Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

M.Sc. Computer Science

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2023-24)

Semester 1 (First Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23CsCmpP111	Major Paper 1 (Theory)	Programming Languages (Python)	4	4	50	50	100
	23CsCmpP112	Major Paper 2 (Theory)	Design and Analysis of Algorithm	4	4	50	50	100
	23CsCmpP113	Major Paper 3 (Theory)	Advanced Database Techniques	4	4	50	50	100
	23CsCmpP114	Major Paper 4 (Practical)	Lab on 23CsCmpP111 and 23CsCmpP113	4	2	25	25	50
Major Electives (4)	23CsCmpP121	Major Elective 1 (T+P)	DOT NET	4	4	50	50	100
	23CsCmpP122	Major Elective 2 (T+P)	Software Development Engineering Testing	4				
RM (4)	23ScCmpP131	RM Paper 1	Section 1 RM Core Paper	2	4	50	50	100
		RM Paper 2	Section 2 Artificial Intelligence (Departmental Specific Elective)	2				
OJT(4)		–	–	–	–	–	–	–
Total				24	22	275	275	550

Semester 2 (First Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23CsCmpP211	Major Paper 1 (Theory)	Advanced Operating Systems (UNIX/Linux Internals)	4	4	50	50	100
	23CsCmpP212	Major Paper 2 (Theory)	Mobile Computing (Android)	4	4	50	50	100
	23CsCmpP213	Major Paper 3 (Theory)	Data Mining and Data Warehousing	4	4	50	50	100
	23CsCmpP214	Major Paper 4 (Practical)	Lab on 23CsCmpP211 and 23CsCmpP212	4	2	25	25	50
Major Electives (4)	23CsCmpP221	Major Elective 1 (T/P)	Information System Security	4	4	50	50	100
	23CsCmpP222	Major Elective 2 (T/P)	Software Project Management	4				
RM (4)		–	–	–	–	–	–	–
		–	–	–				
OJT(4),	23CsCmpP204	OJT	On Job Training-Project	8	4	50	50	100
Total				28	22	275	275	550

Semester 3 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23CsCmpP311	Major Paper 1 (Theory)	Cloud Computing	4	4	50	50	100
	23CsCmpP312	Major Paper 2 (Theory)	UI/UX	4	4	50	50	100
	23CsCmpP313	Major Paper 3 (Theory)	Machine Learning and Deep Learning	4	4	50	50	100
	23CsCmpP314	Major Paper 4 (Practical)	Lab Course on 23CsCmpP311 & 23CsCmpP312	4	2	25	25	50
Major Electives (4)	23CsCmpP321	Major Elective 1 (Theory)	Block chain Technology	4	4	50	50	100
	23CsCmpP322	Major Elective 2 (Theory)	Big Data Analytics	4				
RP (4)	23CsCmpP304	RP	Research Project-I	8	4	50	50	100
OJT(4)								
Total				26/28	22	275	275	550

Semester 4 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory	23CsCmpP411	Major Paper	Industrial Training	6	16	200	200	400
RP (4)	23CsCmpP404	RP	Research Project II	12	6	75	75	150
OJT(4)								
Total				18	22	275	275	550

OJT : On Job Training: Internship/Apprenticeship
FP : Field Project
RM: Research Methodology
RP: Research Project

Semester –I

Course Code : 23CsCmpP111
Course Name : Programming Languages(Python)

Teaching Scheme: TH: 4Hours/Week **Credit: 04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- An understanding of programming in an imperative language (e.g., C/C++, Java)
- Knowledge of basic algorithms and data structures (e.g., sorting, searching, lists, stacks, and trees)
- Knowledge of basic discrete mathematics (e.g., sets, relations, functions, induction, and simple algebraic concepts)

Course Objectives:

- An understanding of programming language paradigm.
- Understanding of Lambda Calculus.
- Learning functional programming language Python.

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Understanding & analyzing new conceptual, theoretical and practical knowledge	**2,4**
CO 2	Students can solve problems by using the Python language.	**3**
CO 3	Students can build projects by using Python Framework.	**3,6**
CO 4	Students can make use the different libraries depending upon different problems	**3**
CO 5	By summarizing python we can work on other related fields like machine learning, data science, etc.	**2**
CO 6	Simplify big complex problems	**4**

Course Contents

Unit 1	**Introduction to programming languages**	2 lectures
	1.1 The Art of Language Design 1.2 The Programming Language Spectrum 1.3 Why Study Programming Languages? 1.4 Programming Environments 1.5 Declarative style of programming,	
Unit 2	**Introduction to FP & Mathematical Functions**	5 lectures
	2.1 Principles of FP 2.2 History Of FP 2.3 Why functional programming 2.4 Mathematical functions : definition, lambda expression 2.5 Functional Forms or a higher-order function :- Function Composition, Construction 2.6 Disadvantages of FP	
Unit 3	**Introduction to Lambda calculus**	5 lectures
	3.1 Introduction, 3.2 The benefits of lambda notation, 3.3 Lambda calculus as a formal system - Lambda terms (Variables, Constants, Combinations, Abstractions), 3.4 Free and bound variables, 3.5 Substitution 3.6 Conversions: Definition Only (Alpha conversion, Beta 3.7 conversion, Eta conversion) 3.8 Lambda reduction	
Unit 4	**Introduction To Python**	2 lectures
	4.1 Installation and 4.2 Working with Python 4.3 Understanding Python variables 4.4 Python basic Operators 4.5 Understanding python blocks	
Unit 5	**Python Data Types**	2 lectures
	5.1 Declaring and using Numeric data types: int, float, complex 5.2 Using string data type and string operations 5.3 Defining list and list slicing 5.4 Use of Tuple data type	
Unit 6	**Python Program Flow Control**	4 lectures
	6.1 Conditional blocks using if, else and elif 6.2 Simple for loops in python 6.3 For loop using ranges, string, list and dictionaries 6.4 Use of while loops in python Loop manipulation using pass, continue, break and else 6.5 Programming using Python conditional and loops block	
Unit 7	**Python Functions**	3 lectures
	7.1 Modules And Packages 7.3 Organizing python codes using functions 7.3 Organizing python projects into modules Importing own module as well as external modules 7.4 Understanding Packages	
Unit 8	**Python String, List And Dictionary Manipulations**	3 lectures

	8.1 Building blocks of python programs 8.2 Understanding string in build methods 8.3 List manipulation using in build methods 8.4 Dictionary manipulation Programming using string, list and dictionary in build functions	
Unit 9	**Python File Operation**	2 lectures
	9.1 Reading config files in python 9.2 Writing log files in python 9.3 Read functions, read(), readline() and readlines() 9.4 Write functions, write() and writelines() 9.5 Manipulating file pointer using seek Programming using file operations	
Unit 10	**Python Object Oriented Programming**	2 lectures
	10.1 Oops Concept of class 10.2 Object and instances Constructor 10.3 Class attributes and destructors 10.4 Real time use of class in live projects 10.5 Inheritance 10.6 Overlapping and overloading operators 10.7 Adding and retrieving dynamic attributes of classes 10.8 Programming using Oops support	
Chpater 11	**Python Regular Expression**	2 Lectures
	11.1 Powerful pattern matching and searching Power of 11.2 Pattern searching using regex in python 11.3 Real time parsing of networking or system data using regex Password, email, url validation using regular expression 11.4 Pattern finding programs using regular expression	
Unit 12	**Python Database Interaction**	2 Lectures
	12.1 SQL Database connection using python 12.2 Creating and searching tables Reading and storing config information on database	
Unit 13	**Python Libraries**	11 Lectures
	13.1 Numpy 13.2 Pandas 13.3 Matplotlib 13.4 Scipy Only Introduction	
Unit 14	**Python Framework**	2 Lectures
	14.1 Introduction to Django	
Unit 15	**Experiential Learning**	1 Lecture
	15.1 Analysis of all Functional programming with respect to Python 15.2 Analysis and study of Libraries provided by Python to support AI	

References:

1. Functional Programming: Practice and Theory by Bruce J. Maclennan • ISBN-10: 0201137445 • ISBN-13: 978-0201137446 2.
2. An Introduction to Functional Programming Through Lambda Calculus (Dover Books on Mathematics) Paperback by Greg Michaelson • ISBN-10: 0486478831 • ISBN-13: 978-0486478838
3. Computational Semantics with Functional Programming by Jan van Eijck (Author), Christina Unger (Author) • ISBN-10: 0521757606 • ISBN-13: 978-0521757607
4. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus by Charles Dierbach
5. Programming Languages: Principles and Practice By Kenneth C. Louden • ISBN-10: 1575864967 • ISBN-13: 978-1575864969
6. LEARNING TO PROGRAM WITH PYTHON by Richard L. Halterman
7. Python 3 Object-oriented Programming Second Edition by Dusty Phillips
8. The Definitive Guide to Web Development Done Right by Adrian Holovaty and Jacob Kaplan-Moss

Course Code : 23CsCmpP112
Course Name : Design and Analysis of Algorithms

Teaching Scheme: TH:4Hours/Week **Credit :04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Basic knowledge of algorithms and programming concepts
- Data Structures and Advanced Data Structures
- Basic Knowledge of Graphs and Algorithms

Course Objectives:

- To design the algorithms
- To select the appropriate algorithm by doing necessary analysis ofalgorithms
- To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation ,Understand different design strategies

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Analyze the problem and develop the algorithm	**4**
CO 2	Classify the problem	**2,4**
CO 3	Apply the appropriate design strategy to develop algorithm	**3**
CO 4	Design algorithm in context of space and time complexity	**6**
CO 5	Apply asymptotic notation	**3**
CO 6	Comparing all the design strategies to apply on different problems	**2,4,5**

Course Contents

Unit1	**Basics of Algorithms**	8 lectures
	1.1.Algorithm definition and characteristics 1.2.Spacecomplexity 1.3.Time complexity, worst case-best case-average case complexity, asymptotic notation 1.4.Recursive and non-recursive algorithms 1.5.Sorting algorithms (insertion sort, heap sort, Bubble sort) 1.6.Sorting in linear time: counting sort, concept of bucket and radix sort 1.7 Searching algorithms: Linear ,Binary	
Unit 2	**Divide and conquer strategy**	4 lectures
	2.1.General method, control abstraction 2.2.Binarysearch 2.3.Merge sort, Quicksort 2.4.Comparison between Traditional method of Matrix Multiplication vs. 2.5 Strassen's Matrix Multiplication	
Unit 3	**Greedy Method**	10 lectures
	3.1.Control Abstraction 3.2. Knapsack problem 3.3.Job sequencing with deadlines, 3.4.Minimum-cost spanning trees: Kruskal and Prim's algorithm 3.5. Optimal storage on tapes 3.6.Optimal merge patterns 3.7.Huffman coding 3.8Shortest Path: Dijkstra's algorithm	
Unit 4	**Dynamic Programming**	7 lectures
	4.1.Principle of optimality 4.2.Matrix chain multiplication 4.3.0/1 Knapsack Problem 4.3.1.Merge & Purge 4.3.2.Functional Method 4.4. Concept of Shortest Path 4.4.1.Single Source shortest path 4.4.2.Dijkstra's Algorithm 4.4.3.Bellman Ford Algorithm 4.4.4. All pairs Shortest Path 4.4.5. Floyd- Warshall Algorithm 4.4.6.Longest common subsequence 4.4.7. String editing, 4.4.8. Travelling Salesperson Problem	
Unit 5	**Decrease and Conquer**:	5 lectures
	5.1. Definition of Graph 5.2 Representation of Graph By - DFS and BFS 5.2.Topological sorting 5.3.Connected components and spanning trees	

	5.4.By Variable Size decrease Euclid's algorithm 5.5.Flow in graph 5.6. Articulation Point and Bridge edge	
Unit 6	**Backtracking**	5 lectures
	6.1.General method 6.2.Fixed Tuple vs. Variable Tuple Formulation 6.3.n- Queen's problem 6.4.Graph coloring problem 6.5.Hamiltonian cycle 6.6. Sum of subsets	
Unit 7	**Branch and Bound**	5 lectures
	7.1.Introduction 7.2.Definitions of LCBB Search 7.3.Bounding Function, Ranking Function 7.4.FIFO BB Search 7.5.Traveling Salesman problem Using Variable tuple 7.6. Formulation using LCBB 7.7. 0/1 knapsack problem using LCBB	
Unit 8	**Problem Classification**	3 lectures
	7.4 Nondeterministic algorithm 7.5 The class of P, NP, NP-hard and NP – Complete problems 7.6 Cook's theorem	
Unit 9	Experiential Learning	1 Lecture
	9.1 Search n number of cities on Google map and find shortest route, 9.2 Consider any stable algorithms which are in currently use and find out space Complexity,Time Complexity and control abstraction.	

