



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited "A++" Grade by NAAC | 12B Status by UGC | Approved by AICTE

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SCHOOL OF SCIENCE AND HUMANITIES

DEPARTMENT OF COMPUTER SCIENCE

1.1.3 Courses Having Focus on Employability/ Entrepreneurship/ Skill Development

Contents

S. No.	Course Code	Course Name	Page No.
Employability			
1	SBSA1102	Programming in C and C++	3
2	SBSA2201	Data Structures Lab	4
3	SBSA1202	Python programming	5
4	SBSA1305	Computer Graphics and Multimedia	6
5	SBSA1302	Java Programming	7
6	SBSA1304	Software Engineering	8
7	SBSA1306	Block Chain Technology	10
8	SBSA2301	Java Programming Lab	11
9	SBSA2401	Database Management System Lab	12
10	SBSA1401	Database Management System	13
11	SBSA1402	Cloud Computing	14
12	SBSA1403	Object Oriented Analysis and Design	16
13	SCSA1404	Introduction to Robotics	17
14	SBSA1501	Advanced Java Programming	18
15	SBSA1503	Web Technology	19
16	SBSA1504	Machine Learning	20
17	SBSA1507	Data Analytics	22
18	SBSA2501	Advanced Java Programming Lab	24
19	SBSA2502	Machine Learning Lab	25
20	SBSA3011	Foundation of AI	26

Entrepreneurship			
21	SBSA1304	Software Engineering	27
22	SBSA1503	Web Technology	29
23	SBSA2402	Robotics Lab	30
24	SBAA4002	Principles Of Management and Professional Ethics	31
25	SBSA3010	Introduction to Internet of Things	33
Skill Development			
26	SBSA1101	Digital Computer Fundamentals	34
27	SBSA1102	Programming in C and C++	35
28	SBSA1201	Fundamentals of Data Structures	36
29	SBSA1301	Operating Systems	37
30	SBSA1303	Computer Architecture	38
31	SBSA1401	Database Management System	39
32	SBSA1502	Data Communication and Computer Networks	40
33	SCSA3091	Society 5.0	41

SBSA1102	PROGRAMMING IN C & C++	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ program.
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions.
- To impart the knowledge about pointers which is the backbone of effective memory handling.
- To perform Inheritance, Overloading of operators, functions, constructors, and File Handling
- To demonstrate adeptness of object-oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

UNIT 1

12 Hrs.

BASICS OF C PROGRAMMING: Introduction to C: Features of C - Structure of C program-Data Types-‘C’ Tokens- Input/output statements-Control Statement, Functions: – Types of Functions –Recursion.

UNIT 2

12 Hrs.

ARRAYS, STRINGS AND STRUCTURES: Arrays: Single and Multidimensional Arrays— Array as Function Arguments, Strings: String Handling Functions, Structure: Nested Structures – Array of Structures – Structure as Function Argument– Function that Returns Structure, Union.

UNIT 3

12 Hrs.

POINTERS AND FILE PROCESSING: Pointers: Introduction, Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer, Dynamic Memory Allocation, Storage Classes, File Handling in 'C'

UNIT 4

12 Hrs.

OBJECT ORIENTED PROGRAMMING CONCEPTS : Introduction-Procedure vs. object oriented programming-Concepts: Classes and Objects-Operator and Function Overloading-Inheritance-Polymorphism and Virtual Functions.

UNIT 5

12 Hrs.

TEMPLATES AND EXCEPTION HANDLING: Function Templates and Class Templates – Name spaces – Standard Template Library - Casting – Exception Handling – case study.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop simple applications in C using basic constructs.

CO2 - Design and Implement applications using arrays and strings.

CO3 - Develop and Implement applications using memory allocation and File concepts.

CO4 - Use proper class protection to provide security.

CO5 - Describe the reusability of code through Inheritance.

CO6 - Demonstrate the use of virtual functions to implement polymorphism.

TEXT/ REFERENCE BOOKS

1. Deitel and Deitel, C how to Program, 7th Edition, Pearson Education, 2013.
2. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Pearson Education, 2015.
3. Yashavant Kanetkar, Understanding Pointers in C, 4th Revised & Updated Edition, Bbp Publications, 2008.
4. E Balagurusamy, Object Oriented Programming with C++, 3rd edition, Tata McGraw Hill, 2006.
5. Bhave, Object Oriented Programming with C++, Pearson Education, 2004.
6. John R Hubbard, “Programming with C++”, Schaums Outline Series, McGraw Hill, 2nd edition, 2009.

Employability

SBSA2201	DATA STRUCTURES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

LIST OF EXPERIMENTS

1. Linked List Implementation.
2. Stack Implementation using Array
3. Queue Implementation using Linked List (Make the program for Ex.1 as a header file and use it)
4. Binary Search Tree Traversal
5. Implementation of Dijkstra's Algorithm
6. String Pattern Matching Algorithm
7. Sorting Techniques
 - a. Heap Sort
 - b. Quick sort
8. Searching Techniques
 - a. Linear Search b. Binary Search
9. Greedy Method – Minimum Spanning Tree
10. Backtracking – N Queens Problem
11. Divide & Conquer – Merge Sort

SBSA1202	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- To provide Basic knowledge of Python
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs
- To learn syntax of Python language
- To create dynamic applications in Python
- To implement object-oriented concepts using Python

Unit 1

9 Hrs.

Overview of Programming : Structure of a Python Program, Elements of Python.

Unit 2

9 Hrs.

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

Unit 3

9 Hrs.

Creating Python Programs :Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments, Errors and Exceptions

Unit 4

9 Hrs.

Iteration and Recursion: Conditional execution, Alternative execution, Nested conditionals, The return statement, Recursion, Stack diagrams for recursive functions, Multiple assignment, The while statement, Tables, Two-dimensional tables.

Unit 5

9 Hrs.

Strings and Lists: String as a compound data type, Length, Traversal and the for loop, String slices, String comparison, A find function, Looping and counting, List values, Accessing elements, List length, List membership, Lists and for loops, List operations, List deletion. Cloning lists, Nested lists..

Max. 45 Hours

COURSE OUTCOME:

- CO1 - To provide Basic knowledge of Python
- CO2 - To learn how to design and program Python applications.
- CO3 - To learn how to use lists, tuples, and dictionaries in Python programs
- CO4 - To learn syntax of Python language
- CO5 - To create dynamic applications in Python
- CO6 - To implement object oriented concepts using Python

TEXT / REFERENCE BOOKS

1. Allen Downey, Jeffrey Elkner, Chris Meyers.How to think like a computer scientist learning with Python / 1st Edition,2012
2. Kenneth A. Lambert,
2. The Fundamentals of Python: First Programs, 2011, Cengage Learning

SBSA1305	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- It aims at teaching about geometric information, 2D and 3D graphics, animation and multimedia.
- To introduce Two and Three dimensional graphical structure.
- To design 2D and 3D methods and Models
- To explore the visible surface detection with illumination and color models.
- To understand the concepts involved in multimedia and basis tools.

UNIT I (9 Hrs)

Introduction to computer Graphics - Video display devices- Raster scan Systems - Random Scan Systems - Interactive input devices - Hard copy devices - Graphics software - Output primitives - line drawing algorithms - initializing lines - line function- circle Generating algorithms.

Unit II (9 Hrs)

2D Geometric Transformations: Basic Transformations – Matrix Representations – Composite Transformations – Other Transformations. 2D Viewing: The Viewing Pipeline – Viewing Co-ordinate Reference Frame – Window-to-Viewport Co-ordinate Transformation - 2D Viewing Functions – Clipping Operations- Point Clipping-Line Clipping-Polygon Clipping-Curve Clipping-Text Clipping-Exterior Clipping.

Unit III (9 Hrs)

Three Dimensional Concepts - 3D Geometric and Modeling Transformations – Three-Dimensional Viewing - Visible-Surface Detection Methods: Back-Face Detection - Depth-Buffer Method -Scan Line Method - A-Buffer Method-Depth Sorting Method-BSP Tree Method-Area Subdivision Method.

Unit IV (9 Hrs)

Multimedia – Definition- Introduction-Multimedia Software- Basic Tools- **Multimedia Authoring Tools- Multimedia Building Blocks: Text- Font Editing and Design Tools – Hypermedia and Hypertext – Multimedia System Sounds – MIDI Versus Digital Audio – Making MIDI Audio** – Audio File Formats– Adding Sound to Your Multimedia Project.

Unit V (9 Hrs)

Images: Making Still Images – Color – Image File Formats – Animation: The Power of Motion – Principles of Animation – Making Animations that Work – Video: Using Video – How Video works - Broadcast Video Standards – Integrating Computers and Television – Shooting and Editing Video – Video Tips – Recording Formats – Digital Video-Multimedia and the Internet

Max 45hrs

COURSE OUTCOMES:

- CO1 - Identify the various line & circle drawing algorithm. Study the various transformations in 2D and 3D objects.
- CO2 - Understand the concepts of curves and surface.
- CO3 - Apply transformation and clipping algorithm in 2D and 3D objects.
- CO4 - Design Illumination and color models.
- CO5 - Implement 2D and 3D Transformation concepts in Real world Applications
- CO6 - To explore the visible surface detection with illumination and color models.

TEXT /REFERENCE BOOKS:

1. D. Hearn and M.P. Baker ,Computer Graphics, 2nd Edition ,PHI 1996
2. Tay Vaughan ,Multimedia: Making it Work,7th Edition, Tata McGraw Hill Edition ,2008
3. W.M. Neumann and R.F. Sproull ,Principle of Interactive Computer Graphics , McGraw Hill,2nd edition ,2002
4. Ranjan Parekh, Principles of multimedia – Sixth edition, Tata McGraw Hill – 2008
5. D. P. Mukherjee , “Fundamentals Of Computer Graphics And Multimedia ” Prentice Hall of India Private Limited, 2006.
6. D. McClelland, L.U.Fuller ,”Photoshop CS2 Bible”, Wiley Publishing, 2005.

Employability

SBSA1302	JAVA PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- To understand and apply the fundamentals core java, packages, database connectivity for computing
- To provide knowledge on advanced features like Swing, JavaBeans, Sockets
- To understand the principles and concepts of object oriented programming
- To Store and retrieve the information from Files.
- To learn multithreading concepts

UNIT I (9 Hrs)

An Overview of Java - Features of Java - Object oriented concepts - Lexical Issues - Data Types - Variables - Type Conversions and Casting - Arrays - Operators - Control Statements.

UNIT II (9 Hrs)

Introduction to Classes and Objects - Declaring Objects and Methods - Constructors - this keyword - finalize() method- Overloading Methods - Overloading Constructors - Recursion - Access Control - Static and Final methods and variables - Nested and Inner class - String class - String Handling

UNIT III (9 Hrs)

Inheritance - Using super - Overriding Methods - Abstract classes - Final with Inheritance - Multi Threaded programming

UNIT IV (9 Hrs)

Packages - Access Protection – Importing Packages – Interfaces – Exception Handling – throw and throws. – Sting tokenizer – Date – Calendar- Random.

UNIT V (9 Hrs)

Applet - AWT Controls - Layout Managers and Menus- -Swing - JDBC/ODBC Connection

Max 45hrs

COURSE OUTCOME:

- CO1 - To understand the principles and concepts of object oriented programming
- CO2 - To Store and retrieve the information from Files.
- CO3 - To learn multithreading concepts
- CO4 - Implement the interface, package and multithread concepts
- CO5 - Implement various built in package and its applications
- CO6 - Develop web based applications using applet programming

TEXT /REFERENCE BOOKS:

1. Herbert Schildt, The Complete Reference JAVA2, 7th Edition, McGraw-Hill/Osborne Media.
2. Bruce Eckel, Thinking in Java, 4th edition, Prentice Hall
3. Michael Morrison, Java Unleashed, 3rd edition, SAMS Publishing
4. Clayton Walnum, Java By Example, QUE Publications, 2000.
5. K. Arnold and J. Gosling, The JAVA programming language, Third edition, Pearson Education, 2000

Employability

SBSA1304	SOFTWARE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- A general understanding of software process models, role of project management, different software architectural styles and approaches to verification and validation
- Software process models and compare their applicability
- Identify the key activities in managing a software project
- Concepts of requirements engineering and Analysis Modelling
- Apply systematic procedure for software design and deployment

UNIT I (9 Hrs)

Definition of software and software engineering – Software myths –Software Engineering paradigms: Linear Sequential Model and Prototyping Model-Incremental – Spiral Model- Iterative Model. Software Project Management. Software Cost Estimation– Software Project Planning.

UNIT II (9 Hrs)

Introduction – The software requirement specifications – Formal specification techniques – Languages and processors for requirements specification : SDAT, SSA, GIST, PSL/PSA, REL/REVS- Software prototyping – rapid prototyping techniques- user interface prototyping- Analysis and modeling – data, functional and behavioral models – Structured analysis and data dictionary.

