cell Shape Detection Using Neural Networks.

UNIT 4 COUNTER PROPAGATION

Introduction - Kohonen Self-Organizing Map (SOM) Layer - Grossberg Layer - Training of the Kohonen Layer -Training of Grossberg Layers - The Combined Counter Propagation Network - Counter Propagation Network Case Study: Character Recognition-Large Scale Memory Storage and Retrieval (LAMSTAR) Network-Basic Principles of the LAMSTAR Neural Network-Adaptive Resonance Theory (ART)- The ART Network Structure.

UNIT 5 STATISTICAL TRAINING AND RECURRENT NEURAL NETWORK

Fundamental Philosophy -Annealing Methods - Simulated Annealing by Boltzman Training of Weights - Stochastic Determination of Magnitude of Weight Change - Temperature-Equivalent Setting -Cauchy Training of Neural Network - Statistical Training Case Study: A Stochastic Hopfield Network for Character Recognition-Recurrent/Discrete Time Networks - Fully Recurrent Networks - Continuously Recurrent Back Propagation Networks - Recurrent Back Propagation Case Study: Character Recognition.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT128	Pattern Recognition	3	0	0	3

UNIT -1 BASICS OF PROBABILITY, RANDOM PROCESSES AND LINEAR ALGEBRA

Probability: independence of events, conditional and joint probability, Bayes' theorem; Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors; Bayes Decision Theory

UNIT-2 BAYES DECISION THEORY

Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features -Parameter Estimation Methods -Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case

UNIT-3 UNSUPERVISED LEARNING AND CLUSTERING

Criterion functions for clustering; Algorithms for clustering: K-Means, Hierarchical and other methods; Cluster validation; Gaussian mixture models; Expectation-Maximization method for parameter estimation; Maximum entropy estimation

UNIT-4 SEQUENTIAL PATTERN RECOGNITION

Hidden Markov Models (HMMs); Discrete HMMs; Continuous HMMs- Nonparametric techniques for density estimation: Parzen-window method; K-Nearest Neighbour method -Dimensionality reduction-Fisher discriminant analysis; Principal component analysis; Factor Analysis

UNIT-5 LINEAR DISCRIMINANT FUNCTIONS

Gradient descent procedures; Perceptron; Support vector machines-Non-metric methods for pattern classification: Non-numeric data or nominal data; Decision trees: CART

Text Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001

2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009

3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT129	Language Processing	3	0	0	3

UNIT 1 INTRODUCTION TO NLP

History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, NLP pipeline Phases of NLP, NLP APIs, NLP Libraries-Introduction- Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK.

UNIT 2 LANGUAGE MODELING AND PART OF SPEECH TAGGING

Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition

UNIT 3 WORDS AND WORD FORMS

Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation

UNIT 4 TEXT ANALYSIS, SUMMARIZATION AND EXTRACTION

Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR

UNIT 5 MACHINE TRANSLATION

Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation (SMT), Parameter learning in SMT (IBM models) using EM), Encoder-decoder architecture, Neural Machine Translation

Reference Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT130	DEEP LEARNING	3	0	0	3

UNIT I INTRODUCTION 9

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENTIONALITY REDUCTION 9

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT IV OPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT V CASE STUDY AND APPLICATIONS 9

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

REFERENCES:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.

2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

3. Ian Good fellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT1304	Pattern Recognition Lab	0	0	2	1

List of Experiments:

1. Implement K-means clustering.
2. Implement Hierarchical clustering.
3. Implement Gaussian Mixture Models.
4. Implement HMM.
5. Implement K-NN.
6. Implement PCA.
7. Implement LDA.
8. Implement SVM.
9. Implement Perceptron.
10. Implement Decision Trees.

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT1305	Language Processing Lab	0	0	2	1

List of Experiments:

1. Accessing Text Corpora

2. Processing Raw Text

3. Categorizing and Tagging Words

4. Learning to classify text

5. Extracting Information from text

6. Building feature-based grammars

7. Analyzing the meaning of sentences

8. Managing Linguistic data

COURSE CODE	COURSE TITLE	L	T	P	C
10212IT1306	Deep Learning Lab	0	0	2	1

List of Experiments:

1. Data Representations for Neural Networks

2. Tensor Operations

3. Gradient based Optimization

4. Setting up a Deep learning workstation using Keras, Tensorflow and Theano

5. Data preprocessing for Neural Networks

6. Training a convnet from scratch on a small dataset

7. Working with text data using LSTM.

8. Sequence Processing with convnets.

9. Classifying Movie Reviews a binary classification

10. Classifying newswires a multiclass classification