References:

1. Ellis Horowitz, SartajSahni&SanguthevarRajasekaran, Computer Algorithms,Galgotia
2. T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press,1990
3. A. Aho, J. Hopcroft& J. Ullman, The Design and Analysis of ComputerAlgorithms,
4. Addison Wesley,1974
5. Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81), Addison Wesley
6. Steven Skiena, The Algorithm Manual, SpringerISBN:9788184898651
7. Jungnickel, Graphs, Networks and Algorithms, Springer, ISBN:3540219056

Course Code :23CsCmpP113
Course Name : Advanced Database Techniques

Teaching Scheme: TH: 4Hours/Week **Credit : 04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites

- Knowledge of RDBMS
- Knowledge of SQL and PLSQL
- Networking basics

Course Objectives

- To reinforce and strengthen the database concepts
- To equip students with knowledge to implement and integrate databases in actual applications.
- To introduce advanced concepts of transaction management and recovery techniques.
- To create awareness of how enterprise can organize and analyze large amounts of data

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms cognitive level
CO 1	Database System Architectures, Different Types of DBMS Parallelism, Centralized and Client-Server Architectures,	**1**
CO 2	Inter and Intra query Inter and Intra Query Parallelism, Inter and Intra operation Parallelism, Types of Distributed Databases (Horizontal, Vertical, Hybrid), Replication Schemas, Recovery	**2**
CO 3	Features of OODBMS, Objects and Attributes, Structures and Unstructured data	**3**
CO 4	XML Data Model, DTD, XML Schema, XML Querying, Web Databases, JDBC	**4**
CO 5	Four V's of Big data, NoSQL Databases, Examples of NoSQL DB, NoSQL Vs SQL	**5**
CO 6	Write the queries to implement different functionalities of MongoDb language, Architecture of NoSQL, Databases, Collections, Documents / Objects, CRUD	**6**

Course Contents

Unit 1	Introduction to Advanced Databases	3 lectures
	1.1 Database System Architectures: 1.2 Centralized and Client-Server Architectures 1.3 Server System Architecture 1.4 Parallel Systems 1.5 Distributed Systems	
Unit 2	Parallel Databases	5 lectures
	2.1 Introduction 2.2 Goals of Parallel Databases 2.3 Different Types of DBMS Parallelism 2.4 Performance Parameters 2.5 Parallel Data Architecture 2.6 Evaluation of Parallel Query 2.6.1 Inter and Intra Query Parallelism 2.6.2 Inter and Intra operation Parallelism 2.7 Optimization of Parallel query 2.8 Virtualization	
Unit 3	**Distributed Databases**	8 lectures
	3.1 Introduction 3.2 Goals of Distributed Databases 3.3 Types of Distributed Databases (Horizontal,Vertical,Hybrid) 3.4 Data replication 3.5 Replication Schemas 3.6 Query Processing and Optimization 3.7 Recovery 3.7.1 Two-phase commit protocol 3.7.2 Concurrency problems 3.7.3 Concurrency Controls	
Unit 4	**Object Based Databases**	8 lectures
	4.1 Concepts of Object Databases 4.2 Features of OODBMS 4.3 Challenges in ODBMS Implementation 4.4 Object Identity – Object structure 4.5 Objects and Attributes 4.5.1 Type Constructors 4.5.2 Encapsulation of Operations 4.5.3 Methods 4.5.4 Persistence 4.5.5 Type and Class Hierarchy 4.6 Structures and Unstructured data 4.7 Case Studies	
Unit 5	**XML Databses**	9 lectures
	5.1 XML Data Model 5.2 DTD 5.3 XML Schema 5.4 XML Querying 5.4 Web Databases 5.6 JDBC	

	5.7 Information Retrieval	
Unit 6	**Big Databases**	3 lectures
	6.1 Introduction 6.2 Four V's of Big data 6.3 NoSQL Databases 6.4 Examples of NoSQL DB 6.5 Advantages 6.7 NoSQL Vs SQL	
Unit 7	**NoSQL (Any one fromMongoDB/CASSANDRA)**	12 lectures
	7.1 Overview 7.2 Architecture 7.3 Features 7.4 Advantages 7.5 Basics 7.6 Servers 7.7 Databases 7.8 Collections 7.9 Documents / Objects 7.8 CRUD 7.9 Indexes	
Unit 8	**Experiential Learning**	1 lecture
	8.1 Create same database using RDBMS and NoSQL 8.2 Do operations on these databases 8.3 Do comparative study of it.	

References:

1. Database System Concepts :-Silberschatz, Korth, Tata McGraw-Hill Publication, ISBN-13: 978- 9332901384, ISBN-10: 9332901384
2. Database Management System :-Raghu Ramkrishnan, Tata McGraw-Hill Publication, ISBN: 978-81-317- 0885-9
3. SQL, PL/SQL The Programming Language Oracle :- Ivan Bayross, BPB Publication.
4. Database Systems Concepts , Designs and Application by Shio Kumar Singh , Pearson
5. Introduction to SQL by Reck F. van der Lans by Pearson
6. Modern Database Management by Jeffery A Hoffer ,V.Ramesh, Heikki Topi , Pearson
7. Database Management Systems by Debabrata Sahoo ,Tata Mac Graw Hill
8. Getting Started with NoSQL Kindle Edition by Gaurav Vaish, ISBN-10: 1849694982

Course Code : 23CsCmpP114
Course Name : Lab on Programming Languages (Python) and Advanced Database Techniques

Teaching Scheme: Practical: 2+2 = 4Hours/Week **Credit : 02**
Examination Scheme: CIA : 25 Marks **End-Sem : 25 Marks**

Course outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Students can solve problems by using the Python language.	**3**
CO 2	Understanding & analyzing new conceptual & practical knowledge	**2,4**
CO 3	Students can build projects by using Python Framework.	**3,6**
CO 4	Understanding fundamentals of MOngoDb and apply the methods of unstructured Databases design	**2,3**
CO 5	Analyse different databases and identify use of appropriate database systems for the application.	**4**
CO 6	Write the queries to implement different functionalities of NoSQL language.	**6**

Lab assignments of Programming Languages(Python)

Assignment 1	**Introduction To Python**
	Installation of Python on different OS Working with Python as a calculator
Assignment 2	**Programs on Flow Control**
	Basic to advance programs for understanding of different control flow in Python
Assignment 3	**Functions**

	Writing Programs using functions Use of Modules Use of packages
Assignment 4	**Python programs for String, List**
	Building blocks of python programs Understanding string in build methods List manipulation using in build methods
Assignment 5	**Dictionary Manipulations**
	Dictionary manipulation Programming using string, list and dictionary in build functions Some of the Algorithms are implemented by using Python which are learnt in DAA
Assignment 6	**Python File Operation**
	Reading config files in python Writing log files in python read functions, read(), readline() and readlines() write functions, write() and writelines()
Assignment 7	**Python Object Oriented Programming**
	Simple OO programs
Assignment 8	**Python Regular Expression**
	pattern matching and searching pattern searching using regex in python
Assignment 9	**Python Database Interaction**
	Demo for SQL/ SQlite connectivity
Assignment 10	**Python Libraries**
	Numpy Pandas
Assignment 11	**Python Libraries**
	Matplotlib Scipy
Assignment 11	**Python Framework**
	Tutorial on Django

Lab assignments of Advanced Database Techniques

Assignment Number	Name
1	Create User and add Role
2	Creation of database and collection
3	Insert data in collection, inserting multiple documents in collection
4	CRUD operations on collections
5	Aggregate commands
6	Query and Write operation commands
7	Finding documents with expressions and comparison queries
8	Sort and limit queries with examples
9	Usage of functions
10	Functional Loops - forEach and map
11	Interacting with cursors
12	Regular expressions with examples

Course Code: 23CsCmpP121
Course Name:DOT NET

Teaching Scheme: TH: 4 Hours/Week **Credit: 04**
Examination Scheme: CIA:50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.
- Familiarity with programming language such as C++ and/or Java.
- Knowledge of web development

Objectives :

- To understand the DOTNET framework,
- C# language features
- Web development using ASP.NET

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Knowledge of object-oriented concepts Design user experience and functional requirements C#.NET application.	**1**
CO 2	Code solutions and compile C# projects within the .NET framework.	**2,3**
CO 3	Design and develop professional console and window based .NET application,Web application	**4,5,6**
CO 4	Data Binding concepts using ADO.NET in window based application, Web Application	**4,6**
CO 5	Determine design patterns which is best practice for Web service interface documents.	**5,6**
CO 6	Discuss the current problems in the Company and suggest solution(s) using .NET applications.	**6**

Course Contents

Unit 1	**DOTNET Framework**	2 lectures
	1.1 Introduction to DOTNET **1.2** DOT NET class framework **1.3** Common Language Runtime **1.3.1** Overview **1.3.2** Elements of .NET application **1.3.3** Memory Management **1.3.4** Garbage Collector : Faster Memory allocation, Optimizations **1.4** Common Language Integration **1.4.1** Common type system **1.4.2** Reflection API **1.5** User and Program Interface	
Unit 2	**Introduction to C#**	6 lectures
	2.1 Language features **2.1.1** Variables and Expressions, type conversion **2.1.2** Flow Control **2.1.3** Functions, Delegates **2.1.4** Debugging and error handling, exception handling (System Defined and User Defined) **2.2** Object Oriented Concepts **2.2.1** Defining classes, class members, Interfaces, properties **2.2.2** Access modifiers, Implementation of class, interface and properties **2.2.3** Concept of hiding base class methods, Overriding **2.2.4** Event Handling **2.3** Collections, Comparisons and Conversions **2.3.1** Defining and using collections, **2.3.2** Indexers, iterators **2.3.3** Type comparison, Value Comparison **2.3.4** Overloading Conversion operators, as operator **2.4** Generics **2.4.1** Using generics **2.4.2** Defining Generics, generic Interfaces, Generic methods, Generic Delegate	
Unit 3	**Window Programming**	5 Lectures
	3.1 Window Controls **3.1.1** Common Controls **3.1.2** Container Controls **3.1.3** Menus and Toolbars	