UNIT III (9 Hrs)

Abstraction – Modularity – Software architecture – Cohesion, coupling – Various design concepts and notations – Real time and distributed system – Design – Documentation – Data flow oriented design – Jackson system development – Design for reuse – Programming standards. User interface Design- principles- SCM- Need for SCM- Version control – Introduction to SCM process – software configuration items

UNIT IV (9 Hrs)

Levels - Test activities - Types of s/w test - Black box testing - Testing boundary condition - Structural testing- Test coverage criteria based on data flow mechanisms - Regression testing - Testing in the large- S/W testing strategies - Strategic approach and issues - Unit testing - Integration testing - Validation testing - System testing and debugging. Case studies – Writing black box and white box testing

UNIT V (9 Hrs)

Introduction – Quality assurance – Walk through and inspections – Static analysis – Symbolic execution- Software Maintenance: Introduction – Enhancing maintainability during development- Managerial aspects of software maintenance – Configuration management – Source code metrics – Other maintenance tools and techniques

Max 45hrs

COURSE OUTCOMES

- CO1 - Identify and apply software lifecycle model for a given problem and will know the criteria for each level of CMM.
- CO2 - Comprehend types of requirements and summarize Requirement Engineering Process
- CO3 - Design data, functional and behavioral model for any given software requirement.
- CO4 - Identify and analyze levels of testing and perform white box testing and black box testing for a given problem.
- CO5 - Describe concepts of software quality assurance and software configuration management.
- CO6 - Compare and contrast forward engineering, reverse engineering and reengineering.

TEXT / REFERENCE BOOKS:

1. Pressman. R. S. ,Software Engineering - Fourth Edition- McGraw Hill International Edition 1997.
2. Richard Fairley, Software Engineering - (Design Reliability and Management), -Tata McGraw hill Edition -1983.
3. Fleeger.P Software Engineering, - Prentice Hall, 1999.
4. Pfleeger and Lawrance, “Software Engineering: Theory and Practice” Pearson Education, Second Edition, 2001
5. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited ,2009.

6. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
7. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.

 Employability

SBSA1306	BLOCKCHAIN TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To introduce Bit coin and other crypto currencies.
- To study the algorithms and techniques in block chain.
- To understand the practical aspects in the design of crypto currency.
- To understand the function of Block chains as a method of securing distributed ledgers.
- To design, code, deploy and execute a smart contract.

UNIT 1

12 Hrs.

Basics of blockchain-Public Ledgers-Block Chain as Public Ledgers-Types of Block chains- Pillars of Block chain- Government Initiatives of BlockChain – **Bitcoin – Smart Contracts.**

UNIT 2

12 Hrs.

Block in a Block chain-find Transactions-**Distributed Consensus-Proof of work**, Stake, Space-Attacks on POW- Ethereum Pos/POW Hybrids-Crypto currency to block chain 2.0, Model of Blockchain-Algorand.

UNIT 3

12 Hrs.

Hash Function and Merkle Tree-Security Properties-Security Considerations for block chain-Digital Signature-Public Key Cryptography-Bit coin block chain incentive structures- Nash Equilibriums- evolutionary stable strategies,-and Pareto efficiency (game theory) Weaknesses and new Points of Failure - Mitigation Methods -Redundancies and fall-back methods.

UNIT 4

12 Hrs.

Mining – Pools – Impact of CPU and GPU – Transaction in Bit coin Network – Block Mining – Block Propagation and block relay

UNIT 5

12 Hrs.

Industry applications of Blockchain-Blockchain in Government-Government use cases-Preventing Cybercrime through block chain-Block Chain in defense, tax payments.

Max. 60Hours

COURSE OUTCOMES:

On completion of the course, the student will be able to

- CO1 - Explain the structure of a block chain.
- CO2 - Analyze the incentive structure in a blockchain based system.
- CO3 - Judge the scenario where “smart” contract is most appropriate.
- CO4 - Identify Basic knowledge of Bitcoin, Ethereum.
- CO5 - Apply Blockchain in future use cases for security.
- CO6 - Understand the various Block Chain applications.

TEXT / REFERENCE BOOKS

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos O'Reilly, Second Edition, 2018.
2. Blockchain by Melanie Swa, O'Reilly Media 2015.
3. Zero to Block chain - An IBM Redbooks course, by Bob Dill, David Smits.

SBSA2301	JAVA PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

LIST OF PROGRAMS

1. Substring removal from a String using StringBuffer class.
2. Determining the orders of the numbers generated randomly using Random class
3. Usage of Calendar class and manipulation
4. String manipulation using CharArray
5. Usage of Vector class
6. Implementing Thread based applications and exception handling
7. Application using synchronization such as Thread based, Class based and synchronized Statement Using Applets and swings
8. Working with frames and other controls
9. Working with Dialog and Menus
10. Working with Panel and Layout
11. Incorporating Graphics
12. Database creation for storing email addresses and manipulation using Swing

Employability

SBSA2401	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

LIST OF EXPERIMENTS

1. Data Definition Language(DDL).
2. Data Manipulation Language(DML)
3. Data Control Language(DCL)
4. Constraints and Built-in functions.
5. Joins and Group-by functions.
6. PL/SQL programs using functions
7. PL/SQL programs using procedures
8. PL/SQL programs using triggers
9. Developing GUI applications using PHP.
10. Student Information System.
11. Inventory Management.
12. Payroll Processing.

Employability

SBSA1401	DATABASE MANAGEMENT SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To gain knowledge in fundamentals of data models using ER diagram.
- To make a study of SQL and relational database design.
- To understand about Query processing, optimization and Concurrency control technique
- To understand terms related to database design and management
- To gain knowledge in relational model and relational database management system
- To implement relational databases using SQL & My SQL

UNIT I (9 Hrs)

Basic Concepts: Database and Database users – Database system concepts and architecture – Data modeling using Entity Relationship model – Enhanced entity relationship and object modeling – Record storage and file organizations – Index Structures for files

UNIT II (9 Hrs)

Relational Model, Languages and Systems: The Relational Data Model, Relational Constraints, and the relational Algebra – SQL – The Relational Database Standard – ER and EER to Relational Mapping and Other Relational Languages – Examples of Relational Database Management Systems: Oracle and Microsoft Access.

UNIT III (9 Hrs)

Database Design, Theory and Methodology: Functional dependencies and normalization for relational database – Relational database design algorithms and further dependencies – Practical database design and tuning

UNIT IV (9 Hrs)

System Implementation Techniques: Database system architectures and the system catalog – Query processing and optimization

UNIT V (9 Hrs)

Transaction processing concepts – Concurrency control techniques – Database recovery techniques – Database security and Authorization. Introduction to Emerging Database Technologies and Application

Max 45hrs

COURSE OUTCOMES

- CO1 - Design ER-models to represent simple database application scenarios
- CO2 - Ability to understand and design data modelling using Entity-Relationship model
- CO3 - Implement SQL to a broad range of query and data update problems
- CO4 - Articulate socio-economic applications of distributed databases and use database recovery mechanisms
- CO5 - Familiar with data warehousing and data mining applications
- CO6 - Apply Normalization techniques to normalize and improve the database design

TEXT / REFERENCE BOOKS:

1. Elmasri & Navathe, Fundamentals of Database Systems, 6th Edition, Addison Wesley, 2010
2. Korth, Silberschatz & Sudarshan, Database System Concepts, 5th Edition, Tata McGraw Hill, 2010
3. Raghu Ramakrishnan & Johannesgerhrke, Data Base Management Systems, 3rd Edition, Tata Mc Graw Hill, 2002.
4. Abraham Silberschatz, Henry.F.Korth and S.Sudharshan, "Database System Concepts", 4th Edition, 2002.
5. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012
6. Jan L. Harrington, "Object oriented database design", Harcourt India private limited 2000.

USEFUL WEBSITES:

http://nptel.iitm.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design/index.php

SBSA1402	CLOUD COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To articulate the main concepts, key technologies, strengths, and limitations of cloud computing
- To learn how to use Cloud Services.
- To implement Virtualization
- To understand the basic concepts of cloud computing and cloud enables.
- To understand cloud services and Multi-tenancy computing

UNIT I (9 Hrs)

The vision of cloud computing - The cloud computing reference model - Characteristics and benefits - Challenges ahead - Historical developments - Distributed systems - Virtualization - Building cloud computing environments - Application development - Infrastructure and system development - Computing platforms and technologies - Parallel vs. distributed computing - Elements of parallel computing - Hardware architectures for parallel processing Approaches to parallel programming - Laws of caution.

Unit-II (9 Hrs)

Introduction - The cloud reference model - Types of clouds - Economics of the cloud Virtualization: Introduction - Characteristics of virtualized environments - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization - Technology example: VMware: full virtualization.

Unit-III (9 Hrs)

Anatomy of the Aneka container - Introducing parallelism for single-machine computation - Programming applications with threads - Multithreading with aneka - Programming applications with aneka threads. Cloud computing economics: Cloud infrastructure - Economics of private clouds - Software productivity in the cloud - Economies of scale: public vs. private clouds.

Unit-IV (9 Hrs)

Multi-entity support - Multi-schema approach - Multi-tenancy using cloud data stores - Data access control for enterprise applications.- Data in the cloud: Relational databases - Cloud file systems: GFS and HDFS - BigTable, HBase - Cloud data stores: Datastore and SimpleDB.

Unit-V (9 Hrs)

Amazon web services: Compute services - Storage services - Communication services - Additional services. Google AppEngine: Architecture and core concepts - Application life cycle - Cost model – Observations. Microsoft azure: Azure core concepts - SQL azure - Windows azure platform appliance.

Max 45hrs

COURSE OUTCOMES

- CO1 - Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.
- CO2 - Implement and install the cloud tools to make enable the cloud computing infrastructures.
- CO3 - Apply and design suitable Virtualization concept, Cloud Resource Management and collaboration services.
- CO4 - Create combinatorial auctions for cloud resources and services for computing clouds Develop and make cloud services as commercial.
- CO5 - Assess cloud and cloud to Fog with IoT.
- CO6 - Ability to, understand fog computing architecture

TEXT/REFERENCE BOOKS :

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, “Mastering Cloud Computing” - Foundations and Applications Programming , MK publications, 2013.
2. Gautam Shroff, “Enterprise Cloud Computing: Technology, Architecture, Applications” by Cambridge University Press, 2010.
3. Cloud computing concepts, technology and Architecture – Thomas Erl, Zaigham Mahmood, Ricardo Puttini ,

Pearson , 2017.

4. Instant Guide to Cloud Computing, Anand Nayar(Ed), Ashokkumar, sudeep Tanwar, BPB, 2019.
5. Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenpeter TATA McGraw - Hill, New Delhi - 2010
6. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008

Employability 

SBSA1403	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES :

- To Understand the fundamentals of Object Oriented System Development
- To understand the object oriented methodologies.
- To use UML in requirements elicitation and designing.
- To understand concepts of relationships and aggregations.
- To test the software against its requirements specification

UNIT I INTRODUCTION (9hrs.)

Overview of object oriented language systems development – Object basics hierarchy – Object and identity –Static and dynamic binding – Object oriented SDLC.

UNIT II OBJECT ORIENTED METHODOLOGIES (9 hrs.)

Rumbaugh et al.'s technique – Booch, Jacobson Methodologies – Patterns – Framework – Unified approach –UML – UML diagrams – UML dynamic modeling – UML extensibility – UML meta-model.

UNIT III OBJECT-ORIENTED ANALYSIS (9 hrs.)

Use case model – Object analysis classification – Approaches for identifying classes – Classes responsibilities and collaborators – Identifying object relationships, attributes and methods.

UNIT IV OBJECT ORIENTED DESIGN (9 hrs.)

Design process and design axioms – Designing classes – Access Layer – Object storage and object Interoperability – View layer – Designing interface objects.

UNIT V SOFTWARE QUALITY (9 hrs.)

Software quality assurance – Testing strategies – Test cases – Test plan – Myers debugging principle – System usability and measuring user satisfaction.

Max 45hrs

COURSE OUTCOMES

- CO1 - Understand the basics object model for System development. CO2 - Understand the object Oriented Methodologies
CO3 - Express software design with UML diagrams CO4 - Understand the concept of Relationships
CO5 - Design software applications using OO concepts.
CO6 -Understand the various testing methodologies for OO software

TEXT/ REFERENCE BOOKS:

1. Ali Bahrami, "Object oriented systems development using the unified modeling language", 1st Edition, McGraw- Hill, 1998.
2. Grady Booch, James Rumbaugh, and Ivar Jacobson, "The Unified Modeling Language User Guide", 3rd Edition Addison Wesley, 2007.
3. John Deacon, "Object Oriented Analysis and Design", 1st Edition, Addison Wesley, 2005.
4. Grady Booch, James Rumbaugh, and Ivar Jacobson, "The Unified Modeling Language User Guide", 3rd Edition Addison Wesley.
5. John Deacon, "Object Oriented Analysis and Design", 1st Edition, Addison Wesley,.
6. Bernd Oestereich, "Developing Software with UML, Object - Oriented Analysis and Design in Practice", Addison-Wesley.

Employability

SBSA1404	INTRODUCTION TO ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To develop the student's knowledge in various aspects of robotic system.
- To develop student's skills in perform kinematics analysis of robot systems.
- To develop student's skills in selecting various sensors associated with the robotic operations.
- To provide the student with some knowledge and skills associated with robot control.
- To understand the mechanical movements of the robots and its applications.

UNIT 1

12 Hrs.

Types and components of a robot, Classification of robots, closed-loop and open- loop control systems. Kinematics systems; Definition of mechanisms and manipulators, Social issues and safety.

UNIT 2

12 Hrs.

Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

UNIT 3

12 Hrs.

Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc.

Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations.