	3.1.4 Printing **3.1.5** Dialogs **3.2** Deploying Window Application **3.2.1** Deployment Overview **3.2.2** Visual studio setup and Deployment project types **3.2.3** Microsoft windows installer architecture **3.2.4** Building the project : Installation	
Unit 4	**Data Access**	2 lectures
	4.1 File System Data **4.2**.XML **4.3** Databases and ADO.NET **4.4** Data Binding	
Unit 5	**Web Programming**	2 lectures
	5.1 Basic Web programming **5.2** Advanced Web programming **5.3** Web Services **5.4** Deployment Web applications	
Unit 6	**.NET Assemblies**	4 lectures
	6.1 Components **6.2** .NET Assembly features **6.3** Structure of Assemble **6.4** Calling assemblies, private and shared assemblies	
Unit 7	**Networking**	3 lectures
	7.1 Networking overview **7.2** Networking programming options **7.2.1** Webclient **7.2.2** WebRequest and WebResponse **7.2.3** TcpListener&TcpClient	
Unit 8	**Introduction to GDI+**	3 lectures
	8.1 Overview of Graphical Drawing **8.2** Pen Class, Brush Class, Font Class **8.3** Using Images **8.4**Clipping, Drawing2D, Imaging	
Unit 9	**Introduction to ASP.NET**	2 lectures
	Introduction to ASP.NET	
Unit 10	**Server Controls and Variables, control Structures & Functions**	2 lectures
	10.1 Forms, webpages, HTML forms, Webforms **10.2** Request & Response in Non-ASP.NET pages **10.3** Using ASP.NET Server Controls **10.4** Datatypes : Numeric, text, arrays, datacollections **10.5** Overview of Control structures **10.6** Functions : web controls as parameters	

Unit 11	**Even Driven Programming and PostBack**	**2** lectures
	11.1HTML events **11.2** ASP.NET page events **11.3** ASP.NET Web control events **11.4** Event driven programming and postback	
Unit 12	**Reading from Databases**	5 lectures
	12.1 Data pages **12.2** ADO.NET	
Unit 13	**ASP.NET Server Controls**	7 lectures
	13.1 ASP.NET Web Controls **13.2** HTML Server Controls **13.3** Web Controls	
Unit 14	**DOTNET assemblies and Custom Controls**	2 lectures
	14.1 Introduction to Cookies, Sessions **14.2** Session events **14.3** State management Recommendations	
Unit 15	**Web Services**	2 lectures
	15.1 HTTP, XML & Web services **15.2** SOAP **15.3** Building ASP.NET web service **15.4** Consuming a web service	
Unit 16	**Experiential learning**	1 1ecture
	16.1 Review performance statistics of websites developed in .net	

References:

1. **Beginning Visual C#,**Wrox Publication
2. **Professional Visual C#,** Wrox Publication
    i. **Inside C#,** by Tom Archer ISBN: 0735612889Microsoft Press © 2001, 403 pages
3. **Beginning ASP.NET 3.5,** Wrox Publication
4. **Programming ASP.NET 3.5by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly**

Co**urse Code : 23CsCmpP122**
Course Name : Software Development Engineering Testing

Teaching Scheme: TH:4Hours/Week **Credit : 04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequites : Software Engineering

Objectives :

- Understanding software development life cycle
- Understanding Security testing

Course outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Describe the different software development model, and understand the concepts and application of it.	**1**
CO 2	Analyze different testing types and identify use of appropriate test cases to develop software.	**4**
CO 3	Understand and learn different types of testing, review automation testing efficiencies using different automation framework tools and techniques.	**2,3**
CO 4	Discover testing skills by understanding and applying different tasting types and testing tools .	**4**
CO 5	Design test cases to measure and build quality and Perform test scripts in software testing.	**6**
CO 6	Write the test cases to software testing and learn different types of testing tools	**6**

Course Contents

Unit 1	SDLC	4 Lectures
	1.1 What is Software development lifecycle? 1.2 Phases ofSDLC 1.3 Models of SDLC-Waterfall, Agile and Agile Scrum 1.4 What is the difference between Waterfall andAgile? 1.5 Advantages of using Agile OverWaterfall 1.6 Agile Scrum and LeanModel 1.7 Userstory,StoryPoints,Productbacklog,Sprintbacklog,Rolesandresponsibilityofascrummasterand Productowner 1.8 Meetings conducted in AgileScrum	4
Unit 2	**Types of Testing**	**10 Lectures**
	2.1 Static Testing/DynamicTesting 2.2 Regression/Retesting 2.3 Usability/accessibility 2.4 Smoke / Sanitytesting 2.5 Unit Testing/ Integration Testing/ SystemTesting 2.6 UAT – Alpha Testing /BetaTesting 2.7 White Box/Black boxtesting 2.8 Functional/Non-functionalTesting 2.9 PerformanceTesting 2.10 LoadTesting 2.11 StressTesting 2.12 PenetrationTesting 2.13 Cross platform / Cross devicetesting	
Unit 3	**STLC (Software Testing Life Cycle)**	**5 Lectures**
	3.1 TestPlanning 3.2 TestPlan 3.3 What is a testPlan 3.4 Who creates a TestPlan 3.5 When is the Test Plancreated 3.6 Purpose of creating a TestPlan 3.7 Components of a Testplan. 3.8 Testdesign 3.9 Test implementation andExecution 3.10 Defect Reporting andtracking 3.11 Defect lifecycle 3.12 Testclosures 3.13 Testmetrics	
Unit 4	Automation Testing – Basics	**6 Lectures**
	4.1 Introduction to AutomationTesting 4.2 What is Automationtesting 4.3 Benefits of AutomationTesting 4.4 Tool selectioncriteria	

Unit 5	Security Testing	**6 Lectures**
	5.1 The Basis of SecurityTesting 5.2 SecurityRisks 5.3 Information Security Policies andProcedures 5.4 Security Auditing and Its Role in SecurityTesting	
Unit 6	Automation Testing with Testing Tools - Advanced	**10 Lectures**
	6.1 FundamentalsofSelenium,overview,presentation,exportfeatures,installation,SeleniumIDEandwebdriver. 6.2 TestapplicationwithSeleniumIDE,RCVSwebdriver,howtocreatetestdrivewithwebdrive. 6.3 Install Selenium IDE andFirebug 6.4 Selenium IDE Script, Locators in SeleniumIDE 6.5 Source Control, Debugging Techniques, HTML,CSS 6.6 Installation of Selenium Web Driver, Scripts in Web Driver 6.7 Accessing Forms in Web Driver, Links &Tables	
Unit 7	Web Services Testing	**6 Lectures**
	7.1 Service Oriented Architecture (SOA), who usesSOA 7.2 WebServices,WhyWebServicesareBeingUsed?WhatisWSDL?,WebServiceStandards,toolstotest 7.3 Webservices, how to test web services, why to test webservices. 7.4 UnderstandingWSDL,howisitused,specifications,document,andfile,RetrievingandViewing/ InspectingWSDLfile. 7.5 SOAP, SoapUI tool, download and installation RESTFulService	
Unit 8	Experiential learning	**1 Lecture**
	8.1 Compare performance characteristics of different testing tools	

References:

1) Lessons Learned in Software Testing: By CemKaner , James Bach , Bret Pettichord

2)Software Testing by Ron Patton, Lisa Crispin, Janet Gregory: Agile Testing : A Practical Guide for Testers and Agile Teams

Course Code: 23ScCmpP131
Course Name : Research Methodology

Section 1

Teaching Scheme: 2 Hours/Week **Credit : 02**

Examination Scheme: CIA :25 Marks **End-Sem : 25 Marks**

Prerequisite Courses:

- B.A., B.Sc. B.Com,B.Voc., BBA, BBA IB, BBA CA

Course Objectives:

- To make students aware about research and its importance
- To obtain knowledge regarding systematic gathering of data and get advanced knowledge in the selected topic
- Toinculcatelogical and organized thinking in students
- To investigate some existing situation or problem by creating new system or method
- To help students to design research problem

Course Outcomes:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall and explain the fundamental significance and objectives of research	1
CO 2	Understand concepts of publication ethics and analyze differences between ethical/unethical practices	2
CO 3	Apply criteria to choose relevant research problems and analyze their feasibility	3,4
CO 4	Formulate clear and testable hypotheses based on research problem	4
CO 5	Perform data analysis using parametric/non-parametric tests and organize data effectively	5
CO 6	Draft comprehensive research reports adhering to principles of scientific writing and ethics	6

Course Contents

Unit 1	Research problem and design	No. of lectures
	Introduction to research :meaning and definition of research, objective of research, importance of research, characteristics of good research, purpose and role of research, classification of research **Research problem :** defining of research problem, Criteria for selecting the research problem, , importance of literature survey in defining research problem. Hypothesis :Defining Hypothesis, types of hypothesis, characteristics of good hypothesis, formulation of hypothesis **Research Design :**Definition and features of research design, Concept of research design, types of research design, preparation of research design, Sampling techniques, characteristics of good sampling designs	**15**
Unit 2	**Data analysis, report writing and publication ethics**	**15**
	Definition of Data, methods of data collection, analysis of data, types of data analysis, Questionnaire, Design of Questionnaire, Testing hypothesis : parametric and non-parametric tests : T-test, Z-test, Chi-square test, ANOVA **Report writing** : importance of interpretation of results, meaning, definition and significance of report /thesis writing, Principals of research report drafting, Types of reports, layout of research report, important parts of reports, precautions of preparation of report/ thesis **Publication ethics :**definition, introduction and importance, best practices/ standard settings initiative and guidelines COPE, WAME, etc, conflict of interest, Publication misconduct :definition, concept problems that lead to unethical behavior, violation of publication ethics, predatory publishers and journals, software tools to identify predatory publications developed by SPPU	

References :

- C. R. Kothari (2004) Research Methodology : Methods and Techniques 2nd Edition, New age International (p) Ltd Publications, New Delhi, India

- J.W. Creswell and J.D. Creswell (2017) Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5thEdition, SAGE Publications, USA.

- C. G. Thomas (2021) Research Methodology and Scientific Writing, 2nd Edition, Springer Nature, New York.

- M. Kheider lectures from University of Biskra (2017) https://univ-biskra.dz/sites/fll/images/houadjli%20Ahmed%20Chaouki.pdf

Course Code : 23ScCmpP131
Course Name : Artificial Intelligence (Departmental Specific Elective)

Section 2

Teaching Scheme: TH:4Hours/Week **Credit : 02**
Examination Scheme: CIA : 25 Marks **End-Sem : 25 Marks**

Prerequisites: -

- Basic Knowledge of Data Structure.
- Basic knowledge of Algorithm.

Course Objectives:

- The course will cover basic ideas and techniques underlying the design of intelligent computer systems.
- To understand implementation of basic AI algorithms.

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify and define problems that are amenable to solution by AI methods.	**1,3**
CO 2	Identify appropriate AI methods to solve a given problem.	**3**
CO 3	Formalize a given problem in the language/framework of different AI methods.	**6**
CO 4	Classify data using different Data classification technique	**2**
CO 5	Interpret different gaming techniques for different game models	**5**
CO 6	Distinguish between different AI techniques	**4**

Course Contents

Unit 1	**Introduction to AI**	**2 lectures**
	1.1 Introduction to AI 1.2 History of AI 1.3 Course logistics	
Unit 2	**Problem Solving** :	**6 lectures**
	2.1 Problem space 2.2 Solving Problems by Searching 2.3 Heuristic search techniques 2.4 Constraint satisfaction problems 2.5 Stochastic search methods.	
Unit 3	Heuristic Search Techniques	**10 lectures**
	3.1 Generate-and-test 3.2 Hill Climbing 3.3 Best First Search 3.4 Problem Reduction 3.5 Constraint Satisfaction 3.6 Mean-Ends Analysis,	
Unit 4	**Knowledge and Reasoning** :	**12 lectures**
	4.1 Building a Knowledge Base : Propositional logic, first order logic, situation calculus. 4.2 Theorem Proving in First Order Logic. Planning, partial order planning. 4.3 Uncertain Knowledge and Reasoning	
Unit 5	**Knowledge Inference**	**11 lectures**
	5.1 Knowledge representation -Production based system, Frame based system. 5.2 Inference – Backward chaining, Forward chaining, Rule value approach only introduction with examples	
Unit 6	**Gaming Planning And Learning**	**4 lectures**
	6.1 minimax, alpha-beta pruning. 6.2 Overview of different forms of learning	
Unit 7	**Experiential Learning**	**3 lectures**
	Review any Two AI based Research Project Find out problem definition of NLP/ Computer Vision research projects	

Reference books –

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight
4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd.,
5. New Delhi, 1997, 2nd Printing, by Dan Patterson.
6. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd edition.
7. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

Semester –II

Course Code : 23CsCmpP211
Course Name : Advanced Operating Systems(UNIX/Linux Internals)

Teaching Scheme: TH: 4 Hours/Week **Credit: 04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites

- General knowledge of operating systems
- Working knowledge of C programming.
- Basic algorithms and data structure concepts.

Course Objectives

- To study, learn, and understand the main concepts of advanced operating systems
- It is intended for anyone writing C programs that run under Unix/Linux.
- To study threads management.
- Study of Synchronization, communication and scheduling in parallel systems

Course Outcomes

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Understand the Operating Systems Structure with examples of Unix/Linux.	1
CO 2	Explain the structure of files and directory in UNIX/LINUX OS.	2
CO 3	Identify and Use various system calls related to file subsystem.	3
CO 4	Analyse the process control subsystem structure in UNIX/LINUX OS	4
CO 5	Assess various system calls related to the process control subsystem.	5
CO 6	Develop the concept of signal handling with practical implementation	6

Course Contents

Unit 1	**Introduction to UNIX/LINUX Kernel**	**3 lectures**
	1.1 Overview of operating system 1.2 Introduction to UNIX OS 1.3 Architecture of UNIX 1.4 Basics of navigating UNIX environment	
Unit 2	**File system**	**7 lectures**
	2.1 Introduction to UNIX file system 2.2 File system layout 2.3 Files and directory management 2.4 Processes and process management	
Unit 3	**Usage of command line-shell**	**4 lectures**
	3.1 Types of shell 3.2 Shell functionality 3.3 Environment 3.4 Shell Commands 3.5 Permissions, users and groups	
Unit 4	**Shell Scripting**	**9 lectures**
	4.1Writing, executing and debugging basic script 4.2 Making interactive scripts 4.3 Conditional statements 4.4 Loops 4.5 Command line arguments 4.6 Functions and file manipulations 4.7 Regular expressions and filters	
Unit 5	**Different Types of System Calls**	**7 lectures**
	5.1 Process Control 5.2 File management 5.3 Device management 5.4 Information maintenance 5.5 Programming using system calls	
Unit 6	Interprocess Communication(IPC)	**8 lectures**
	6.1 Introduction to IPC 6.2 IPC between processes on a single computer system 6.3 IPC between processes on different systems 6.4 Pipes-creation IPC between related processes using FIFOs(Named pipes) 6.5 Differences between unnamed and named pipes 6.6 popen and pclose library functions. 6.6 Message Queues 6.7 Semaphores	
Unit 7	**Signals**	**5 lectures**
	7.1 Introduction to signals 7.2 Interrupts Concept 7.3 Difference between signals and Interrupts 7.4 Signal function	

	7.5 Signal names 7.6 Signal generation 7.7 Signal handling 7.8 Kernel support for signals	
Unit 8	**Virtualization and Containers**	**4 lectures**
	8.1 Introduction to visualization 8.2 Virtual machine 8.3 Introduction to containers 8.4 Importance of containers 8.5 Virtual Box 8.6 Difference between containers and 8.7 virtualization	
Unit 9	**Experiential Learning**	**1 lecture**
	9.1 Comparison of different operating systems 9.2 Study of open source OS characteristics 9.3 Changing parameters of configuration files and study behavior of it	

References:

1. Linux System Programming, O'Reilly, by Robert Love.
2. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
3. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens.
4. Modern Operating Systems, Tanenbaum, IIIrd Edition, PHI
5. Linux Command Line & Shell Scripting, Richard Blum and Christine Bresnahan, 2nd edition, Wiley
6. UNIX for Programmers and Users, 3rd Edition Graham Glass, King Ables

Course Code:23CsCmpP212
Course Name: Mobile Computing (Android)

Teaching Scheme: TH: 4 Hours/Week **Credit : 04**
Examination Scheme: CIA: 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Student must be aware of Wired and Wireless Networks
- Student must be aware of TCP/IP protocol suit
- Java Programming Knowledge is essential

Course Objectives

- To make the students well aware of software development framework and network architecture for Mobile Computing in order to fulfill the requirements of skill sets expected by IT Industry.

Course Outcome:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify and define the principles and theories of mobile computing technologies,memorize cellular system	1
CO 2	Demonstarte the technologies GSM, GPRS, DECT,UMTS.	2
CO 3	Interpret changes/modifications required in standard protocols like IP and TCP for mobile wireless network. Identify the functionality of Mobile IP and Transport Layer	3
CO 4	Examine software architecture and changes in application environment for the mobile computing.	4
CO 5	Inspect Android programming environment	5
CO 6	Develop Android-based applications with effective UI design, multimedia integration, and sensing capabilities. Develop technical competence in the field of mobile technology.	6

Course Contents

Unit 1	**Introduction to Mobile Computing**	**2 lectures**
	1.1 Mobility and Portability 1.2Location Dependent Services 1.3 Simplified Reference Model 1.4 Cellular Systems	
Unit 2	**Telecommunication Systems**	**5 lectures**
	2.1 GSM (System Architecture, Localization and Calling, Handover, Security) 2.2 GPRS Architecture 2.3 DECT – System Architecture 2.4 UMTS – System Architecture, Handover 2.5 UTRAN - System Architecture	
Unit 3	**Mobile Network Layer**	**12 lectures**
	3.1 Mobile IP (Goals, Entities and Terminologies, Packet Delivery, Agent Discovery, Registration, Tunneling & Encapsulation, Optimizations, IPV6, Micro-mobility Support) 3.2 Dynamic Host Configuration Protocol 3.3 Mobile Ad-hoc Networks (Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Alternate Metrics)	
Unit 4	**Mobile Transport Layer**	**4 lectures**
	4.1 Tradition TCP Issues 4.2 TCP Improvements (Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/Fast Recovery, Transmission/Time-out Freezing, Selective Retransmission, Transaction – Oriented TCP) 4.3 TCP over 2.5G/3G/4G 4.4 Performance Enhanced Proxies	
Unit 5	**Introduction to Mobile Development Frameworks and Tools**	**5 lectures**
	5.1 N-Tier Client-Server Framework and Tools 5.2 JAVA (J2ME, CLDC,CDC, Java Card, JINI, JXTA Peer-to-Peer Protocol) 5.3 BREW 5.4 WINDOWS CE 5.5 WAP (Architecture, WAP UI, Proxies and Gateways, MMS, WAP Push, Security, Dimensions of Mobility) 5.6 Symbian EPOC	
Unit 6	**XML and Mobile Applications**	**5 lectures**
	6.1 DOM Parsing 6.2 SAX Parsing 6.3 XML Web Services 6.4 SOAP	

	6.5 WSDL 6.6 Key XML Technologies for Mobile Computing	
Unit 7	**UI Development**	**4 lectures**
	7.1 Building Generic User Interfaces 7.2 UML for Modeling GUI Components 7.3 XForms 7.4 Platforms for Mobile GUIS (WAP, J2ME, BREW, Microsoft) 7.5 Multimodal User Interfaces (Software and System Architecture) 7.6 Mobile Agents for Mobile Computing and Application of Mobile Agents 7.7 Peer-to-Peer Application Development for Mobile Computing	
Unit 8	**Introduction to Android Operating System &Programming**	**10 lectures**
	8.1 Android Architecture 8.2 Components of Android Application 8.3 UI Designing and Event Handling 8.4 Exploring 2D Graphics 8.5 Multimedia 8.6 Storing Local Data 8.7 Locating and Sensing 8.8 SQLite	
Unit 9	**Experiential Learning**	**1 lecture**
	9.1 Comparisons of various mobile 9.2 applications that are used by students and submission of report.	

Reference Books

1. Mobile Communications, Jochen Schiller, Pearson Education
2. Mobile Computing Principles, Reza B'Far, CAMBRIDGE
3. Beginning Android Application Development by Wei-Meng Lee Wiley India
4. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder
5. The Android Developers Guide [http://developer.android.com/guide/index.htm]

Course Code : 23CsCmpP213
Course Name :Data Mining and Data Warehousing

Teaching Scheme: TH: 4 Hours/Week **Credit : 04**
Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Basic programming skills
- Basic skills in statistics and linear algebra

Course Objectives:

- This course will introduce the concepts, techniques, design and applications of data warehousing and data mining.
- Some systems for data warehousing and/or data mining will also be introduced.
- The course is expected to enable students to understand and implement classical algorithms in data mining and data warehousing

Course outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Explain the fundamentals of data mining, including basic tasks, issues, metrics, and distinguish it from knowledge discovery in databases.	**1**
CO 2	Expalin the architecture and key components of data warehouses and OLAP systems, and model dimensional data using star and snowflake schemas.	**2**
CO 3	Apply data preprocessing steps such as data cleaning, integration, transformation, and reduction to prepare data for mining tasks.	**3**
CO 4	Analyze and implement key data mining techniques such as frequent itemsets, association rules, and algorithms like Apriori and FP-growth. Explore advanced data mining techniques such as active learning, reinforcement learning, text mining, web mining, graphical models, and spatial mining, understanding their applications and challenges.	**4**
CO 5	Evaluate, and optimize classification and prediction models using decision trees, Bayesian classifiers, Linear and Non - Linear regression techniques, and handle common issues such as overfitting.	**5**
CO 6	Use clustering algorithms for effective grouping of data. Utilize popular data mining tools for implementing mining algorithms and applying them to practical data sets and real-world problems.	**6**