UNIT 4

12 Hrs.

Basics of control: Transfer functions, Control laws: P, PD, PID Non-linear and advanced controls

UNIT 5

12 Hrs.

Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators. Control Hardware and Interfacing: Embedded systems: Architecture –Robotic applications.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Perform kinematic and dynamic analyses with simulation.
- CO2: Design control laws for a robot.
- CO3: Integrate mechanical and electrical hardware for a real prototype of robotic device.
- CO4: Select a robotic system for given application.
- CO5 : Simulate Real time Robot for Industrial applications.
- CO6: Create an AI based Robot for any real time applications.

TEXT/REFERENCE BOOKS

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

SBSA1501	ADVANCED JAVA PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- Develop client/server and web applications. Develop server side programs in the form of servlets and JSP
- To know about Enterprise architecture models
- To introduce the basics of session tracking
- To understand JSP and to write Custom Tags
- To be used in web enterprise applications.

UNIT I (9 Hrs)

J2EE Platform– Enterprise Architecture Styles – J2EE API - J2EE Architecture for Containers – RMI Architecture- Overview of JNDI Java Database Connectivity –Introduction – Driver Types- Establishing a connection - Creating and Executing SQL Statement – Prepared Statement -The Result Set Object- java.sql package- Simple Application.

UNIT II (9 Hrs)

Java Script:-Embedding Java Script In HTML - Variables - Literal - Conversion Functions - Arrays - Java Script Programming- Statements – Functions - Events Handling - Working With Objects – Date, Math, String, Window, Calendar -Connecting To Search Engines.

UNIT III (9 Hrs)

Servlets- Background- Life Cycle of a Servlet- HTTP protocol- The Servlet API – Generic and Http Servlet- ServletConfig and ServletContext- Handling HTTP Requests and Responses- Handling form data with get and post request.

UNIT IV (9 Hrs)

Advanced Servlets: Approach to Session Tracking - HTTP Session Interface – Demonstrating Session – Lifecycle with cookies– A simple Shopping cart using Sessions – Servlet Context Interface – Servlet Context Lifecycle – Event Handling – Servlet Collaboration – Servlet Chaining – Request Dispatching.

UNIT V (9 Hrs)

Java Server Pages - JSP Technologies – Difference between Servlets and JSP- JSP Directives –Scripting elements - Standard Actions – Implicit Objects –Simple Application - Introduction to Enterprise Java Beans –Session Beans-Entity Beans-Message Driven Beans.
Max 45hrs

COURSE OUTCOMES

- CO1 - Implement JDBC connectivity
- CO2 - Implement Servlets and advanced Servlets
- CO3 - Implement JSP and Java Mail
- CO4 - Implement EJB
- CO5 - Implement Struts
- CO6 - To develop enterprise java applications thereby meeting the industrial requirements

TEXT/ REFERENCE BOOKS:

1. Subrahmanyam Allamaraju, Cedric Buest, John Davies, Tyler Jewell, Rod Johnson, Andy Longshaw, Ramesh Nagappan, P. G. Sarang, Alex Toussaint, Sameer Tyagi, Gary Watson, Marc Wilcox, Alan Williamson, Professional Java Server Programming J2EE”, 1.3 Edition ,Wrox Publications
2. Patrick Naughton, Herbert Schildt, “The Complete Reference Java 2”, Third Edition, Tata McGraw hill
3. Thomas A. Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, McGraw Hill/Osborne,
4. Jayson Falkner, Kevin Jones, “Servlets and JavaServer Pages, The J2EE Technology Web Tier”, Pearson Education
5. James Holmes-Struts, “The complete Reference”, 2nd Edition, Tata McGraw Hill, 2007.
6. Subrahmanyam Allamaraju and Cedric Buest ,”Professional Java Server Programming”, A press, J2EE 1.3, 2007.

Employability

SBSA1503	WEB TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To effectively design with a range of technologies.
- To develop static websites & dynamic web applications.
- To learn new emerging web technologies.
- To gain knowledge and skills required for web development careers.
- To develop skills in the use and application of specific methods in user experience design.

UNIT 1 (9 Hrs.)

Introduction To HTML- **DHTML , XML** – Structuring XML document using DTD – Schemas – XML parsers – DOM – SAX presentation technologies – XSL – XFORMS – XHTML – Transformations – XSLT – XLINK – XPATH – XQuery. Responsive Web Design-Intro-Fluid Grid-Viewport-Media Queries-Images. Introduction To CSS-Syntax, Selectors-Types of style sheets.

UNIT 2 (9 Hrs.)

Java Script – Advantages – Data types – Variables – Operators – **Control statements – Functions – Objects and arrays – Windows and frames – Forms. AJAX – XMLHttpRequest (XHR) – Create Object – Request – Response – Ready state.**

UNIT 3 (9 Hrs.)

Introduction To **PHP – Data Types – Control Structures – Arrays - Function – Html Form with PHP –Form Handling & Validation- File Handling – Cookies – Sessions – Filters – Exception Handling - Database Connectivity With MySQL.**

UNIT4 (9 Hrs.)

Angular JS Expression – Modules – Directives – Data Binding – Controllers – Scopes – Filters – Services – Tables – Events– Form – Validation. Query Syntax – Selects – **Events – jQuery Effects – jQuery – jQuery HTML – jQuery Traversing.**

UNIT 5 (9 Hrs.)

UX Introduction -Elements of UX Design- UX Design Process- Research Methods and Tools-Understanding User Needs and Goals. UX Design Process: Visual Design Principles-Information Design and Visualization-Interaction Design-Prototyping Tools-Usability Test. UI Introduction-**User Interface Components -Tools and Processes.**

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 - Able to work with XML technologies.
- CO2 - Design web page to perform form validation using client-side scripting language.
- CO3 - Implement new technologies such as Angular JS and JQuery.
- CO4 - Develop web applications using server-side scripting language.
- CO5 - Understand the differences between usability and user experience.
- CO6 - Effectively select and utilize design thinking processes and UX/UI tools.

TEXT /REFERENCE BOOKS

1. Jeffrey C. Jackson, WebTechnologies: A Computer Science Perspective, Pearson Education, 2009.
2. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
3. Ken Williamson, Learning AngularJS: A Guide to AngularJS Development, O'Reilly, 2015.
4. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development, John Wiley and Sons Inc., 2014.
5. CallumMacrae, Learning from JQuery, O'Reilly, 2013.
6. Steve Krug, Dont Make Me Think, 2ndEdition, New Riders Publishing, USA, 2006.

SBSA1504	MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To introduce Machine Learning concepts
- To understand Linear regression and predictive models.
- To understand classification and clustering techniques
- To understand the ensembling models and its techniques.
- To evaluate the model and compare the algorithms.

UNIT 1

12 Hrs.

What is machine learning – Applications of Machine Learning- Types of Machine learning Techniques- Designing a Learning System–Learning Associations- Decision boundary- Cost function-Dimensionality Reduction -- security with deep learning - Reinforcement learning.

UNIT 2

12 Hrs.

Supervised Machine Learning -Introduction - Classification – Linear Classifiers – Naïve Bayes Classifier- K Nearest Neighbor – DecisionTrees- Regression- Simple Linear Regression Model –Learning a Class from Examples- VCDimension - Probably Approximately Correct (PAC) Learning - Learning Multiple Classes –Principal Components Analysis - Factor Analysis - Multidimensional Scaling -Linear Discriminant Analysis.

UNIT 3

12 Hrs.

Unsupervised Machine Learning – Introduction – Clustering Techniques - K means clustering - Density-Based Clustering Methods- Hierarchical Based clustering methods- Association Rule Mining - Apriori algorithm for association rule learning Problems - Nonparametric Methods.

UNIT 4

12 Hrs.

Deep Learning - - pattern based with deep learning - Need of Ensembling- Applications of Ensembling - Types of Ensembling- Techniques of Ensembling- Bagging-Boosting –Stacking-Blending-AdaBoost-informatics with deep learning.

UNIT 5

12 Hrs.

Statistical tests - validation Techniques-Cross validation -Nested Cross validation- Essential Model Evaluation Terms and Techniques - Bootstrapping and Uncertainties -Cross-validation and Hyperparameter Optimization - Algorithm Comparison - Testing the Difference of Proportions - Comparing Two Models with the McNemar Test - The F-test for Comparing Multiple Classifiers - Comparing Algorithms - optimizing deep learning hyper parameters by evolutionary algorithm.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Reduce the dimension of the dataset with machine learning techniques

CO2: Implement the predictive analytics for any real scenario

CO3: Implement applications with clustering and classification techniques

CO4: Implement the ensembling model .

CO5: Implement model evaluations and model comparisons.

CO6: Design a case study on the business data and compare the performance of the classifiers and algorithms.

TEXT /REFERENCE BOOKS

1. Introduction to Machine Learning with Python: A Guide for Data Scientists Paperback – 1 January 2016 by Andreas Muller

2. Zhi-Hua Zhou, “Ensemble Methods: Foundations and Algorithms”, CRC Press, 2012
3. <https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python/>
4. <https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html>

Employability

SBSA1507	DATA ANALYTICS	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To introduce the concepts and phases of big data analytics.
- To study the tools required to manage and analyse big data .
- To explore the concept of knowledge representation
- To learn the ability of planning strategies
- To study the learning techniques and logistic regression

UNIT 1

12 Hrs.

Introduction - Challenges of Conventional Systems, What is Business Analytics, Business Analytics lifecycle, Why Big Data Analytics, Defining Big data, Characteristics of Big Data(V's), Business Analytics phases: Data Acquisition- Data Cleaning - Data Manipulation - Data Analysis (Statistical and Analytical methods) to make sense of data - Data Visualization

UNIT 2

12 Hrs.

Introduction to HADOOP - Hadoop ecosystem components and uses, Hadoop Storage: HDFS, Concept of Hadoop Distributed file system, Design of HDFS, Configuration of HDFS. Hadoop Data Types, large-scale deep belief nets with mapreduce - Functional-Concept of Mappers, Functional-Concept of Reducers, MapReduce Execution Framework, Partitioners and Combiners, Hadoop Clusters component : NameNode, Secondary NameNode, and DataNode, Data flow (Anatomy of File Write and Read) - detecting malicious domain using deep Learning at scale.

UNIT 3

12 Hrs.

Issues, predicate logic, resolution, representing knowledge using rules, forward versus backward reasoning, matching, control knowledge, weak slot and filler structure-semantic nets, frames, strong slot - learning curve analysis by logistic regression.

UNIT 4

12 Hrs.

Mini-max search, alpha-beta cutoffs, planning system, goal stack planning, hierarchical planning, understanding as constraint - satisfaction, waltz algorithm, natural language processing, syntactic processing - scalable multi-dimensional prediction model

UNIT 5

12 Hrs.

Rote learning, learning by taking advice, learning in problem solving, learning from examples, winston's learning program, decision trees, perception, vision, speech recognition, navigation, manipulation, robot architecture - data analytics using scalable logistic regression - sentimental classification of bigdata using logistic regression

COURSE OUTCOMES

Max:60 Hrs.

On completion of the course the student will be able to

- CO1:Understand the key issues in big data management
- CO2:Acquire various analysing techniques, software tools in big data analytics
- CO3:Analyse various AI approaches to solve problems.
- CO4:Learn various classification techniques in big data analytics.
- CO5:Design models for real world scenarios.
- CO6:Design a case study and retrieve the patterns from large data to solve complex tasks.

TEXT/ REFERENCE BOOKS

1. Distributed Databases: Principles and Systems Paperback – 1 Jul 2017 by Stefano Ceri , Giuseppe Pelagatti , McGraw Hill Education, ISBN-10: 0070265119, ISBN-13: 978-0070265110, 2017.
2. Tom White “ Hadoop: The Definitive Guide” Fourth Edition, O’reilly Media, 2015
3. Prajapati, V. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2013

4. E.RichK.Knight, and B. Nair, Artificial Intelligence, 3rdEdition, TMH, 1 July 2017
5. RusselNorvig, Artificial Intelligence A modern Approach, 3 rd Edition, Pearson Education,2010

Employability

SBSA2501	ADVANCED JAVA PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

LIST OF PROGRAMS

1. Write an Application for Student Information System using JDBC and AWT
2. Write an Application for Library Information System using JDBC and AWT
3. Client validation using JavaScript
4. Write a program to demonstrate event handling in JavaScript.
5. Web Application using servlet to demonstrate the Http Handling(GetRequest)
6. Web Application using servlet to demonstrate the Http Handling(PostRequest)
7. Write a servlet program to demonstrate the cookie.
8. Write a servlet program to demonstrate the URL Rewriting.
9. Simple shopping cart application using JSP
10. Banking Application using JSP Use Bean Methods.

Employability

SBSA2502	MACHINE LEARNING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments:

1. Analysis and implementation using Python /Jupyter Notebook/Colab
 - i. Compute the distance travelled by the robot from current position after a sequence of movement and original point.
 - ii. Creation of scatter plot using sepal length and petal width to separate the Species classes
2. Computation of Statistical details and Complexity
 - i. Calculate the Five Number Summary(Quartiles, IQR) for the attribute(age) of each employee at a Tea Factory.
 - ii. Analyze the complexity of Heap sort, applied over different sized random lists.
3. Preprocessing and construction of a quality dataset
 - i. Preprocess the given data to build good training sets (80%) and test sets (20%) by removing the missing values and imputing them with the mean value.
 - ii. Examine the interrelations among the set of variables using Principal Component Analysis, display the PCA Components and generate Heatmap.
4. Analysis and Interpretation of data
 - i. Manipulate the Twitter Data Set by removing the Punctuation, Numbers, Special Characters and word length<=3. Tokenize the Words and Stem.
 - ii. Generate a word cloud for the Twitter dataset and retrieve the top 15 positive and negative tags.
5. Build new models (Classification and Clustering)
 - i. Find core samples of high density and expand clusters from them using DBSCAN Clustering.
 - ii. Split the iris dataset into train and test data(80%-20%) and train or fit the data into the model using K Nearest Neighbor Algorithm.
6. Evaluate the Performance of Machine Learning algorithms
 - i. Evaluate the performance of Machine Learning algorithms using Confusion Matrix, Accuracy, Sensitivity, Specificity, Precision and Recall.
 - ii. Employ Linear Regression to check the linearity between the a)stock price and interest rate, b)stock price and unemployment rate.