Course Contents

Unit 1	**Introduction to Data Mining**	**5 lectures**
	1.1. Basic Data Mining Tasks 1.2. DM versus Knowledge Discovery in Databases 1.3. Data Mining Issues 1.4. Data Mining Metrics 1.5. Social Implications of Data Mining 1.6. Overview of Applications of Data Mining	
Unit 2	**Introduction to Data Warehousing**	**5 lectures**
	2.1. Architecture of Data Warehouse 2.2. OLAP and Data Cubes 2.3. Dimensional Data Modeling-Star, Snowflake Schemas 2.4. Data Processing 2.4.1. Need 2.4.2. Data Cleaning 2.4.3. Data Integration 2.4.4. Transformation 2.4.5. Data Reduction 2.5. Machine Learning 2.6. Pattern Matching	
Unit 3	**Data Mining Techniques**	**6 lectures**
	3.1. Frequent Item-Sets 3.2. Association Rule Mining 3.3. Rule Basic Measures – Support and Confidence 3.4. Apriori Algorithm 3.5. Use of Sampling for Frequent Item Set 3.6. FP tree algorithm 3.7. Graph Mining 3.8. Tree mining 3.9. Sequence Mining	
Unit 4	**Classification & Prediction**	**17 lectures**
	4.1. Decision Tree 4.2. Construction, Performance, Attribute Selection 4.3. Issues: Over-Fitting, Tree Pruning Methods, Missing Values 4.4. Continuous Classes 4.5. Classification and Regression Trees (CART) 4.6. Bayesian Classification 4.7. Bayes Theorem, Naïve Bayes classifier 4.8. Bayesian Networks 4.9. Linear Classifier & Types of Linear Classifiers 4.10 Least Squares 4.11 Prediction 4.12 Linear Regression 4.13 Non-linear Regression	

Unit 5	Accuracy Measures	4 lectures
	5.1. Precision, Recall, F-measure, Confusion Matrix 5.2. Cross-validation, Bootstrap	
Unit 6	**Data Mining Tools**	**3 lectures**
	6.1. Usage of DM Tools 6.2. Sample applications of Data Mining	
Unit 7	**Clustering**	**4 lectures**
	7.1. Distance Based Clustering 7.2. K-Means Clustering 7.3. Expectation Maximization (EM) Algorithm 7.4. Hierarchical Clustering 7.4.1. Agglomerative Clustering 7.4.2 Divisive Clustering 7.5. Computing Inter-Cluster Distance	
Unit 8	**Overview of Advanced Techniques**	**3 lectures**
	8.1. Active Learning 8.2. Reinforcement Learning 8.3. Text Mining 8.4. Graphical Models 8.5. Web Mining 8.6. Spatial Mining	
Unit 9	**Experiential Learning**	**1 lecture**
	9.1. Usage of DM Tool	

References :s

1. Data Mining: Concepts and Techniques, Han, ElsevierISBN:9789380931913/ 9788131205358
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education
3. Tom Mitchell, ―Machine Learning‖, McGraw-Hill,1997
4. R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification. Second edition. John Wileyand Sons,2000.
5. Christopher M. Bishop, ―Pattern Recognition and Machine Learning‖, Springer 2006
6. Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, Second Edition, McGraw Hill International
7. Ian H.Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman), ISBN:9789380501864
8. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data mining field

Course Code : 23CsCmpP214
Course Name : Lab on AOS and Mobile Computing (Android)

Teaching Scheme: TH: 2 + 2 = 4 Hours/Week **Credit : 02**
Examination Scheme: CIA : 25 Marks **End-Sem : 25 Marks**

Lab Assignments on Advanced Operating Systems

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Understand, execute basic and advanced Linux shell commands to perform file and system operations effectively.	1
CO 2	Demonstrate to manage users, groups, and set appropriate file permissions in a Linux environment using C Programming	2
CO 3	Apply shell scripts incorporating conditional statements, loops, command-line arguments, and functions for automation. Examine regular expressions and filters within shell scripts	3
CO 4	Analyze file-related system calls and handle file descriptors including duplication with dup and dup2, unnamed and named pipes for inter-process communication and demonstrate process synchronization.	4
CO 5	Understand the usage of signals using signal handlers.	5
CO 6	Design and develop the concept of signal handling with practical implementation	6

1	Usage of shell and execute different shell commands
2	Creations of different Users and Groups and setting permissions
3	Write Shell Scripts using Conditional statements
4	Write Shell Scripts using Loops
5	Write Shell Scripts using Command line arguments
6	Write Shell Scripts using Functions and file manipulations
7	Write Shell Scripts using Regular expressions and filters
8	Usage of file related system calls
9	Usage dup and dup2 system calls
10	Create unnamed and named pipes and communicate between different processes using it
11	Usage of signals using three types of signal handlers
12	Basic assignments using virtual machine

Lab Assignments on Mobile Technologies (Android)

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall the fundamentals of Android OS, architecture, components, and basic UI elements.	1
CO 2	Explain the lifecycle of Activities and Fragments and the concept of Intents in Android.	2
CO 3	Design and implement Android user interfaces using layouts, views, and resources.	3
CO 4	Analyze the behavior of Android components and implement event-driven programming including handling user inputs.	4
CO 5	Use multithreading techniques such as AsyncTask and Services to perform background processing in Android apps.	5
CO 6	Implement data storage solutions using SQLite and SharedPreferences in Android applications.	6

1	Android Installation and Introduction to Android Studio
2	Running Simple Hello World
3	Applying different Layouts
4	Activity ,Intent,Fragments
5	Threds,Services
6	ImageSwitcher,Spinner,TimePicker, DatePicker, Alert Dialog
7	User Interface and Event Handling
8	Menus
9	Multimedia: Play audio, video
10	Location-Based Services and Google Maps
11	Databases – Sqlite
12	Deploying Android Application on Device

Course Code :23CsCmpP221

Course Name : Information System Security

Teaching Scheme: 4 Lectures/Week **Credits: 4**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Desired Prerequisites:

- Knowledge of basic Information Systems

Course Objectives:

- To enable students to get sound understanding of Information system security and Cryptograph

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Explain the fundamental concepts of information system security including threats, risks, and core principles.	1
CO 2	Apply cryptographic techniques (symmetric and asymmetric) for securing data and communications.	2
CO 3	Analyze and compare symmetric and asymmetric encryption algorithms.	3
CO 4	Evaluate message integrity and authentication mechanisms for system security.	4
CO 5	Assess and implement internet and server security protocols and mechanisms.	5
CO 6	Identify and categorize virus threats and suggest mitigation strategies.	6

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	**Conceptual Foundation of Information Systems Security**	**3**
	1.1 Concepts and Terminology: Threats, Attacks, Vulnerabilities, Risks, Risk Assessment and Mitigation 1.2 Security – Confidentiality, Integrity, availability, Identification, Authentication, Authorization, Accountability, Privacy	
Unit 2	**Cryptography**	**2**
	2.1 Techniques 2.2 Mathematical Foundation 2.3 Steam Ciphers 2.4 Block Ciphers 2.5 Cryptanalysis	
Unit 3	**Symmetric/Secret Key Encryption**	**6**
	3.1 Algorithm Types and Modes 3.2 DES (Data Encryption Standard) 3.3 Double DES 3.4 Triple DES 3.5 AES (Advanced Encryption Standard) 3.6 IDEA 3.7 Blowfish 3.8 RC5	
Unit 4	**Public Key Encryption**	**8**
	4.1Principles of public key crypto-systems 4.2 Mathematical Foundation 4.3 RSA Algorithm 4.4 Key Management 4.5 Deffie-Hellman Key Exchange 4.6 Elliptic curve cryptography 4.7 Digital Signatures using DSA (Digital	

	Signature Algorithm) 4.8 DSS (Digital Signature Standard) and RSA	
Unit 5	**Message Integrity Techniques**	**2**
	5.1 MD5 5.2 SHA	
Unit 6	**Public Key Infrastructure**	**4**
	6.1 Trust Hierarchy 6.2 Digital Certificates 6.3 Transaction Certificates	
Unit 7	**Authentication Techniques**	**4**
	7.1 Passwords 7.2 Pass-code 7.3 Pass-phrase 7.4 Challenge-response 7.5 Biometrics based registration and Authentication 7.6 Kerbores	
Unit 8	**Internet Security Protocols**	**11**
	8.1 SSL/TLS 8.2 TSP 8.3 SET 8.4 3-D Secure Protocol 8.5 Electronic Money 8.6 Email Security(PGP, PEM, S/MIME) 8.7 IP Security: IPSec, VPN	
Unit 9	**Server Security**	**4**
	9.1 Concepts 9.2 Design and Implementation of Firewalls, 9.3 Intrusion Detection Systems (IDS) 9.4 Intrusion Prevention Systems (IPS) etc	
Unit 10	**Virus Threats**	**2**
	10.1 Network Viruses 10.2 Worms	
Unit 11	**Data Hiding**	**1**
	11.1 Steganography	
	EXPERIENTIAL LEARNING	**1**

Reference Books:

1. AtulKahate," Cryptography And Network Security" TMH, **ISBN-10:** 9781259029882

2. Nina Godbole, "Information Systems Security", Wiley, ISBN-13: 978-8126516926

Course Code :23CsCmpP222

Course Name : Software Project Management

Teaching Scheme: 4 Lectures/Week **Credits: 4**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Desired Prerequisites:

- Software Engineering
- Basic testing concepts

Course Objectives:

- Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects.
- It examines Requirements Elicitation, Project Management, Verification &Validation and Management of Large Software Engineering Projects.

Course Outcomes:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Explain the fundamental concepts and principles of software project management, including project lifecycle, roles, and responsibilities.	**1**
CO 2	Identify various roles in a software project team and explain the importance of leadership and team dynamics in software project success.	**2**
CO 3	Apply project management techniques such as project planning,WBS, scheduling (e.g. PERT, CPM), and resource allocation to real-world software projects.	**3**
CO 4	Develop a complete project management plan including scope, time, cost, quality, HR, communication,Risk and procurement management.	**6**
CO 5	Analyse software cost estimation models (e.g. COCOMO) and risk management techniques to identify and mitigate potential project risks.	**4**
CO 6	Monitor and control project progress using key performance indicators (KPIs),CMM	**5**

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	**Introduction to Project Management**	**4**
	1.1 What is a Project? 1.2 What is Project management? 1.3 Project phases and project life cycle 1.4 Organizational structure 1.5 Qualities of Project Manager 1.6 WBS	
Unit 2	**Project Management Components**	**6**
	2.1 Project Integration Management-Project plan development and execution 2.2 Change controls 2.3 CCB 2.4 Configuration management	
Unit 3	**Scope Management**	**4**
	3.1 Strategic planning 3.2 Scope planning, definition 3.3Verification and control	
Unit 4	**Time management**	**2**
	4.1 Activity planning 4.2 Schedule development and control 4.3 GANTT Chart	
Unit 5	**Cost Management**	**2**
	5.1 Cost estimation and Control 5.2 COCOMO model 5.3 BASIC COCOMO NUMERICALS	
Unit 6	**Quality Management**	**2**
	6.1 Quality planning and assurance	
Unit 7	**Human Resource Management**	**2**
	7.1 Organizational planning • 7.2 Staff acquisition	
Unit 8	**Communication Management**	**2**
	8.1 Information distribution	