SBSA3011	FOUNDATION OF AI	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

UNIT 1

12 Hrs.

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information.

UNIT 2

12 Hrs.

Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance.

UNIT 3

12 Hrs.

Knowledge based agent – The Wumpus world environment – Propositional logic – Inference rules – First-order logic – Syntax and semantics – Situation calculus – Building a knowledge base – Electronic circuit domain – Ontological Engineering – Forward and backward chaining – Resolution – Truth maintenance system-Mental Events and Mental Objects.

UNIT 4

12 Hrs.

Planning – Representation of planning – Partial order planning –Planning and acting in real world – Acting under uncertainty – Bayes's rules – Semantics of Belief networks – Inference in Belief networks – Making simple decisions – Making complex decisions.

UNIT 5

12 Hrs.

AI applications – Language Models – Information Retrieval- Information Extraction –Fields of Natural Language Processing, Chatbots and its types , Artificially Intelligent Chatbots, Introduction to Chatbot Applications(Retrieval based- Conversation based)-Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: An ability to identify, analyze the search algorithm for the AI problems.
- CO2: Represent a problem using first order logic.
- CO3: Provide the knowledge based agent to solve the problem.
- CO4: Understand the Informed search strategies.
- CO5: Apply the baye's rule to solve the problem for societal concern.
- CO6: Design user centric applications that use AI concepts

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rdEdition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.
4. Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, David L. Poole and Alan K. Mackworth, 2010

Employability

SBSA1304	SOFTWARE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- A general understanding of software process models, role of project management, different software architectural styles and approaches to verification and validation
- Software process models and compare their applicability
- Identify the key activities in managing a software project
- Concepts of requirements engineering and Analysis Modelling
- Apply systematic procedure for software design and deployment

UNIT I (9 Hrs)

Definition of software and software engineering – Software myths –Software Engineering paradigms: Linear Sequential Model and Prototyping Model-Incremental – Spiral Model- Iterative Model. Software Project Management. Software Cost Estimation– Software Project Planning.

UNIT II (9 Hrs)

Introduction – The software requirement specifications – Formal specification techniques – Languages and processors for requirements specification : SDAT, SSA, GIST, PSL/PSA, REL/REVS- Software prototyping – rapid prototyping techniques- user interface prototyping- Analysis and modeling – data, functional and behavioral models – Structured analysis and data dictionary.

UNIT III (9 Hrs)

Abstraction – Modularity – Software architecture – Cohesion, coupling – Various design concepts and notations – Real time and distributed system – Design – Documentation – Data flow oriented design – Jackson system development – Design for reuse – Programming standards. User interface Design- principles- SCM- Need for SCM- Version control – Introduction to SCM process – software configuration items

UNIT IV (9 Hrs)

Levels - Test activities - Types of s/w test - Black box testing - Testing boundary condition - Structural testing- Test coverage criteria based on data flow mechanisms - Regression testing - Testing in the large- S/W testing strategies - Strategic approach and issues - Unit testing - Integration testing - Validation testing - System testing and debugging. Case studies – Writing black box and white box testing

UNIT V (9 Hrs)

Introduction – Quality assurance – Walk through and inspections – Static analysis – Symbolic execution- Software Maintenance: Introduction – Enhancing maintainability during development- Managerial aspects of software maintenance – Configuration management – Source code metrics – Other maintenance tools and techniques

Max 45hrs

COURSE OUTCOMES

- CO1 - Identify and apply software lifecycle model for a given problem and will know the criteria for each level of CMM.
- CO2 - Comprehend types of requirements and summarize Requirement Engineering Process
- CO3 - Design data, functional and behavioral model for any given software requirement.
- CO4 - Identify and analyze levels of testing and perform white box testing and black box testing for a given problem.
- CO5 - Describe concepts of software quality assurance and software configuration management.
- CO6 - Compare and contrast forward engineering, reverse engineering and reengineering.

TEXT / REFERENCE BOOKS:

8. Pressman. R. S. ,Software Engineering - Fourth Edition- McGraw Hill International Edition 1997.
9. Richard Fairley, Software Engineering - (Design Reliability and Management), -Tata McGraw hill Edition -1983.
10. Fleegeer.P Software Engineering, - Prentice Hall, 1999.
11. Pfleegeer and Lawrance, “Software Engineering: Theory and Practice” Pearson Education, Second Edition, 2001

12. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
13. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
14. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each uniformly distributed – No choice

20 Marks

PART B : 2 Questions from each unit of internal choice, each carrying 16 marks

80 Marks

 Entrepreneurship

SBSA1503	WEB TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To effectively design with a range of technologies.
- To develop static websites & dynamic web applications.
- To learn new emerging web technologies.
- To gain knowledge and skills required for web development careers.
- To develop skills in the use and application of specific methods in user experience design.

UNIT 1 (9 Hrs.)

Introduction To HTML- DHTML , XML – Structuring XML document using DTD – Schemas – XML parsers – DOM – SAX presentation technologies – XSL – XFORMS – XHTML – Transformations – XSLT – XLINK – XPATH – XQuery. Responsive Web Design-Intro-Fluid Grid-Viewport-Media Queries-Images.Introduction To CSS-Syntax,Selectors-Types of style sheets.

UNIT 2 (9 Hrs.)

Java Script – Advantages – Data types – Variables – Operators – Control statements – Functions – Objects and arrays – **Windows and frames – Forms.AJAX – XMLHttpRequest (XHR)** – Create Object – Request – Response – Ready state.

UNIT 3 (9 Hrs.)

Introduction To PHP – Data Types – Control Structures – Arrays - Function – **Html Form with PHP –Form Handling & Validation-File Handling** – Cookies – Sessions – Filters – Exception Handling - Database Connectivity With MySQL.

UNIT4 (9 Hrs.)

Angular JS Expression – Modules – Directives – **Data Binding – Controllers – Scopes – Filters – Services – Tables – Events- Form Validation.Query Syntax – Selects – Events – jQuery Effects – jQuery – jQuery HTML – jQuery Traversing.**

UNIT 5 (9 Hrs.)

UX Introduction -Elements of UX Design- UX Design Process- Research Methods and Tools-Understanding User Needs and Goals. **UX Design Process: Visual Design Principles-Information Design and Visualization-Interaction Design-Prototyping Tools-Usability Test.UI Introduction-User Interface Components -Tools and Processes.**

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 - Able to work with XML technologies.
- CO2 - Design web page to perform form validation using client-side scripting language.
- CO3 - Implement new technologies such as Angular JS and JQuery.
- CO4 - Develop web applications using server-side scripting language.
- CO5 - Understand the differences between usability and user experience.
- CO6 - Effectively select and utilize design thinking processes and UX/UI tools.

TEXT /REFERENCE BOOKS

7. Jeffrey C. Jackson, WebTechnologies: A Computer Science Perspective, Pearson Education, 2009.
8. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
9. Ken Williamson, Learning AngularJS: A Guide to AngularJS Development, O'Reilly, 2015.
10. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development, John Wiley and Sons Inc., 2014.
11. CallumMacrae, Learning from JQuery, O'Reilly, 2013.
12. Steve Krug,Dont Make Me Think,2ndEdition,New Riders Publishing,USA,2006.

SBSA2402	ROBOTICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Experiments:

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Color identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

SBAA4002	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		4	0	0	3	100

COURSE OBJECTIVES

- To gain knowledge about the fundamentals of management.
- To understand the tools and techniques of the various aspects of management.
- To apply management concepts in decision making.

UNIT 1

(9 Hrs.)

MANAGEMENT THEORIES

Definition of management, science or art, manager vs entrepreneur; Types of managers - managerial roles and skills; Evolution of management-scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

UNIT 2

(9 Hrs.)

PLANNING, DECISION MAKING AND ORGANISING

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes, Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and Decentralization, job design,

UNIT 3

(9 Hrs.)

STAFFING AND LEADING

Human resource management, HR Planning, Recruitment selection, training & development, performance management, career planning and management, Directing individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT 4

(9 Hrs.)

CONTROLLING AND REPORTING

Controlling, system and process of controlling, budgetary and non-budget control technique, use of computer and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

UNIT 5

(9 Hrs.)

VALUES AND ETHICS

Human Values – Natural acceptance - Ethics – Definition- Objectives - Virtues – Challenges in the work place - Engineering ethics - Scope - Moral issues and judgment - Moral development theories – Engineers as responsible experimenters - Codes of ethics - Industrial standards - Global Issues: Environmental ethics- Computer ethics - Ethics and codes of business conduct in MNC.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the evolution and development of management concepts
- CO2 - Understand the functions of management
- CO3 - Apply the concepts and develop key competencies for managing human resources
- CO4 - Analyze appropriate management techniques for Controlling and Reporting.
- CO5 - Evaluate the various aspects of decision making and demonstrate critical thinking
- CO6 - Elaborate the importance of the ethical dimension in workplace

TEXT / REFERENCE BOOKS

1. Robins S.P. and Couiter M, Management, Prentice Hall India, 11th Edition, 2012.
2. Harold Koontz and Heinz Weihrich, 'Essentials of Management' Tata McGraw Hill, 10th Edition, 2015.
3. Nagaraazan R.S., A Text Book on Human Values and Ethics, New Age International Publishers, New Delhi, 2018.
4. Stoner James A.F., Freeman R.E. and Gilbert R.D., Management, Pearson Education, 6th Edition, 2018.

5. Griffin R.W., Management, South-Western College Publication 11th Edition, 2012.
6. Joseph L. Massie, Essentials of Management, Pearson Education, 4th Edition, 2016.
7. Harris Pritchard and Rabins, Engineering Ethics, Cengage Learning, New Delhi, 4th Edition, 2014.

 Entrepreneurship

SBSA3010	INTRODUCTION TO INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Internet of Things.
- To identify the various elements of an IoT System
- To understand the various means of communication from Node / Gateway to Cloud Platforms
- To identify types of data analytics and data visualization tools
- To make students aware of security concerns and challenges while implementing IoT solutions

UNIT 1

(9 Hrs.)

Introduction to IoT, Current technological trends and future prospects, - Evolution of IoT, Business Scope, Relation with embedded system, - Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT, IoT Value Chains, An emerging industrial structure for IoT.

UNIT 2

(9 Hrs.)

Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards,

UNIT 3

(9 Hrs.)

IoT Communication Model, Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud, Selecting and Creating cloud service, cloud based IoT platforms - IBM Watson, Google cloud.

UNIT 4

(9 Hrs.)

Big Data Analytics, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Storm, Data Visualization, Visualization tools for IoT

UNIT 5

(9 Hrs.)

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), DIY Kits – Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max.45 Hours

COURSE OUTCOMES

On Completion of course the student will be able to

- CO1 - To learn and understand the technology and current trends in Internet of things.
- CO2 - To understand the various elements of IoT system and hardware devices.
- CO3 - To learn the programming languages and platforms for building IoT applications.
- CO4 - To understand the cloud computing and its relevance for developing IoT applications.
- CO5 - To design and implement IoT applications that manages big data with data analytics and visualization tools.
- CO6 - To implement hands-on projects using an appropriate software and hardware devices in various applications.

TEXT / REFERENCE BOOKS

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi
2. Architecting the Internet of Things, Springer publications. Author(s): Dieter Uckelmann, Mark Harrison, Florian Michahelles
3. Internet of Things with Arduino Cookbook, Packt Publications. Author(s): Marco Schwatz
4. Internet of Things and Data Analytics, Wiley Publications.

SBSA1101	DIGITAL COMPUTER FUNDAMENTALS	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- To Understand the concept of digital systems
- To operate on various number systems and Simplify Boolean functions.
- To Distinguish logical and combinational circuits
- To Design counters and understand the working of arithmetic logic and control unit

UNIT 1

9 Hrs.

Number systems - Conversion from one number system to another - compliments - Binary codes - Binary logic - Logic gates- Truth tables.

UNIT 2

9 Hrs.

Boolean Algebra - Axioms - Truth table simplification of Boolean function - map method (upto 5 Variables) - Mc-Clausky tabulation method.

UNIT 3

9 Hrs.

Sequential logic - RS, JK,D and T Flip flops - Registers -Shift Registers - Counters - Ripple Counters - Synchronous Counter- Design of Counters.

UNIT 4

9 Hrs.

Adders - Subtractors - Decoders - Encoders - Multiplexer - Demultiplexer - Design of Circuits using decoders/Multiplexers - ROM - PLA - Designing circuits using ROMIPLA.

UNIT 5

9 Hrs.

Design of ALU - Design of Status Register - Design of accumulator - Introduction to Computer Design.