	8.2 Reporting	
Unit 9	**Risk Management**	**2**
	9.1 Risk identification 9.2 Quantification and control	
Unit 10	**Procurement Management**	**2**
	10.1 Solicitation management and control 10.2 Contract administration 2	
Unit 11	**Software Metrics**	**6**
	11.1 The scope of software metrics 11.2 Size- oriented metrics 11.3 Function oriented 11.4 Software metrics data collection 11.5 Analyzing software data	
Unit 12	**Software Reliability**	**6**
	12.1 Measurement and prediction 12.2 Resource measurement 12.3 Productivity, teams and tools	
Unit 13	**Planning a measurement program**	**4**
	13.1 What is metrics plan? 13.2 Developing goals, questions and metrics 13.3 Where and When: Mapping measures to activities 13.4 How: Measurement tools 13.5 Who: Measurers , analyst, tools revision plans	
Unit 14	**Quality Standards**	**4**
	14.1 CMM levels 14.2 KPA's 14.3 PSP/TSP	

References:

1. Software Engineering Roger Pressman McGraw-Hill

2. Software Metrics for Project Management and process improvement Robert B. Grady Prentice hill

3.Software engineering principles and practice, McGraw-Hill, Waman S. Javadekar

Course Code 23CsCmpP204
Course Name : On Job Training-Project
Teaching Scheme: Practical :8Hours/Week **Credit : 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Explain the workflow, technologies used in the organization.	1
CO 2	Apply theoretical knowledge of computer science to resolve real-world tasks during the project work.	2
CO 3	Analyze software requirements, system architecture, or code structure to understand the project's scope.	3
CO 4	Evaluate tools, technologies, or programming practices used in the organization in terms of efficiency and relevance.	4
CO 5	Design and implement a software module or contribute to a project under industry supervision.	5
CO 6	Reflect critically on the internship experience to assess personal learning, strengths, and areas for improvement.	6

Second Year
Semester-III

Course Code:23CsCmpP311

Course Name : Cloud Computing

Teaching Scheme: TH: 4Hours/Week **Credit: 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Knowledge of Operating System Concepts
- Fundamentals of Computer Networks
- Good Understanding of Object-Oriented Programming Concepts

Course Objectives:

- To understand the principles and paradigm of Cloud Computing
- To understand the role of Virtualization Technologies
- To develop an Ability to design and deploy Cloud Infrastructure
- To understand cloud security issues and solutions

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Define Cloud Computing, List desired features and benefits of Cloud Computing	1
CO 2	Demonstrate cloud deployment models, cloud service models	2
CO3	Discover the security and compliance challenges of cloud computing	3
CO 4	Compare operation and economic models of various trending cloud platforms prevailing in IT industry.	4
CO 5	Examine the virtualization foundations to cater to the needs of elasticity, portability, and resilience of cloud service providers	5
CO 6	Discuss architectural style, work flow of real-world applications and to implement the cloud applications using map reduce programming models	6

Course Contents

Unit 1	Introduction to Cloud Computing	10 Lectures
	1.1. Overview of Cloud Computing 1.1.1 Need of Cloud Computing 1.1.2. Acceptance of Cloud Computing	

	1.1.3.Layers and Types of Cloud 1.1.4. Desired Features of a Cloud 1.1.5. Benefits and Disadvantages of Cloud Computing 1.2. Cloud Infrastructure Management 1.2.1. Infrastructure as a Service Providers 1.2.2. Platform as a Service Providers 1.3. Multitenant Technology 1.4. Cloud-Enabling Technology 1.4.1. Broadband Networks and Internet Architecture 1.5. Data Center Technology 1.6. Virtualization Technology 1.6.1. Infrastructure as a Service, Platform as a Service, Software as a Service 1.7. Cloud Deployment Models	
Unit 2	**Abstraction and Virtualization**	**8 Lectures**
	2.1. Introduction to Virtualization Technologies 2.2. Load Balancing and Virtualization 2.3. Understanding Hyper visors 2.4. Virtual Machines Provisioning and Manageability Virtual Machine Migration Services 2.5. Provisioning in the Cloud Context Virtualization of CPU 2.5.1. Memory 2.5.2. I/O Devices 2.6. Virtual Clusters and Resource management	
Unit 3	**Programming, Environments and Applications**	**12 Lectures**
	3.1. Features of Cloud and Grid Platforms 3.1.1. Programming Support of Google App Engine 3.1.2. Programming on Amazon AWS and Microsoft Azure, 3.2. Emerging Cloud Software Environments 3.3. Applications 3.3.1. Moving application to cloud 3.3.2. Microsoft Cloud Services 3.3.3. Google Cloud Applications 3.3.4. Amazon Cloud Services	

	3.4. Cloud Applications	
Unit 4	**Security In The Cloud**	**10 Lectures**
	4.1. Security Overview 4.1.1. Cloud Security Challenges and Risks 4.2. Software-as-a-Service Security 4.3. Security Governance 4.4. Risk Management 4.5. Security Monitoring 4.6. Security Architecture Design 4.7. Data Security 4.8. Application Security 4.9. Virtual Machine Security 4.10. Identity Management and Access Control 4.11. Disaster Recovery in Clouds	
Unit 5	**Cloud Technologies And Advancements**	**6 Lectures**
	5.1. Hadoop 5.2. MapReduce 5.3. Virtual Box 5.4. Federation in the Cloud 5.4.1. Four Levels of Federation 5.4.2. Federated Services and Applications 5.4.3. Future of Federation 5.4.4. Constraints and limitations of cloud tech 5.4.5. Local access dependency	
Unit 6	**Experiential Learning**	**2 Lectures**
	Statistical Study in various aspects of different websites which use Cloud to store their data	

Reference Books:

1) Cloud Computing Principles and Paradigms, RajkumarBuyya Wiley
2) Cloud computing Black Book Dreamtech Publication , KailashJayaswal, Donald J. Houde, JagannathKallakurchi
3) Distributed and Cloud Computing, Kai Hwang, Mk Publication
4) Using Google Apps engine O'reilly Publication , Charles Severance
5) Programming Amazon EC2, O'reilly Publication Jurg van Vliet
6) Cloud security, Ronald L. Wiley Publication
7) Cloud computing Dr. Kumar Saurabh, wily Publication
8) Virtualization for Dummies, Wiley Publication

Course Code :23CsCmpP312

Course Name : UI/UX(User Interface/User Experience)

Teaching Scheme: TH: 4Hours/Week **Credit : 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Knowledge of HTML, CSS , JS, HTTP
- Basic concepts of web applications and technology like Cookies, Sessions, HTTP Protocols, Caching, Redirects

Course Outcome:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify project scope, requirements, frameworks, and developer tools	**1**
CO 2	Discover Responsive Web Design	**2**
CO 3	Identify appropriate technology for designing web pages	**3**
CO 4	Illustrate practical methods for approaching a *design* and allow users to meet their needs in the most effective, efficient, and satisfying manner that meet their needs	**4**
CO 5	Determine testing methods and tools	**5**
CO 6	Implement practical methods for approaching a design	**6**

Course Contents

Unit 1	Overview of User experience and Design principles	3 Lectures
	1.1 Course Overview 1.2 Design Fundamentals, User Flows and Navigation 1.2.1 Identify the project parameters	

	1.2.1.1 User personas, storyboards 1.2.2 Introduction to wireframing and mockups 1.2.2.1 Wireframes, paper prototyping, rapid prototyping 1.2.2.2 Wireframes vs Prototypes 1.2.2.3 Workflow for designing a site 1.3 UXD Principles 1.3.1 Visual design, Focal point , Flow and Interaction, Responsive design, The effects of good UXD design ○ 1.4 Designing for multi-device environments 1.4.1 Introduction to responsive web design 1.5 Introduction to CSS	
Unit 2	**Introduction to Developer Tools**	**1 Lecture**
	2.1 Using console to debug javascript, angular, react codes. 2.2 Using console to debug javascript, angular, react codes. 2.3 Testing Request and Response Objects	
Unit 3	**Optimization Techniques**	**3 Lectures**
	3.1 Caching 3.2 Minification and Deferring of CSS, JS, HTML 3.3 Eliminating unused code and render blocking scripts 3.4 Image optimization (Types JPG, PNG, SVG https://tinypng.com/)	
Unit 4	**Responsive Web Design**	**3 Lectures**
	4.1 View port 4.1.1 What is viewport? 4.1.2 Setting up viewport. 4.2 Introduction to Media queries 4.2.1 Min and Max parameters, examples. 4.2.2 Screen resolutions and orientations 4.3 Introduction to Bootstrap 4.3.1 Bootstrap Basics , Grids, Themes 4.3.2 Bootstrap CSS & JS	
Unit 5	**Introduction to Typescript**	**3 Lectures**
	5.1 Comparison between Javascript and Typescript 5.2 Data types and variables 5.2.1 Basic data types, arrays, enums, tuples	

	5.2.2 Difference between let and var 5.2.3 Const declaration 5.2.4 Type casting 5.2.5 Arrow function 5.3 Working with classes 5.3.1 Writing and using classes 5.3.2 Constructor method 5.3.3 Inheritance 5.4 Working with Interfaces 5.4.1 Interface Declaration and Initialization with an object, DuckTyping, Interface Implementation by class, Extending Interfaces 5.5 Modules and Namespaces 5.5.1Export Syntax, Import Syntax , Re-export, Default exports, Using require(), Declaring and Using Namespaces 5.6 Introduction to Block element modifier	
Unit 6	**Introduction to Front End Frameworks**	**2 Lectures**
	6.1 Feature comparison between Angular Js, React Js, VueJs, Create Js, Express, Node Js	
Unit 7	**Node Js**	**3 Lectures**
	7.1 Introduction to Node Js 7.2 Node Js Modules and File System 7.3 Use npm and manage node packages 7.4 Node Js and Database connectivity 7.4.1 MySQL and MongoDB connectivity. 7.5 Node Js and Express Js example	
Unit 8	**AngularJS**	**12 Lectures**
	8.1 Introduction to Single Page Application 8.2 Introduction to AngularJS MVC Architecture 8.2.1 AngularJS Expressions - Number and String Expressions, Object Binding and Expressions 8.2.2 AngularJS Modules - Module Loading and Dependencies 8.2.3 AngularJS Data Binding 8.2.4 AngularJS Directives & Events - Core directives, conditional directives. 8.2.5 AngularJS Scope and Controllers - Programming	

	Controllers and $scope object, Nested & Multiple Controllers and Scope Inheritance, Adding Behavior to a Scope Object 8.2.6 AngularJS Filters - Purpose of filters, Built-in and Custom filters 8.2.7 AngularJS Services - Developing services 8.2.8 AngularJS HTTP 8.2.9 AngularJS Tables 8.2.10 AngularJS Select - Working with Select and Options 8.2.11 Fetching Data from MySQL 8.2.12 AngularJS Validation	
Unit 9	**Unit Testing**	**2 Lectures**
	9.1 Why we do unit testing 9.2 Introduction to Jasmine, Karma, using the ngMock Module 9.3 Cross Browser, Cross Device testing (Developer perspective)	
Unit 10	**React and Redux**	**10 Lectures**
	10.1 Introduction to React and Redox 10.2 Introduction to ReactJS 10.2.1 History of front end libraries 10.2.2 Key differentiators (Virtual DOM, One way binding) 10.2.3 Thinking in React, React Components 10.2.4 React component 10.2.5 Render function 10.2.6 Component API 10.2.7 Component lifecycle 10.2.8 State 10.2.9 Props 10.2.10 Mixins 10.2.11 JSX ,React internals 10.2.12 Reconciliation algorithm 10.3 Component inter communication 10.3.1 Component composition 10.3.2 Pass data from parent to child & vice-versa 10.4 Component styling 10.4.1 Radium 10.4.2 CSS Modules LESS/SASS 10.5 Unit testing components - Enzyme, Jest, React test utilities	