Max. 45 Hours

COURSE OUTCOMES:

- On completion of the course, student will be able to
- CO1 - To Understand the concept of digital systems
 - CO2 - To operate on various number systems and Simplify Boolean functions.
 - CO3 - To Distinguish logical and combinational circuits
 - CO4 - To Design counters and understand the working of counters
 - CO5 - To Design arithmetic logic and control unit
 - CO6-To evaluate the combinational circuits

TEXT/REFERENCE BOOKS

1. M. Morris Mano, "Computer System Architecture", Pearson Education, 2008.
2. Carter Nicholas, "Computer Architecture", Schaun outline Seives , Tata McGraw-Hill, 2008.
3. J.P. Hayes, "Computer Architecture & Organization", Tata McGraw Hill
4. 1. Leach.D.P&Malvino.A.P, (2002), "Digital Principles and Applications", FifthEdition, TMH.(UNIT I,II,III)
5. 2. MorisMano.M,(2001),"Digital Logic and Computer Design", Forth Edition,
6. AnanthiShashasaayee, Sheshasaayee.J.G,(2003), "Digital Logic Fundamentals",First Edition ,Margham Publications

Skill development

SBSA1102	PROGRAMMING IN C & C++	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ program.
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions.
- To impart the knowledge about pointers which is the backbone of effective memory handling.
- To perform Inheritance, Overloading of operators, functions, constructors and File Handling
- To demonstrate adeptness of object-oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

UNIT 1

12 Hrs.

BASICS OF C PROGRAMMING: Introduction to C: Features of C - Structure of C program-Data Types- 'C' Tokens- Input/output statements- Control Statement, Functions: – Types of Functions – Recursion.

UNIT 2

12 Hrs.

ARRAYS, STRINGS AND STRUCTURES: Arrays: Single and Multidimensional Arrays— Array as Function Arguments, Strings: String Handling Functions, Structure: Nested Structures – Array of Structures – Structure as Function Argument– Function that Returns Structure, Union.

UNIT 3

12 Hrs.

POINTERS AND FILE PROCESSING: Pointers: Introduction, Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer, Dynamic Memory Allocation, Storage Classes, File Handling in 'C'

UNIT 4

12 Hrs.

OBJECT ORIENTED PROGRAMMING CONCEPTS: Introduction- Procedure vs. object oriented programming- Concepts: Classes and Objects- Operator and Function Overloading- Inheritance- Polymorphism and Virtual Functions.

UNIT 5

12 Hrs.

TEMPLATES AND EXCEPTION HANDLING: Function Templates and Class Templates – Name spaces – Standard Template Library - Casting – Exception Handling – case study.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Develop simple applications in C using basic constructs.

CO2 - Design and Implement applications using arrays and strings.

CO3 - Develop and Implement applications using memory allocation and File concepts.

CO4 - Use proper class protection to provide security.

CO5 - Describe the reusability of code through Inheritance.

CO6 - Demonstrate the use of virtual functions to implement polymorphism.

TEXT/ REFERENCE BOOKS

1. Deitel and Deitel, C how to Program, 7th Edition, Pearson Education, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education, 2015.
3. Yashavant Kanetkar, Understanding Pointers in C, 4th Revised & Updated Edition, Bbp Publications, 2008.
4. E Balagurusamy, Object Oriented Programming with C++, 3rd edition, Tata McGraw Hill, 2006.
5. Bhave, Object Oriented Programming with C++, Pearson Education, 2004.
6. John R Hubbard, "Programming with C++", Schaums Outline Series, McGraw Hill, 2nd edition, 2009.
7. Bjarne Stroustrup, Programming: Principles and Practice using C++, 1st Edition, Addison Wesley Publications, 2008

Skill development

SBSA1201	FUNDAMENTALS OF DATA STRUCTURES	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES :

- It focuses on how to organize data for more efficient problem solving using data structures methods and techniques.
- To impart the basic concepts of data structures and algorithms
- To be familiar with writing recursive methods.
- To understand concepts about searching and sorting techniques.
- To implement basic concepts about stacks.
- To apply the concepts of queues and its types.

Unit I

12 Hrs.

Arrays- Linked List - Single Linked List - Insertion and Deletion - Doubly Linked List - Circular Linked List – Stack- Queues- Array implementation of a Stack and queue - Linked List implementation of a Stack and Queue- Priority Queues

Unit II

12 Hrs.

Evaluation of arithmetic expression using stack- Prefix –Infix-Postfix-notations, Converting infix expressions to postfix- Evaluation of postfix expression,-Towers of Hanoi problem.

Unit III

12 Hrs

Tree Structures: Binary Trees- Implementation of Binary Trees- Linear Representation of Binary Tree-Linked representation of a Binary Tree. Binary Tree Traversal : Pre order – In order - Post order.

Unit IV

12 Hrs

Sorting Techniques: Bubble Sort- Merge Sort - Shell Sort- Insertion Sort- Selection Sort-Quick Sort- Heap Sort. Searching Techniques: Sequential Search- Binary Search-Hashing- Indexing.

Unit V

12 Hrs

Graphs and Networks: Implementation of Graphs - Adjacency Matrix- Depth First Search-Breath First Search. Networks: Minimum Spanning Tree - The Shortest path Algorithm.

Max 60 Hrs

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the concept of recursive algorithms.
- CO2 - Demonstrate the different types of data structures.
- CO3 - Able to understand the operations on linear data structures.
- CO4 - Summarize searching and sorting techniques.
- CO5 - Choose appropriate data structure as applied to specified problem definition.
- CO6 - Understand and implement the applications of linear data structures.

TEXT / REFERENCE BOOKS:

1. E. Horowitz, S. Sahni, Fundamentals of Data Structures.
2. Bhagat Singh and Thomas L, Introduction to Data Structures, Naps, TMH.
3. Helieman, Data Structures, Algorithms and Object Oriented Programming.
4. Thomas H Coreman, Charles E Leiseron, Ronald L Rivest, Introduction to Algorithms, PHI 2002.
5. Jean-Paul Tremblay, Paul G. Sorenson, 'An Introduction to Data Structures with Application', TMH, 2017.
6. Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2004, 2nd Edition.
7. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Editin, 2004.
8. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

SBSA1301	OPERATING SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES:

- To learn how computers work and to learn about system design (performance vs. simplicity, HW vs. SW, etc.)
- To have an overview of different types of operating systems.
- To learn and implement the concept of process management.
- To observe the concept of storage management.
- To understand the concept of I/O and file systems.
- To learn the basics of Linux Programming

UNIT I 9 Hrs

Introduction: Operating system –Views and Goals - Types of System- OS Structure - Components - Services - System Structure - Layered Approach - Process Management: Process - Process Scheduling - Cooperating Process - Threads - Inter- process Communication.

UNIT II 9 Hrs

CPU Scheduling: CPU Schedulers - Scheduling Criteria - Scheduling Algorithms. Process Synchronization: Critical-Section Problem - Synchronization Hardware - Semaphores Classical Problems of Synchronization - Critical Region - Monitors.

UNIT III 9 Hrs

Deadlocks: Characterization- Methods for Handling Deadlocks - Deadlock Prevention - Avoidance - Detection - Recovery.

UNIT IV 9 Hrs

Memory Management: Address Binding - Dynamic Loading and Linking - Overlays - Logical and Physical Address Space - Contiguous Allocation- Non-Contiguous Allocation.

UNIT V 9 Hrs

File System: File Concepts - Access Methods - Directory Structures - Protection Consistency Semantics - File System Structures - Allocation Methods - Free Space Management.

Max: 45hrs

COURSE OUTCOMES:

- CO1 - Understand the fundamental components of a computer operating system and how computing resources are managed by the operating system.
- CO2 - Apply the concepts of CPU scheduling, synchronization, and deadlocks in real computing problems.
- CO3 - Demonstrate the different memory and I/O management techniques used in Operating Systems.
- CO4 - Have practical exposure to the concepts of semaphores and monitors for process synchronization.
- CO5 - Create design and construct the following OS components: Schedulers, Memory management systems in the modern operating system.
- CO6 - Understand file system structure and implement a file system such as FAT.

TEXT /REFERENCE BOOK:

1. A. Silberschatz P.B.Galvin, Gange., Operating System Concepts, 6th Edition., Addison-Wesley Publishing Co., 2002.
2. H.M. Deitel, An Introduction to Operating System, Second Edition, Addison Wesley, 1990.
3. A.S. Godbole, Operating System-Tata McGraw Hill-1999.
4. William Stallings, Operating Systems, Fourth Edition, PHI.
5. Andrew S Tanenbaum, Operating Systems: Design and Implementation, Third Edition,

Skill development

SBSA1302	COMPUTER ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To design and analyze the main functional units of computer and to understand the combinational and sequential circuits.
- Implementing assembly programs that accomplish basic computational and I/O operations.
- To impart knowledge on various types of Registers and Microinstructions.
- To discuss about the Data path design and Processor design in detail.
- To understand the types of memory organizations.
- To discuss about the registers, interface and communication in I/O devices.
- To analyze about the characteristics, structure communication and synchronization of multiprocessors.

UNIT I (9 Hrs)

Number systems - Conversion from one number system to another - Compliments - Binary codes - Binary logic - Binary Arithmetic - Logic gates - Truth tables. Boolean Algebra - Axioms - Truth table simplification of Boolean function - Map method - Mc-Clausky tabulation method.

UNIT II (9 Hrs)

Combinational Logic: Adders - Subtractors - Decoders - Encoders - Multiplexer – Demultiplexer Sequential logic: RS, JK, D and T Flip flops - Registers -Shift Registers Counters - Design of Counters.

UNIT III (9 Hrs)

Associative Memory – Cache Memory – Virtual Memory – Auxiliary Memory Memory Management Hardware. Peripheral Devices – Input-Output Interface – Asynchronous Data Transfer: Handshaking – Serial Transfer – Communication Interface– Modes of Transfer – Priority Interrupt – DMA –Serial Communication-

UNIT IV (9 Hrs)

Introduction to micro computers, Microprocessors and Assembly languages - Microprocessor architecture and its operations -8085 MPU - 8085 instruction set and Classifications.

UNIT V (9 Hrs)

Central Processing unit: General register and stack organizations, instruction formats - Addressing modes, Data transfer and manipulation - program control, RISC – Pipelining – Arithmetic and instruction, RISC pipeline – vector processing and array processors.

Max 45hrs

COURSE OUTCOMES

- CO1 - Classify the various types of registers, microinstructions and addressing modes.
- CO2 - Design the data path for processor
- CO3 - Demonstrate the usage of Memory Organization.
- CO4 - Describe about the I/O devices.
- CO5 - Explain the characteristics, structure, communication and synchronization of multiprocessor.
- CO6 - State the inter processor communication and synchronization.

TEXT /REFERENCE BOOKS:

1. M.Moris Mano, Computer system Architecture. PHI (Third edition, 1993)
2. M.M. Mano, Digital Logic and Computer Design, Prentice Hall of India, 1994.
3. Carl Hamacher, uonko G.Vranesic, Safwat G.Zaky – Computer Organisation, McGraw hill ISE 1987.
4. John, P.Hayes., Computer System architecture, McGraw Hill, ISE,1988.
5. Hwang.K.Briggs .F.A -Computer Architecture and parallel Processing, McGraw Hill ISE, 1988.

Skill development

SBSA1401	DATABASE MANAGEMENT SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- To gain knowledge in fundamentals of data models using ER diagram.
- To make a study of SQL and relational database design.
- To understand about Query processing, optimization and Concurrency control technique
- To understand terms related to database design and management
- To gain knowledge in relational model and relational database management system
- To implement relational databases using SQL & My SQL

UNIT I (9 Hrs)

Basic Concepts: Database and Database users – Database system concepts and architecture – Data modeling using Entity Relationship model – Enhanced entity relationship and object modeling – Record storage and file organizations – Index Structures for files

UNIT II (9 Hrs)

Relational Model, Languages and Systems: The Relational Data Model, Relational Constraints, and the relational Algebra – SQL – The Relational Database Standard – ER and EER to Relational Mapping and Other Relational Languages – Examples of Relational Database Management Systems: Oracle and Microsoft Access.

UNIT III (9 Hrs)

Database Design, Theory and Methodology: Functional dependencies and normalization for relational database – Relational database design algorithms and further dependencies – Practical database design and tuning

UNIT IV (9 Hrs)

System Implementation Techniques: Database system architectures and the system catalog – Query processing and optimization

UNIT V (9 Hrs)

Transaction processing concepts – Concurrency control techniques – Database recovery techniques – Database security and Authorization. Introduction to Emerging Database Technologies and Application

Max 45hrs

COURSE OUTCOMES

- CO1 - Design ER-models to represent simple database application scenarios
- CO2 - Ability to understand and design data modelling using Entity-Relationship model
- CO3 - Implement SQL to a broad range of query and data update problems
- CO4 - Articulate socio-economic applications of distributed databases and use database recovery mechanisms
- CO5 - Familiar with data warehousing and data mining applications
- CO6 - Apply Normalization techniques to normalize and improve the database design

TEXT / REFERENCE BOOKS:

7. Elmasri & Navathe, Fundamentals of Database Systems, 6th Edition, Addison Wesley, 2010
8. Korth, Silberschatz & Sudarshan, Database System Concepts, 5th Edition, Tata McGraw Hill, 2010
9. Raghu Ramakrishnan & Johannesgerhrke, Data Base Management Systems, 3rd Edition, Tata Mc Graw Hill, 2002.
10. Abraham Silberschatz, Henry.F.Korth and S.Sudharshan, "Database System Concepts", 4th Edition, 2002.
11. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012
12. Jan L. Harrington, "Object oriented database design", Harcourt India private limited 2000.

Skill development

SBSA1502	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of data communication and modulation techniques.
- To get a general overview of “Computer Networks
- To know the functions of Data link layer
- To understand network layer functions and protocols used
- To learn about transport layer, session, presentation and application layer

UNIT I (9 Hrs)

Introduction to Data Communication, Network. Protocols & standards and standards organizations - Line Configuration - Topology - Transmission mode - Classification of Network OSI Model - Layers of OSI Model.

UNIT II (9 Hrs)

Parallel and Serial Transmission - DTE/DCE/such as EIA-449, EIA-530 EIA-202 and x.21 interface - Interface standards - Modems - Guided Media Unguided Media - Performance - Types of Error - Error Detection - Error Corrections.

UNIT III (9 Hrs)

Multiplexing - types of Multiplexing - Multiplexing Application - Telephone systems project 802 - Ethernet - Token Bus - Token Ring FDD IEEE 802.6 - SMDS - Circuit Switching - Packet switching - Message switching Connection oriented and connectionless services.

UNIT IV (9 Hrs)

History of Analog and Digital Network - Access to ISDN - ISDN Layers - Broadband ISDN X.25 Layers - Packet Layer Protocol - ATM - ATM Technology - ATM protocol.

UNIT V (9 Hrs)

Repeaters Bridges Routers - Gateway - Routing algorithms - TCP/IP Network, Transport and Application Layers of TCP/IP - World Wide Web.

Max 45hrs

COURSE OUTCOMES:

- CO1 - To understand the concept of data communication and modulation techniques.
- CO2 - To get a general overview of “Computer Networks
- CO3 - To know the functions of Data link layer
- CO4 - To understand network layer functions and protocols used
- CO5 - To learn about transport layer, session, presentation and application layer

TEXT / REFERENCE BOOKS:

1. Behrouz and Forouzan - Introduction to Data Communication and Networking - 2nd Edition - TMH - 2001.
2. Jean Walrand Communication Networks (A first course) - Second Edition - WCB McGraw Hill - 1998.
3. Andrew S Tanenbaum ,Computer Networks,Third edition, Tata McGraw Hill,2006
4. Fred Halsall ,Data Communications, Computer Networks and Open Systems, 4th Edition , Addison Wesley,, 2000.
5. William Stallings, (2006), “Data and Computer Communication”, 7th Edition, Pearson Education. Unit (IV – V)

Skill development

SBSA3091	SOCIETY 5.0	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVE

- To understand the society 5.0, Cyberspace and Physical Space to solve
- To Provide knowledge and overview about big data, IoT and Artificial Intelligence for Society 5.0.
- Discuss To understand Augmented Reality and Virtual Reality, Next Generation Sensors
- To discuss about Challenges and Technologies towards Society 5.0, Security of Cyber Physical Systems
- Discuss to apply society 5.0 Innovation with Future Trends with Applications

UNIT I

(9 hrs)

INTRODUCTION TO SOCIETY 5.0

Introduction –Schema of society 5.0-Characteristics of Society 5.0. Introduction to communication technologies: Artificial Intelligence – robotics - 3D Printing. People: Centric Society -Knowledge Sharing- Physical space-Cyberspace – Humanity VS Society 5.0 –Elements of Society 5.0-Data Driven to Society- Modeling real world Issues.

UNIT II

(9 hrs)

EMERGING TECHNOLOGIES WITH SOCIETY 5.0

Introduction to Big Data – Issues and Challenges in the traditional systems –Intelligent Data Analysis –Big Data Storage Statistical Concepts: Sampling Distributions - Re-Sampling - Prediction Error – Random Sampling– Artificial Intelligence – - Foundations of AI - Intelligent agent - Types of agents - Structure - Problem solving agents -Internet of Things- Introduction to IoT- Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT-Robotics- Robotics system components - Robot classification Coordinate frames - degree of freedom - dynamic stabilization of robots.

UNIT III

(9 hrs)

INTRODUCTION TO INDUSTRY 4.0

Introduction-Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Cyber Physical Systems and Next Generation Sensors, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis- An emerging industrial structure for IoT -Cyber security in Industry 4.0-Basics of Industrial IoT. Common Issues in Industry 4.0 and Society 5.0.

UNIT IV

(9 hrs)

CHALLENGES AND TECHNOLOGIES TOWARDS SOCIETY 5.0

Overcome with Economic Development and Solution to Social Problems in Society 5.0- Security of Cyber Physical Systems -Embedded and CPS security - attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols- Social Issues in Society 5.0 - human-centered society (Society 5.0)- Sustainable Development Goals-Economic Advancement- Resolution to Social Problems..

UNIT V

(9 hrs)

INNOVATION WITH FUTURE TRENDS WITH APPLICATIONS

Mobility – Health Care –Agriculture- Food Products – Disaster Prevention.

Max 45hrs

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Able to understand the Social Problems By A System That Highly Integrates Cyberspace and Physical Space to solve

CO2 - Ability to get skills For Economic Development And A Human-Centered Society That Balances Economic Advancement

CO3 - Achieve A High Degree Of Convergence Between Cyberspace (Virtual Space) And Physical Space (Real Space)

CO4 - Able to Use Of Emerging Technologies With Society 5.0 To Achieve The More Production / Avoid Loss Of Productions

CO5 - Able Internet and IoT , Big data for production lines to be adaptive, intelligent, and flexible enough to meet the updated requests.

CO6 - Design and apply in Health Care , Agriculture, Food Products, Disaster Prevention

TEXT/ REFERENCE BOOKS:

1. Society 5.0 A People –Centric Super –Smart Society, Hitachi –Utokyo Laboratory, Springer,2020.
2. Society 5.0 Industry of the Future Technologies Methods and Tools By Bruno Salgues,Wiley, 2018
3. Stuart J.Russel, Peter Norvig, “Artificial Intelligence A Modern Approach ”, 3rd Edition, Pearson Education, 2009
4. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi.,2012.
5. McKerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.

 Skill development



SATHYABAMA

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School of Science and Humanities

Department of Computer Science

1.1.3 Courses Having Focus on Employability/ Entrepreneurship/ Skill Development

Contents

S. No.	Course Code	Course Name	Page No.
Employability			
1	SCSA5102	Database Technologies	2
2	SCSA5103	Software Quality Assurance and Testing	3
3	SCSA5104	Web Based Application Development	4
4	SBSA5202	Internet of Things	5
5	SBSA5203	Introduction to Machine Learning	6
6	SBSA5303	Data Science	7
7	SBSA6301	Cyber Physical System Lab	8
Entrepreneurship			
	SCSA5103	Software Quality Assurance And Testing	9
8	SBSA5104	Web Based Application Development	10
9	SBSA5201	Design Thinking	11
10	SBSA6201	Internet Of Things Lab	13
Skill Development			
11	SCSA5101	Advanced Data Structures And Algorithms	14
12	SCSA5103	Software Quality Assurance And Testing	15
13	SBSA5201	Design Thinking	16
14	SBSA5302	Introduction To AI	18

SCSA5102	DATABASE TECHNOLOGIES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture.
- Demonstrate principles of design, development and administration relevant to Oracle database technology.
- Formulate a working definition of database development and administration.
- To understand the emerging databases like Mobile, Multimedia, Cloud and Big Data and Hadoop infrastructures.

UNIT 1 INTRODUCTION

9 Hrs.

Data base system Architecture – Query Optimization Techniques - Transaction Management: Transaction Processing Concepts - Concurrency Control - Recovery Techniques -Database Security

UNIT 2 PARALLEL DBMS

9 Hrs.

Architecture-Query evaluation-Query optimization-parallelizing Individual operations. Distributed DBMS: Architecture-storing data-Cataloguing-Query processing-Transactions Concurrency and Recovery.

UNIT 3 MOBILE DATABASES

9 Hrs.

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols

UNIT 4 OBJECT AND MULTIMEDIA DATABASE SYSTEMS

9 Hrs.

Object Databases–Advantages and disadvantages compared to Relational Databases- Abstract data types, Objects identity and reference types- Inheritance Database design for ORDBMS ODMG data model and ODL OQL.MULTIMEDIA DATABASES: Nature of Multimedia data and applications Data management issues– Components of Multimedia database management system.

UNIT 5 BIGDATA AND HADOOP

9 Hrs.

Big Data–Introduction-Technologies–Reference Architecture- Hadoop– Introduction to Hadoop Distributed File System– Design of HDFS–HDFS Concepts–Interfaces for Hadoop File System–Map Reduce–weather Dataset–Analyzing the data with Hadoop–Anatomy of Map Reduce Job Run.

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3rd Edition McGraw Hill Publications.
2. Korth.H.F. and A.Silberschatz, “Data base system concepts”, 3rd Edition, McGraw Hill Publications.
3. Ramez Elmasri and B.Navathe:“Fundamentals of Database Systems”, 5th Ed., Addison Wesley, 2008.
4. Stenfnno Ceri and Gieusppepelagatti, “Distributed database-principles and systems”, 3rd Edition.
5. O’Reilly, “Hadoop–The Definitive Guide“, O’Reilly Media.
6. <http://www.oracle.com/technetwork/topics/entarch/articles/info-mgmt-big-data-ref-arch-1902853.pdf>
7. <http://www.comptechdoc.org/independent/database/basicdb/dataobject.html>.

Employability

SCSA5103	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.
- To introduce the concepts of Software quality and its assurance.

UNIT 1 INTRODUCTION

9 Hrs.

Software testing fundamentals-objectives-principles-Testability-Levels of testing-TMM- Characteristics of a tester-A testing group-Comparison of KPA in ISO, CMM and TMM-Software quality attributes.

UNIT 2 SOFTWARE TESTING METHODS AND STRATEGIES

9 Hrs.

Test case design-White box testing- Basic path testing-Flow Graph Notation-Cyclomatic Complexity-Deriving Test Cases- Graphic matrices-Control Structure Testing-Deriving Test cases-Dataflow Testing-Loop Testing-Black box Testing-Graph Based Testing Methods-Equivalence partitioning-Boundary value analysis-Comparison testing. Strategic Approach to Software Testing- Verification and Validation-Strategic issues-Unit testing-Consideration Procedures. Integration Testing-Regression Testing- Integration Test Documentation-Validation testing-Configuration Review-Alpha and Beta Testing System Testing-Art of Debugging. Case studies: Writing test cases for white box and black box testing.

UNIT 3 OBJECT ORIENTED TESTING, METRICS AND MEASUREMENTS

9 Hrs.

Testing OOD Models-OO Testing Strategies-Test Case Design for OO Software-Testing Methods applicable at the class level- Inter class test design-The intent of OO metrics-Distinguishing characteristics of OO metrics. Common software measurements: Code coverage-Cohesion-Comment density, Coupling-Function point analysis- Number of classes and interfaces-Number of lines of customer requirements-Robert Cecil Martin's software package metrics-Bugs per line of code-Source lines of code.

UNIT 4 QUALITY CONSIDERATIONS

9 Hrs.

Planning for quality – Quality plan – Cost/benefit tradeoff – Feature/bug tradeoff – Modeling quality improvement- Notation of defects-Defects-Defect removal activities-Conditions for each activity-Defect removal goals-Quality improvement teams- quality recognition-Manage Priorities Effectively-Statistical Quality Assurance-Software Reliability.

UNIT 5 OVERVIEW OF STANDARDS

9 Hrs.

Levels of standards-Quality assurance standards-Project management standards-Dependability standards-Product standards- Process standards-ISO9000-Reviews, Audits and Certification.

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Ilene Barnstein,"Practical Software Testing-A Process Oriented Approach", Springer International Edition.
2. Humphrey, W.S. (2002), "A Discipline for Software Engineering. Reading, MA", Addison-Wesley.
3. Roger S.Pressman, "Software Engineering, A Practitioner's Approach", Tata McGraw Hill, 5th Edition.
4. Marc Roper, "Software Testing", McGraw Hill Professional, 1994.
5. Ian Sommerville, "Software Engineering", Addison-Wesley, 5th Edition, 1996.

Employability

SBSA5101	WEB BASED APPLICATION DEVELOPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To provide knowledge on web architecture, web services, client side and server side scripting technologies to focus on the development of web-based information systems and web services.
- To provide skills to design interactive and dynamic web sites.
- To provide knowledge for implementing web applications using .NET framework.

UNIT 1 HTML & CSS

9 Hrs.

Introduction to web, Web development overview, HTML Tag, Rules of HTML, Text Formatting & Style, List, Adding Graphics to Html Document, Tables and Layout, Linking Documents, Frame, Forms, Project in HTML, Introduction to DHTML, CSS, Class & DIV, External Style Sheet.

UNIT 2 SCRIPTING

9 Hrs.

Java Script : Introduction, documents, forms, statements, functions, objects, event handling, Advantage of Java Script, JS object model and hierarchy, Handling event, Operators and syntax of JS, Function, Client side JS Vs Server side JS, JS security Introduction to VB Script, Operator & Syntax of VB Script, Dialog Boxes, Control & Loop, Function in VBS.

UNIT 3 SERVER SITE PROGRAMMING

9 Hrs.

Introduction, Internet Information System (IIS), ASP object, Server object File system object, session, Accessing data base with an ASP page, ODBC – ADO connection object, common methods and properties, ADO record set object.