Unit 11	**Introduction to Redux**	**4 Lectures**
	11.1 Flux Architecture and redux 11.2 Redux action, combining reducers, and Reduxthunk 11.3 client-server communication using Fetch and the REST API. 11.4 Testing, building and deploying React applications.	
Unit 12	**Experiential Learning**	**2 Lectures**
	Study the overall success of any Website or Application using User Experience parameters / innovative ideas	

References books

1) Programming JavaScript Applications Robust Web Architecture with Node, HTML5, and Modern JS Libraries by Eric Elliot
2) Learning AngularJS - By Brad Dayley
3) AngularJS Web Application Development Cookbook - By Matt Frisbie
4) Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability - Steve Krug
5) Full-Stack JavaScript Development: Develop, Test and Deploy with MongoDB, Express, Angular and Node on AWS by Eric Bush
6) Learning React: Functional Web Development with React and Redux - Book by Alex Banks and Eve Porcello
7) Learn React with Typescript 3 by Carl Rippon

Some Useful Links

- https://docs.angularjs.org/tutorial
- https://blog.codewithdan.com/author/dwahlin/
- https://www.youtube.com/user/dwahlin/featured
- https://reactjs.org/docs/getting-started.html
- https://getbootstrap.com/docs/4.3/getting-started/introduction/
- https://css-tricks.com/snippets/css/media-queries-for-standard-devices/
- https://jsfiddle.net/
- https://www.html5rocks.com/en/tutorials/developertools/part1/

Course Code : 23CsCmpP313

Course Name: Machine Learning and Deep Learning

Teaching Scheme: TH: 4 Hours/Week **Credit : 04**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisites:

- Knowledge of DBMS and Data mining
- Basic knowledge of Python programming language
- Knowledge of Mathematical Concepts like Probability, Linear Algebra and Statistics Multivariate Calculus

Course objectives:

- To Understand human learning aspects
- To understand concepts,techniques of machine learning and deep learning
- To apply machine learning,deep learning techniques for problem-solving
- To use tools and techniques for understanding the concept of machine learning and deep learning

Course outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	• Define key concepts in machine learning • List various machine learning algorithms • Identify trends in machine learning	**1**
CO 2	• Explain the differences between supervised and unsupervised learning. • Summarize how key algorithms like linear regression and classification models work. • Classify different types of machine learning problems (classification, regression, clustering). • Understand the model of deep learning and Neural Network, • Explain the architecture and functioning of neural networks like Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs).	**2**

CO 3	• Apply machine learning algorithms to real-world datasets using Python and libraries like Scikit-learn. • Use cross-validation and regularization techniques to improve model performance.	**3**
CO 4	• Analyze the performance of machine learning models using evaluation metrics like precision, recall, and F1 score. • Compare the performance of different algorithms	**4**
CO 5	• Evaluate the effectiveness of various models in solving real-world problems by comparing their accuracy and computational efficiency.	**5**
CO 6	• Design and build end-to-end machine learning pipelines, from data preprocessing to model selection and evaluation. • Design and implement Convolution Neural Networks (CNN) and RNN	**6**

Course Contents

Unit 1	**Introduction to Machine Learning**	**12 Lectures**
	1.1 What is Machine learning? 1.2 When to use ML? 1.3 Why to study ML? 1.4 Applications of machine learning 1.5 Types of learning - Supervised learning, Unsupervised learning, Semi-supervised learning 1.6 Dimensionality reduction- Introduction to dimensionality reduction, Subset selection, Principal Component Analysis(PCA) 1.7 Designing learning system- Steps in developing learning system, Data preprocessing, Missing data, categorical data, feature scaling, training set vs. test set, Data Modeling phases 1.8 Case studies	
Unit 2	**Supervised Learning**	**12 Lectures**
	2.1 Supervised learning 2.2 Learning with Classification - Decision Tree, Support Vector Machine, Naive Bayes, K-Nearest Neighbors, Logistic regression 2.3 Learning with Regression - Simple Linear regression, Multiple linear Regression	

	2.4 Evaluating model performance - Confusion matrix, Accuracy, Precision, Recall, Cross Validation and Comparison 2.5 Case studies	
Unit 3	**Unsupervised Learning**	**8 Lectures**
	3.1 Un-supervised learning 3.2 Clustering algorithms - K-means clustering, Hierarchical clustering 3.3 Rule based learning - Association rule mining, Apriori, FP growth algorithms, Support and Confidence parameters and Comparison 3.4 Case studies	
Unit 4	**Learning with Neural Network**	**10 Lectures**
	4.1 Limitations of Machine Learning 4.2 What is Deep learning? 4.3 Artificial Neural network - Neurons, Activation function, A Multilayer Feed-Forward Neural Network, Defining network topology, Back propagation algorithm 4.4 Convolutional Neural Networks (CNNs) : Convolutional Layers and Filters ,Pooling Layers: Max Pooling, Average Pooling 4.5 Recurrent Neural Networks(RNN): Basics of Recurrent Neural Networks ,Long Short-Term Memory (LSTM) Networks,Gated Recurrent Unit (GRU) Networks 4.5 Case studies	
Unit 5	**Trends in Machine Learning**	**6 Lectures**
	5.1 Introduction to Natural Language Processing(NLP) 5.2. Reinforcement learning - Elements of Reinforcement learning, Exploration, Exploitation, Rewards, Penalties 5.3 Ensemble methods - Bagging, Boosting	

Reference Books:

1) T. Mitchell, Machine Learning, McGraw-Hill, 1997
2) P. Langley. "Elements of Machine Learning" Morgan Kaufmann Publishers, Inc. 1996
3) EthemAlpaydin "Introduction to machine learning", MIT Press
4) William W. Hsieh, "Machine Learning Mehods in the Environmental Sciences", Cambridge
5) Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers
6) Margaret. H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

Text Books:

1) Peter Harrington “Machine Learning In Action”, DreamTech Press
2) Stephen Marsland, “Machine Learning An Algorithmic Perspective” CRC Press

Course Code :23CsCmpP314

Course Name : Lab Course on 23CsCmpP311 & 23CsCmpP312

Teaching Scheme: 4/2 Hours/Week **Credits: 2**

Examination Scheme: CIA :25 Marks **End-Sem : 25 Marks**

Cloud Computing Lab Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify various popular Cloud Service Providers(CSP) ,list and understand various services provided by these CSPs	**1**
CO 2	Demonstrate Infrastructure as a Service, Software as a Service, Platform as a Service	**2**
CO3	Implementation of Storage as a Service and IAM (Identity and Access Management)	**3**
CO 4	Examine VPC(Virtual Private Cloud)	**4**
CO 5	Determine installation and configuration of cloud Hadoop and demonstrate simple query	**5**
CO 6	Discuss and test the various services of Cloud Service Providers	**6**

Sub:- Cloud Computing	
Sr. No.	**Topic of Practical Assignment**
1.	Working and Implementation of Infrastructure as a service
2.	Working and Implementation of Software as a service.
3.	Working and Implementation of Platform as a services.
4.	Practical Implementation of Storage as a Service
5.	Working of Google drive to make spreadsheet and notes
6.	Working and Implementation of identity management
7.	Write a program for web feed.
8.	Implementation of Private cloud using Eucalyptus or Open stake ,Working with KVM to create VM - Installation and configuration of Private cloud - Bundling and uploading images on a cloud Creating web based UI to launch VM - Working with Volumes – Attached to the VM
9.	Installation and configuration of cloud Hadoop and demonstrate simple query
10.	Create a sample mobile application using Amazon Web Service (AWS) account as a cloud service. Also provide database connectivity with implemented mobile application.

UI/UX Lab Course Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify developer tools, and techniques for designing web pages, and Allow users to meet their needs in the most effective, efficient, and satisfying manner that meet their needs	**1**
CO 2	Illustrate Responsive Web Design	**2**
CO 3	Construct web pages using TypeScript, Bootstrap	**3**
CO 4	Examinepractical methods for approaching a web page *design* using Node,Angular,MEAN ,React,Redux	**4**
CO 5	Determine testing methods and tools	**5**
CO 6	Implementation of various web applications	**6**

Sub:- UI/UX(User Interface/User Experience)	
Sr. No.	**Topic of Practical Assignment**
1.	Design and create responsive wireframes using pen, paper for login page and registration page. Responsive means 3 views - Desktop view , Tablet view, Mobile view. After getting it reviewed from concerned professor, create it using an open source designing tool like draw.io
2.	Create an HTML page to display a slider using JS and CSS. Add minimum 5 images. Open Developer tools, note down the CSS, JS and Image Resources Sizes. Also note the page load time. Then apply magnification on css, jS. Check if the JS can be deferred. Optimize images using open source online tool like tinypng.com
3.	Implement the login and registration page designed in 1st practical using Bootstrap (i.e. Keep it responsive)
4.	Typescript - Create a calculator using typescript.

5.	Node : Create a simple web server exposing a REST-based web service that returns the count of each character in an input alphanumeric string. OR Node: Create a shopping cart using Node js, Angular and MongoDB.
6.	Angular - Create a news feed / blog feed using angular that'll display latest posts on the top followed by next, a date wise index of the news and their links.
7.	MEAN - Extend the above example to add/edit/remove the blog posts, store the data along with their relevant resources like images/audio/video in database (mongo/mysql)
8.	React - Create a Netflix like UI using react to display different list of movies, series, trending, recommended. (Use static data / json)
9.	Redux - Extend the code done in example 8 to incorporate a module, that'll allow an admin to add / remove / edit the movies, shows (Dynamic Data/Data manipulation)
10.	Unit Testing - Create unit test for all the above practical examples as mentioned, 1. React-Redux using Jest, Enzyme. 2. Angular using Jasmine, Karma 3. Typescript using Jasmine, Mocha

Code : 23CsCmpP321

Course Name : Block chain Technology

Teaching Scheme: TH: 4Hours/Week **Credit: 04**

Examination Scheme: CIA :25 Marks **End-Sem : 25 Marks**

Prerequisites:

- Expertise in programming,
- basic knowledge of computer security,
- cryptography, networking, concurrent or parallel programming

Course Objectives:

- To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
- To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.
- To provide a critical evaluation of existing "'smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify the importance of Blockchain technology	**3**
CO 2	Interpret the fundamentals and basic concepts in Blockchain	**5**
CO 3	What are the requirements of the basic design of blockchain	**1**
CO 4	Compare the working of different blockchain platforms	**4**
CO 5	Summarize the different technologies and latest trends in Blockchain	**2**
CO 6	Discuss the importance of blockchain in finding the solution to the real-world problems	**6**