UNIT 4 XML

9 Hrs.

XML-XML structure – elements, well formed XML, XML Namespaces - working with DTD- Adding DTDs to documents - defining DTD entities - defining Parameter entities - Working with attributes – Defining attributes, defining multiple attributes, using predefined attributes - CSS basics - Adding CSS to document, CSS selections, Controlling fonts - Need of XSL, XSL basics, XSL transformations, Introduction to Schemas- Defining simple elements and types-XML query

UNIT 5 PHP

9 Hrs.

Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Jeffrey C Jackson, Web Technology – A computer Science perspective, Person Education, 2007.
2. Ivan Bayross, HTML, DHTML, Java Script, Perl & CGI, BPB Publication
3. Chris Bates, Web Programming – Building Internet Applications, Wiley India, 2006.
4. Deitel & Deitel, Internet and World Wide Web How to Program, Third Edition.
5. Ullman, PHP for the Web: Visual QuickStart Guide, Pearson Education
6. Mark Birbeck, Stev Livingstone, Stephen F. Mohr, Jonathan Pinnock, Steven Livingston, Professional XML, 2nd Edition, Peer Information, 2001
7. Gopalan. N.P, Web Technology A Developer Perspectives, PHI, 2009.

Employability

SBSA5202	INTRODUCTION TO INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the concepts of Internet of Things.
- To identify the various elements of an IoT System
- To understand the various means of communication from Node / Gateway to Cloud Platform
- To identify types of data analytics and data visualization tool
- To make students aware of security concerns and challenges while implementing IoT solution

UNIT 1 INTRODUCTION TO IOT

9 Hrs.

Introduction to IoT, Current technological trends and future prospects, - Evolution of IoT, Business Scope, Relation with embedded system, - Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT, IoT Value Chains, An emerging industrial structure for IoT.

UNIT 2 ELEMENTS OF IOT

9 Hrs.

Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards,

UNIT 3 COMMUNICATION AND CONNECTIVE TECHNOLOGIES

9 Hrs.

IoT Communication Model, Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud, Selecting and Creating cloud service, cloud based IoT platforms - IBM Watson, Google cloud.

UNIT 4 DATA ANALYTICS AND IOT PLATFORM

9 Hrs.

Big Data Analytics, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Storm, Data Visualization, Visualization tools for IoT

UNIT 5 HANDS-ON PROJECTS

9 Hrs.

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), DIY Kits – Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 : To learn and understand the technology and current trends in Internet of things.
- CO2 : To understand the various elements of IoT system and hardware devices.
- CO3 : To learn the programming languages and platforms for building IoT applications.
- CO4 : To understand the cloud computing and its relevance for developing IoT applications.
- CO5 : To design and implement IoT applications that manages big data with data analytics and visualization tools.
- CO6 : To implement hands-on projects using an appropriate software and hardware devices in various applications.

TEXT/REFERENCE BOOKS

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi
2. Architecting the Internet of Things, Springer publications. Author(s): Dieter Uckelmann, Mark Harrison, Florian Michahelle
3. Internet of Things with Arduino Cookbook, Packt Publications. Author(s): Marco Schwartz
4. Internet of Things and Data Analytics, Wiley Publications.

SBSA5203	INTRODUCTION TO MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To focus on the construction and study of algorithms that can learn from data
- To emphasize on the logical, knowledge-based approach.
- To introduce students to the basic concepts and techniques of Machine Learning
- To develop skills of using recent machine learning software for solving practical problems
- To gain experience of doing independent study and research.

UNIT 1 **9 Hrs.**

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation

UNIT 2 **9 Hrs.**

Linear regression, Decision trees, overfitting. Instance based learning, Feature reduction, Collaborative filtering based recommendation.

UNIT 3 **9 Hrs.**

Clustering: k-means, adaptive hierarchical clustering, Bayes learning, Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.

UNIT 4 **9 Hrs.**

Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network.

UNIT 5 **9 Hrs.**

Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 : Comprehend the Machine Learning concepts, classifications of Machine Learning

CO2 : Solve problems using Supervised Learning concepts

CO3 : Apply Support Vector Machine concepts to given problems

CO4 : Implement unsupervised learning concepts on real time datasets

CO5 : Recognise and implement various suitable model parameters for different machine learning techniques

CO6 : Evaluate models generated from data.

TEXT/REFERENCE BOOKS

1. Ethem Alpaydin, Introduction to Machine Learning, MIT press. 2020
2. Andriy Burkov, The Hundred page Machine Learning Book, Andriy Burkov, ISBN:199957950X, 9781999579500, 2019
3. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning, Cambridge University Press. 2017
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, Second Edition. 2009.
5. Avrim Blum, John Hopcroft and Ravindran Kannan, Foundations of Data Science, January 2017.
6. Christopher Bishop, Pattern Recognition and Machine Learning, Springer. 2006.

 Employability

SBSA5303	DATA SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To study the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools

UNIT 1 INTRODUCTION TO DATA SCIENCE

9 Hrs.

What is Data Science? – The data life cycle: pre-processing, analysis, post-processing – Preprocessing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT 2 APPROACHING ANALYTICS PROBLEMS

9 Hrs.

Key roles for successful Analytics project- Discovery- Business domain, Resources, Problem framing, Key stakeholders, Analytics sponsors, Initial hypotheses, Data sources- Data Preparation- Learning about the data, conditioning- Model Planning- Data exploration, Model selection- Model Building- Common tools for model building- Communicate Results- Analysis over the different models- Operationalize- Moving the model to deployment environment-Analytics Plan

UNIT 3 INTRODUCTION TO R

9 Hrs.

Introduction to R- R Graphical user interfaces- Data Import and Export- Attributes and Data Types- Vectors- Arrays and Matrices- Data Frames- Lists- Factors- Contingency Tables- Descriptive statistics- Model building, Evaluation and Deployment- Hypotheses Testing- Null hypotheses and Alternative hypotheses- Probability distributions- Statistical models in R- Data distribution

UNIT 4 MODELING METHODS

9 Hrs.

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 5 DELIVERING RESULTS

9 Hrs.

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.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 : Understand the key concepts in data science, including tools and approaches.
CO2 : Apply a suitable data science technique to solve an information analytics problem.
CO3 : Able to comprehend basic methods of processing data from real world problems
CO4 : Analyze and validate the models using appropriate performance metrics
CO5 : Understand the various techniques in data science
CO6 : Present the results using effective visualization techniques

TEXT/REFERENCE BOOKS

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics” , EMC Education Services,2015
2. NinaZumel,JohnMount,“PracticalDataSciencewithR”,ManningPublications,2014
3. JureLeskovec,AnandRajaraman,JeffreyD.Ullman,“MiningofMassiveDatasets”,Cambridge University Press,2014
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.

SCSA6301	CYBER PHYSICAL SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.

SUGGESTED LIST OF EXPERIMENTS

1. Study about embedded components such as sensors and actuators
2. Study about Industrial Revolution and Cyber physical system opportunities and challenges
3. Create a program that blinks the LED on the development board using MBED software
4. Pick one-one from the available sensors and actuators and find or create code that will display the sensed data on the PC
5. Create a program that displays data from the sensor in regular intervals in a compact format.
6. To Design Basic weather station using embedded components using Lab view software.
7. Login to devicehub.net and create a project then create a virtual device. Add the corresponding sensor and actuator to the virtual device.
8. Study the MQTT protocol. Examine the components of the protocol.
9. Create a connection from an MQTT capable device/software with an MQTT broker then send and receive data using it.
10. To configuring the gateways and exchange the data to local database using Dream factory
11. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots
12. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 : An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.

CO2 : Identify the limitations of some computational models

CO3 : Apply the theoretical knowledge the design of compilers.

CO4 : Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.

CO5 : Categorize the essential modeling formalisms of Cyber-Physical Systems (CPS)

CO6 : Implement the real time use case and problem statements

TEXT/REFERENCE BOOKS

1. wa, O'Reilly Media 2015.
2. Zero to Block chain - An IBM Redbooks course, by Bob Dill, David Smits.

Employability

SCSA5103	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.
- To introduce the concepts of Software quality and its assurance.

UNIT 1 INTRODUCTION

9 Hrs.

Software testing fundamentals-objectives-principles-Testability-Levels of testing-TMM- Characteristics of a tester-A testing group-Comparison of KPA in ISO, CMM and TMM-Software quality attributes.

UNIT 2 SOFTWARE TESTING METHODS AND STRATEGIES

9 Hrs.

Test case design-White box testing- Basic path testing-Flow Graph Notation-Cyclomatic Complexity-Deriving Test Cases- Graphic matrices-Control Structure Testing-Deriving Test cases-Dataflow Testing-Loop Testing-Black box Testing-Graph Based Testing Methods-Equivalence partitioning-Boundary value analysis-Comparison testing. Strategic Approach to Software Testing- Verification and Validation-Strategic issues-Unit testing-Consideration Procedures. Integration Testing-Regression Testing- Integration Test Documentation-Validation testing-Configuration Review-Alpha and Beta Testing System Testing-Art of Debugging. Case studies: Writing test cases for white box and black box testing.

UNIT 3 OBJECT ORIENTED TESTING, METRICS AND MEASUREMENTS

9 Hrs.

Testing OOD Models-OO Testing Strategies-Test Case Design for OO Software-Testing Methods applicable at the class level- Inter class test design-The intent of OO metrics-Distinguishing characteristics of OO metrics. Common software measurements: Code coverage-Cohesion-Comment density, Coupling-Function point analysis- Number of classes and interfaces-Number of lines of customer requirements-Robert Cecil Martin's software package metrics-Bugs per line of code-Source lines of code.

UNIT 4 QUALITY CONSIDERATIONS

9 Hrs.

Planning for quality – Quality plan – Cost/benefit tradeoff – Feature/bug tradeoff – Modeling quality improvement-Notation of defects-Defects-Defect removal activities-Conditions for each activity-Defect removal goals-Quality improvement teams- quality recognition-Manage Priorities Effectively-Statistical Quality Assurance-Software Reliability.

UNIT 5 OVERVIEW OF STANDARDS

9 Hrs.

Levels of standards-Quality assurance standards-Project management standards-Dependability standards-Product standards- Process standards-ISO9000-Reviews, Audits and Certification.

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Ilene Barnstein,"Practical Software Testing-A Process Oriented Approach", Springer International Edition.
2. Humphrey, W.S. (2002), "A Discipline for Software Engineering. Reading, MA", Addison-Wesley.
3. Roger S.Pressman, "Software Engineering, A Practitioner's Approach", Tata McGraw Hill, 5th Edition.
4. Marc Roper, "Software Testing", McGraw Hill Professional, 1994.
5. Ian Sommerville, "Software Engineering", Addison-Wesley, 5th Edition, 1996.

SBSA5101	WEB BASED APPLICATION DEVELOPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To provide knowledge on web architecture, web services, client side and server side scripting technologies to focus on the development of web-based information systems and web services.
- To provide skills to design interactive and dynamic web sites.
- To provide knowledge for implementing web applications using .NET framework.

UNIT 1 HTML & CSS

9 Hrs.

Introduction to web, Web development overview, HTML Tag, Rules of HTML, Text Formatting & Style, List, Adding Graphics to Html Document, Tables and Layout, Linking Documents, Frame, Forms, Project in HTML, Introduction to DHTML, CSS, Class & DIV, External Style Sheet.

UNIT 2 SCRIPTING

9 Hrs.

Java Script : Introduction, documents, forms, statements, functions, objects, event handling, Advantage of Java Script, JS object model and hierarchy, Handling event, Operators and syntax of JS, Function, Client side JS Vs Server side JS, JS security Introduction to VB Script, Operator & Syntax of VB Script, Dialog Boxes, Control & Loop, Function in VBS.

UNIT 3 SERVER SITE PROGRAMMING

9 Hrs.

Introduction, Internet Information System (IIS), ASP object, Server object File system object, session, Accessing data base with an ASP page, ODBC – ADO connection object, common methods and properties, ADO record set object.

UNIT 4 XML

9 Hrs.

XML-XML structure – elements, well formed XML, XML Namespaces - working with DTD- Adding DTDs to documents - defining DTD entities - defining Parameter entities - Working with attributes – Defining attributes, defining multiple attributes, using predefined attributes - CSS basics - Adding CSS to document, CSS selections, Controlling fonts - Need of XSL, XSL basics, XSL transformations, Introduction to Schemas- Defining simple elements and types-XML query

UNIT 5 PHP

9 Hrs.

Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Jeffrey C Jackson, Web Technology – A computer Science perspective, Person Education, 2007.
2. Ivan Bayross, HTML, DHTML, Java Script, Perl & CGI, BPB Publication
3. Chris Bates, Web Programming – Building Internet Applications, Wiley India, 2006.
4. Deitel & Deitel, Internet and World Wide Web How to Program, Third Edition.
5. Ullman, PHP for the Web: Visual QuickStart Guide, Pearson Education
6. Mark Birbeck, Stev Livingstone, Stephen F. Mohr, Jonathan Pinnock, Steven Livingston, Professional XML, 2nd Edition, Peer Information, 2001
7. Gopalan. N.P, Web Technology A Developer Perspectives, PHI, 2009.

SBSA5201	DESIGN THINKING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
- To understand about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To understand the basics about development cycles, IT Operations & faster innovation.
- To understand the practice of design thinking for Strategic Innovation
- To understand DevOps the advanced process of software engineering for faster problem resolution & team collaboration.

UNIT 1 INTRODUCTION TO DESIGN THINKING

9 Hrs.

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- **Design Thinking Framework - Design Thinking Methods** - Empathise –Define – Ideate – Prototype – Test- Software Development Methodology – Waterfall model – V –model -Customer Example.

UNIT 2 INTRODUCTION TO AGILE

9 Hrs.

History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview- Agile frameworks – Extreme programming- Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD)- Scrum - Kanban Methodology – Agile and Devops.

UNIT 3 AGILE SOFTWARE DEVELOPMENT

9 Hrs.

Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework –Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

UNIT 4 DESIGN THINKING FOR STRATEGIC INNOVATION

9 Hrs.

Innovation Management-Changing Management Paradigms-Design Thinking related to Science and art-Design Thinking in Business-Linking Design Thinking Solution to Business Challenges

UNIT 5 DEVOPS

9 Hrs.

Introduction to DevOps – DevOpsvs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD &DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration– Continuous Testing –Continuous Monitoring.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 : Apply design thinking concepts to give solution for the problems identified
- CO2 : Implement Agile software methodology for faster development of quality software
- CO3 : Describe how to improve collaboration between development and operations.
- CO4 : Design innovative products
- CO5 : Implement Automated Installations and Deployments
- CO6 : Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.

TEXT/REFERENCE BOOKS

1. MauricioVianna, YsmarVianna, Brenda Lucena and Beatriz Russo,” Design thinking : Business innovation”, MJV, Technologies and innovation press, 2011
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Valueby Thomas Lockwood (Editor) Published February 16th 2010 by Allworth Press
3. KalloriVikram, —Introduction to DevOps, 1 st Edition, KalloriVikram Publication, 2016.

4. Jaokim Verona, —Practical DevOps, 2 nd Edition, Packt. Publication, 2018.
5. Stephen Fleming, Pravin, —DevOps Handbook: Introduction of DevOps Resource Management—,1st Edition, Createspace Independent Pub. , 2010.
6. Len Bass, Ingo Weber, Liming Zhu, G., —DevOps: A Software Architect's Perspective, 1st Edition, Addison-Wesley Professional, 2015.
7. Alistair Cockburn, “Agile Software Development”, 2nd ed, Pearson Education, 2007.

Entrepreneurship

SBSA6201	INTERNET OF THINGS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To identify the different technologies and different platforms in IoT
- To understand how to use sensors and actuators for design of IoT.
- To learn different protocols used in IOT
- To learn the concepts of smart city development in IOT.
- To learn how to analysis the data in IO

SUGGESTED LIST OF EXPERIMENTS

1. Monitor the soil moisture level using Raspberry pi.
2. Monitor the surrounding air's quality using Arduino & sensors connected to a Raspberry Pi.
3. Implement Raspberry Pi as a local server by installing Apache, PHP, and MySQL.
4. Interface PIR sensor with ESP8266 WiFi module on NodeMCU platform.
5. Posting temperature and humidity of the environment to Thing speak cloud service using NodeMCU.
6. Implement Raspberry Pi Temperature System with Ubidots cloud service.
7. Implement smart cities Sensor Board v3.0 using Wasp mote platform for measuring temperature, humidity and pressure.
8. Measure light intensity and pollution level using Wasp mote platform.
9. Receiving and storing data in Meslium gateway for Wasp mote platform.
10. Implement barometric pressure monitoring using BMP280 sensor for Zolertia module.

Entrepreneurship

SCSA5101	ADVANCED DATASTRUCTURES AND ALGORITHMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and analyze fundamental data structures, such as binary search trees, disjoint sets, and self-adjusting lists.
- Understand the implementation and complexity analysis of fundamental algorithms such as RSA, primarily testing, max flow, discrete Fourier transform.
- Will be exposed to algorithmic issues in a variety of areas, including linear programming and game-theory.

UNIT 1 INTRODUCTION TO ALGORITHMS

9 Hrs.

Role of Algorithms in computing- Analyzing algorithm- Designing algorithm- Asymptotic Notations- Summations - Formulas and properties- Recurrences. SORTING TECHNIQUES: Heap sort – Quick sort-Radix sort- Bucket sort- Analysis of sorting algorithms.

UNIT 2 TREE STRUCTURES

9 Hrs.

Binary Search Trees- AVL Trees- Red-Black Trees- BTrees-Splay Trees - HEAP STRUCTURES: Min/Max heaps- Leftist Heaps- Binomial Heaps- Fibonacci Heaps

UNIT 3 MULTIMEDIA STRUCTURES

9 Hrs.

Segment Trees- k-d-Trees-Point Quad Trees-MX-Quad Trees-R-Trees-TV-Trees.

UNIT 4 PROBLEM SOLVING TECHNIQUES

9 Hrs.

Branch and Bound-NP hard and NP complete problems-Huffman Coding-Activity Networks-Flow Shop Scheduling- Randomized Algorithms. ALGORITHMS: Greedy Algorithms-Backtracking-Dynamic programming- Divide and Conquer.

UNIT 5 GRAPH ALGORITHMS

9 Hrs.

GraphRepresentation-BFS-DFS-TopologicalSort-ConnectedComponents-MinimumSpanningtrees— Kruskal's Algorithm -Prim's Algorithm – Dijkstra's Algorithm – Floyd's Algorithm – Bellman Ford Algorithm.

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Thomas H Cormen, Charles E. Leiserson, Ronald L.Rivest, "Introduction to Algorithms", PHI, 2002.
2. Sara Baase, Allenran Gelda, "Computer Algorithms and Introduction to Design and Analysis", Pearson, 2000.
3. Sahni, "Data Structures algorithm and application in C++", PHI, 2000.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Addison Wesley, 3rd Edition.
5. Aho A.V., Hopcroft J.E. and Ullman J.D., "Design and analysis of Computer algorithms".

Skill development

SCSA5103	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.
- To introduce the concepts of Software quality and its assurance.

UNIT 1 INTRODUCTION

9 Hrs.

Software testing fundamentals-objectives-principles-Testability-Levels of testing-TMM- Characteristics of a tester-A testing group-Comparison of KPA in ISO, CMM and TMM-Software quality attributes.

UNIT 2 SOFTWARE TESTING METHODS AND STRATEGIES

9 Hrs.

Test case design-White box testing- Basic path testing-Flow Graph Notation-Cyclomatic Complexity-Deriving Test Cases- Graphic matrices-Control Structure Testing-Deriving Test cases-Dataflow Testing-Loop Testing-Black box Testing-Graph Based Testing Methods-Equivalence partitioning-Boundary value analysis-Comparison testing. Strategic Approach to Software Testing- Verification and Validation-Strategic issues-Unit testing-Consideration Procedures. Integration Testing-Regression Testing- Integration Test Documentation-Validation testing-Configuration Review-Alpha and Beta Testing System Testing-Art of Debugging. Case studies: Writing test cases for white box and black box testing.

UNIT 3 OBJECT ORIENTED TESTING, METRICS AND MEASUREMENTS

9 Hrs.

Testing OOD Models-OO Testing Strategies-Test Case Design for OO Software-Testing Methods applicable at the class level- Inter class test design-The intent of OO metrics-Distinguishing characteristics of OO metrics. Common software measurements: Code coverage-Cohesion-Comment density, Coupling-Function point analysis- Number of classes and interfaces-Number of lines of customer requirements-Robert Cecil Martin's software package metrics-Bugs per line of code-Source lines of code.

UNIT 4 QUALITY CONSIDERATIONS

9 Hrs.

Planning for quality – Quality plan – Cost/benefit tradeoff – Feature/bug tradeoff – Modeling quality improvement-Notation of defects-Defects-Defect removal activities-Conditions for each activity-Defect removal goals-Quality improvement teams- quality recognition-Manage Priorities Effectively-Statistical Quality Assurance-Software Reliability.

UNIT 5 OVERVIEW OF STANDARDS

9 Hrs.

Levels of standards-Quality assurance standards-Project management standards-Dependability standards-Product standards- Process standards-ISO9000-Reviews, Audits and Certification.

Max.45 Hours

TEXT/REFERENCE BOOKS

1. Ilene Barnstein,"Practical Software Testing-A Process Oriented Approach", Springer International Edition.
2. Humphrey, W.S. (2002), "A Discipline for Software Engineering. Reading, MA", Addison-Wesley.
3. Roger S.Pressman, "Software Engineering, A Practitioner's Approach", Tata McGraw Hill, 5th Edition.
4. Marc Roper, "Software Testing", McGraw Hill Professional, 1994.
5. Ian Sommerville, "Software Engineering", Addison-Wesley, 5th Edition, 1996.

Skill development

SBSA5201	DESIGN THINKING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
- To understand about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To understand the basics about development cycles, IT Operations & faster innovation.
- To understand the practice of design thinking for Strategic Innovation
- To understand DevOps the advanced process of software engineering for faster problem resolution & team collaboration.

UNIT 1 INTRODUCTION TO DESIGN THINKING 9 Hrs.

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- Design Thinking Framework - Design Thinking Methods - Empathise –Define – Ideate – Prototype – Test- Software Development Methodology – Waterfall model – V –model -Customer Example.

UNIT 2 INTRODUCTION TO AGILE 9 Hrs.

History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview- Agile frameworks – Extreme programming- Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD)- Scrum - Kanban Methodology – Agile and Devops.

UNIT 3 AGILE SOFTWARE DEVELOPMENT 9 Hrs.

Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework –Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

UNIT 4 DESIGN THINKING FOR STRATEGIC INNOVATION 9 Hrs.

Innovation Management-Changing Management Paradigms-Design Thinking related to Science and art-Design Thinking in Business-Linking Design Thinking Solution to Business Challenges

UNIT 5 DEVOPS 9 Hrs.

Introduction to DevOps – DevOpsvs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD &DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration– Continuous Testing –Continuous Monitoring.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 : Apply design thinking concepts to give solution for the problems identified
- CO2 : Implement Agile software methodology for faster development of quality software
- CO3 : Describe how to improve collaboration between development and operations.
- CO4 : Design innovative products
- CO5 : Implement Automated Installations and Deployments
- CO6 : Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.

TEXT/REFERENCE BOOKS

1. MaurícioVianna, YsmarVianna, Brenda Lucena and Beatriz Russo,” Design thinking : Business innovation”, MJV, Technologies and innovation press, 2011
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Valueby Thomas Lockwood (Editor) Published February 16th 2010 by Allworth Press
3. KalloriVikram, —Introduction to DevOps, 1 st Edition, KalloriVikram Publication, 2016.
4. Jaokim Verona, —Practical DevOps, 2 nd Edition, Packt. Publication, 2018.

5. Stephen Fleming, Pravin, —DevOps Handbook: Introduction of DevOps Resource Management—,1st Edition, Createspace Independent Pub. , 2010.
6. Len Bass, Ingo Weber, Liming Zhu, G., —DevOps: A Software Architect’s Perspective, 1st Edition, Addison-Wesley Professional, 2015.
7. Alistair Cockburn, “Agile Software Development”, 2nd ed, Pearson Education, 2007.

Skill development

SBSA5302	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

- To know the principles and approaches of artificial intelligence(AI).
- To develop a basic understanding of the building blocks of AI.
- To identify the solution to a problem through reasoning and planning.
- To learn various types and concepts of machine learning.
- To list out various domains and applications of AI.

UNIT 1 AI: FOUNDATIONS 9 Hrs.

Introduction – History – Intelligent Agents – Environment – Good behavior – Structure of an Agent – Concept of rationality – Types of agents – Search strategies and its types: BFS and DFS – Uniform Cost Search

UNIT 2 AI: SEARCHING AND SOLVING 9 Hrs.

Agents for problem solving – Informed search strategy – heuristic functions – Optimization: local and global search – Constraint Satisfaction Problems – Pruning - Case Study: Backtracking for CSP

UNIT 3 AI: KNOWLEDGE, REASONING AND PLANNING 9 Hrs.

Logical agents – Propositional Logic – Inference rules - First Order Logic – Syntax and Semantics – Building a knowledge base – Probabilistic reasoning – Classical Planning and its algorithm

UNIT 4 AI: LEARNING CONCEPTS 9 Hrs.

Types of learning: Supervised, Unsupervised and Reinforcement Learning – Theory of learning – Classification and Regression problems – Model selection and optimization – Case Study: Linear Regression for Classification

UNIT 5 AI: APPLICATIONS 9 Hrs.

Speech Processing: NLP basics and tasks – Chatbot applications and its types – Computer Vision: Classifying images and Detecting objects – Robotics: Hardware – Perception – Planning – Control

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 : Identify and analyze various search algorithms for solving the AI problems.
- CO2 : Apply search algorithms for various AI related problems.
- CO3 : Use various logical forms to represent knowledge.
- CO4 : Discriminate between different types of learning techniques
- CO5 : Recognize the working behind chatbot applications
- CO6 : Design user centric applications that use AI concepts

TEXT/REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, “Artificial Intelligence A Modern Approach”, 4th Edition, Pearson Education, 2020.
2. Kevin Warwick, “Artificial Intelligence: the basics”, Routledge Publishers, 2011.
3. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2009.
4. M. Tim Jones, “Artificial Intelligence: A Systems Approach (Computer Science)”, Jones and Bartlett Publishers, Inc., First Edition, 2008