Course Contents:

Unit 1	**Introduction to Blockchain**	4 lectures
	1.1. What is Block chain, 1.2. Block chain Technology Mechanisms & Networks, 1.3. Block chain Origins, 1.4. Objective of Block chain, 1.5. Block chain Challenges, 1.6. Transactions And Blocks	
Unit 2	**Block chain Basics**	4 lectures
	2.1. Types of Network 2.2. Layered Architecture of Blockchain Ecosystem 2.3. Components of blockchain 2.4. Cryptography (private and public keys, Hashing & Digital Signature) 2.5. Consensus Mechanisms	
Unit 3	**How Blockchain Works?**	6 lectures
	3.1. Understanding SHA256 Hash 3.2. Immutable Ledger 3.3. Distributed P2P Network 3.4. How Mining Works? (The NONCE and Cryptographic Puzzle) 3.5. Byzantine Fault Tolerance 3.6. Consensus Protocols: Proof of Work, Proof of State, Défense Against Attackers, Competing Chains 3.7. Blockchain Demo	
Unit 4	**Cryptocurrency Intuition**	8 lectures
	4.1. What is Bitcoin? 4.2. Layers of Cryptocurrency 4.3. Bitcoin's Monetary Policy 4.4. Blockchain Frequency 4.5. Understanding Mining Difficulty 4.6. Mining Pools 4.7. Nonce Range 4.8. How miners pick transactions 4.9. Where do transaction fees come from? 4.10. How Wallet Work? 4.11. Cryptocurrency Demo	
Unit 5	**Smart Contracts**	4 lectures
	5.1. Ethereum Network 5.2. What is a Smart Contract? 5.3. Ethereum Virtual Machine, Ether, Gas 5.4. Initial Coin Offerings 5.5. Demo of Smart Contracts	
Unit 6	**Block chain Applications**	2 lectures

	6.1. Block chain for Government: 6.2. Digital identity, 6.3. land records and other kinds of record keeping between government entities, 6.4. public distribution system / social welfare systems: 6.5. Block chain Cryptography: Privacy and Security on Block chain.	
Unit 7	**Experiencial Lerning**	2 lectures
	Demo on Blockchain, Smart Contracts,	

Reference Books:

1. Wattenhofer, The Science of the Blockchain
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
5. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

Course Code : **23CsCmpP322**

Course Name :Big Data Analytics

Teaching Scheme: 4Hours/Week Credits: 04

Examination Scheme: CIA: 50 Marks **End-Sem : 50 Marks**

Prerequisites:

- Basic Concepts of Database Management System and Structured Query Language

Course Objectives:

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Identify Big Data and its business implications,,fundamentals of Big Data, its types, and the evolution of Hadoop and its ecosystem.	1
CO 2	Demonstrate data analysis using Hadoop tools, Unix commands, BigSheets, and BigInsights	2
CO 3	Describe the architecture, design, and operations of the Hadoop Distributed File System (HDFS) and its data flow mechanisms.	3
CO 4	Analyse tools such as Flume and Sqoop for data ingestion and perform compression, serialization, and data structuring in Hadoop	4
CO 5	Analyze and manage MapReduce job execution, scheduling, failure handling, and performance tuning.	5
CO 6	Compare and implement solutions using components of the Hadoop ecosystem such as Pig, Hive, HBase, and Big SQL for data processing and querying.	6

Unit 1	**INTRODUCTION TO BIG DATA AND HADOOP**	**12 Lectures**
	1.1Types of Digital Data 1.2 Introduction to Big Data, 1.3Big Data Analytics 1.4 History of Hadoop, Apache Hadoop 1.5Analysing Data with Unix tools, 1.6 Analysing Data with Hadoop, 1.7Hadoop Streaming, 1.8Hadoop Echo System, 1.9IBM Big Data Strategy, 1.10 Introduction to InfosphereBigInsights and BigSheets	
Unit 2	**HDFS(Hadoop Distributed File System)**	**10 Lectures**
	2.1 The Design of HDFS 2.2 HDFS Concepts 2.3 Command Line Interface 2.4Hadoop file system interfaces 2.5 Data flow 2.6Data Ingest with Flume and Scoop and Hadoop archives 2.7Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures	
Unit 3	**Map Reduce**	**10 Lectures**
	3.1Anatomy of a Map Reduce Job Run 3.2 Failures, Job Scheduling 3.3 Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features	
Unit 4	**Hadoop Eco System**	**15 Lectures**
	4.1 Pig :Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. 4.2 Hive :Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. 4.3 Hbase :HBasics, Concepts, Clients, Example,Hbase Versus RDBMS 4.4 Big SQL : Introduction	
Unit 5	**Experiential learning**	**1 Lectures**
	5.1 Use of Bit search CV	

Reference Books:

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics Wiley 2015.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics",
8. John Wiley Glen J. Myat, "Making Sense of Data
9. Pete Warden, "Big Data Glossary", O'Reily, 2011.
10.MichaelMineli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today
11.ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
12. Paul Zikopoulos ,DirkDeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan Harness the Power of Big Data The IBM Big Data Platform Tata McGraw Hill Publications, 2012.

Course Code: 23CsCmpP304

Course Name: Research Project- I

Teaching Scheme: 8 Hours/Week Credits: 04

Examination Scheme: CIA: 50 Marks **End-Sem :50 Marks**

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall and describe fundamental concepts of research methodology, including types of research and ethical considerations.	1
CO 2	Explain the significance of a well-defined research problem and interpret relevant literature in the chosen domain.	2
CO 3	Apply appropriate research methods and tools to develop a detailed research proposal.	3
CO 4	Analyze existing research works to identify gaps and justify the research objectives.	4
CO 5	Critically evaluate the feasibility and potential impact of the proposed research approach.	5
CO 6	Formulate a comprehensive research proposal including objectives, methodology, and expected outcomes.	6

Semester –IV

Course Code :23CsCmpP411

Course Name : Industrial Training / Institutional Project

Teaching Scheme: Full Time Training in Industry/Institution

Teaching Scheme: TH: 6 Hours/Week **Credits : 16**

Examination Scheme: CIA:200 Marks **End-Sem : 200 Marks**

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall key concepts, tools, and processes used in the industrial environment relevant to computer science.	1
CO 2	Explain the working of real-world systems, workflows, and technologies observed during the training.	2
CO 3	Apply theoretical knowledge and technical skills to perform assigned tasks during the training.	3
CO 4	Analyze problems encountered in the industrial setting and identify possible solutions or improvements.	4
CO 5	Evaluate the effectiveness of the implemented solutions or processes in the context of industry standards and best practices.	5
CO 6	Document and present a comprehensive project report detailing the training experience, tasks performed, challenges faced, and solutions developed.	6

Guidelines for Continuous Internal Assessment (CIA) of Industrial Training / Institutional Project (ITP/IP) of 150 Marks :

1) Students will participate in the Placement activity conducted by the Department.
2) Upon selection in IT company, the student will submit the photocopy of the Offer letter/ Appointment letter, Joining letter and Identity card .
3) The student will have to submit a Synopsis of the Project work to the department within a period on month from the date of joining.
4) Internal Project Guide will be allotted to each student.

5) Students should interact to internal project guide by means of personal counseling through Whatsapp, E-mail and so on once in a week to discuss about the Project Progress.
6) These presentations / project discussions, communication and interaction will be considered towards CIA.
7) After the completion of the ITP/IP, a student will have to submit the final Project documentation along with the Project completion certificate from the respective Industry/Research Institute /Educational Institute.
8) Project documentation also needs to be submitted in the form of soft copy.
9) A student can complete ITP/IP with a research project of a Faculty / an Expert funded by SavitribaiPhule Pune University, Pune / Modern College of Arts, Science and Commerce(Autonomous), Pune-5/ any Funding Agency.
10) Evaluation for Internal 150 Marks(CIA) will be done by respective internal guide according to the student's performance and details in the Project Progress Report as follows:

Project Discussion (Per Week)	Project Progress (Per Week)	First Presentation / Project Demonstration	Second Presentation & Project Demonstration	Documentation
20	10	40	40	40

Guidelines for End Semester Final Assessment(ESE) of
Industrial Training Project(ITP) / Institutional Project(IP) of 200 Marks:

1) Student will make a presentation of Project work which should include all the details (permitted by Company) of work done by the student during training period.
2) Evaluation for external 150 Marks(ES) will be done by Industrial Expert, Academic Expert and one Internal Examiner depending on Presentation, Documentation, Project Contents, Project Demonstration, Testing etc.
3) The project performance will be graded by the Examiners (One Internal Examiner, one External Examiner(Academic expert) and one Industrial Expert) as follows:

Total marks out of 400 :200 marks CIA + 200 marks ESE

Grades will be assigned as below:

Sr. No.	% of Max. Marks	Grade Point	Grade Letter
1	90<= Marks <= 100	10	O (Outstanding)
2	75 <= Marks <= 80	9	A+ (Excellent)
3	60 <= Marks <= 74	8	A (Very Good)
4	55 <= Marks <= 59	7	B+ (Good)
5	50 <= Marks <= 54	6	B (Above Average)
6	45 <= Marks <= 49	5	C (Average)
7	40 <= Marks <= 44	4	D (Pass)
8	Marks < 40	0	F (Fail)
9	Nil	0	Ab (absent)

IT Project Synopsis Format

Synopsis

Name of the Student: _____

Class: _____ Roll No : _____ Seat No :_____

Company Name: _____

Company's Address:

_____

Company's Contact Number: _____

Name of Contact person with Designation:

_____

Project Title:

_____

Project Category:

_____

_____

_____

Functional Details:

_____

_____

_____

Your Responsibilities:

_____

_____

Any additional Assistance expected from College:

_____

Company Project Guide

Name:_____

Student's Signature

Date: _____

Place: _____

Receiver's Signature

Date: _____

Place: _____

Sample Index of Industrial Training Project Report

- Company Certificate
- College Certificate
- Industrial Training Schedule/ Calendar
- Problem Definition
- Existing System
- Need for Computerization
- Scope of the Proposed System
- Objectives of the Proposed System
- Requirements Gathering and Anticipation
- Platform (H/W, S/W) with version details
- Analysis Specification (Object Oriented Approach)
- Design Specification (Object Oriented Approach)
- Data Dictionary , Flow diagram(Whichever is applicable)
- Implementation Strategies
- Input /Output Screens
- Decision Tools(If any)
- Testing Strategies
- Limitations and Drawbacks
- Conclusion
- Future Enhancements
- User Manual
- References & Bibliography

Course Code : 23CsCmpP404

Course Name :Research Project II

Teaching Scheme: 12 Hours/Week Credits: 06

Examination Scheme: CIA: 75Marks **End-Sem :75 Marks**

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall and document all research procedures, tools, and technologies applied during the project implementation.	1
CO 2	Interpret and explain the research results, findings, and their implications in the context of the problem domain.	2
CO 3	Implement algorithms, models, or systems based on the research design using appropriate programming languages and tools.	3
CO 4	Analyze experimental data or simulation outputs and assess system performance.	4
CO 5	Critically evaluate the effectiveness, limitations, and potential improvements of the implemented solution.	5
CO 6	Compile a comprehensive report detailing the research methodology, implementation, results; present and defend the work professionally.	6