

Progressive Education Society's
Modern College of Arts, Science and Commerce

(Autonomous),

Shivajinagar, Pune - 5

**(An Autonomous College Affiliated to
Savitribai Phule Pune University, Pune: 7)**

Framework and

Syllabus of

M.Sc. (Computer Application)

(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	Hou rs / W ee k	Cre dit	CI A	ES E	Tot al
Major Mandatory (4 + 4+4+2)	23CsCmaP1101	Major Paper 1 (Theory)	Paper1: Design and Analysis of Algorithms	4	4	50	50	100
	23CsCmaP1102	Major Paper 2 (Theory)	Paper2: .NET	4	4	50	50	100
	23CsCmaP1103	Major Paper 3 (Theory)	Paper3: Web Programming - I	4	4	50	50	100
	23CsCmaP1104	Major Paper 4 (Practical/Theory)	Lab on .NET and Web Programming-I	4	2	25	25	50
Major Electives (4)	23CsCmaP1201	Major Elective 1 (T/P)	Paper1: Software Development Engineering in Testing	4	4	50	50	100
	23CsCmaP1202	Major Elective 2 (T/P)	Paper2: Advanced Database Concepts	4	4	50	50	100
RM (4)	23CsCmaP131	RM Paper 1	Section I: Research Methodology	2	4	50	50	100
		RM Paper 2	Section II: Artificial Intelligence	2				
OJT(4),	23CsCmaP1004	—	—	—	—	—	—	—
Total				24	22	275	275	550

Semester 2 (First Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	E S E	Total
Major Mandatory (4 + 4+4+2)	23CsCmaP211	Major Paper 1 (Theory)	Paper1: Advanced Operating System	4	4	50	50	100
	23CsCmaP212	Major Paper 2 (Theory)	Paper2: Information System Security	4	4	50	50	100
	23CsCmaP213	Major Paper 3 (Theory)	Paper3: Web Programming-II	4	4	50	50	100
	23CsCmaP214	Major Paper 4 (Practical/Theory)	Lab on AOS and Web Programming-II	4	2	25	25	50
Major Electives (4)	23CsCmaP221	Major Elective 1 (T/P)	Paper1: Soft Computing	4	4	50	50	100
	23CsCmaP222	Major Elective 2 (T/P)	Paper2: Cloud and Grid Computing	4	4	50	50	100
RM (4)		—	—	—	—	—	—	—
		—	—	—	—	—	—	—
OJT(4),	23CsCmaP204	OJT	On Job Training	8	4	50	50	100
Total				28	22	275	275	550

Please Note: On Job Training can be conducted in the form of Internship/Live Project

Semester 3 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hou rs / W ee k	Cre dit	CI A	E S E	Tot al
Major Mandator y (4 + 4+4+2)	23CsCmaP311	Major Paper 1 (Theory+Practical)	Paper 1:Mobile Technologies(T+P)	6	4	50	25T + 25 P	100
	23CsCmaP312	Major Paper 2 (Theory)	Data Mining and Data Warehousing	4	4	50	50	100
	23CsCmaP313	Major Paper 3 (Theory)	Block Chain Technology	4	4	50	50	100
	23CsCmaP314	Major Paper 4 (Practical)	Programming Language (Python)	4	2	25	25	50
Major Electives (4)	23CsCmaP321	Major Elective 1 (Theory + Practical)	Data Science	6	4	50	50	100
	23CsCmaP322	Major Elective 2 (Theory)	User Experience and Design	4				
RP (4)	23CsCmaP304	RP	Research Project I	8	4	50	50	100
OJT(4)								
Total				34	22	275	275	550

Semester 4 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	E S E	Total
Major Mandatory	23CsCmaP411	Major Project 1	Industrial Training	2	16	200	200	400
RP (4)	23CsCmaP404	RP	Research Project II	12	6	75	75	150
Total				22	22	275	275	550

OE : Open Elective

AEC: Ability Enhancement Course

VEC: value Education Courses

CC : Co-Curricular Courses

IKS : Indian Knowledge System

OJT : On Job Training

FP : Field Project

VSC : Vocational Skill Courses

CEP : Community Engagement Project

Semester —I

(First Year)

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP111

Course Name : Design and Analysis of Algorithms

Teaching Scheme: TH:4 Hours/Week

Credits :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 select the appropriate algorithm by doing necessary analysis of algorithms
- To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation as well as different design strategies

Course Outcomes:

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

- Analyze the problem and develop the algorithm
- Classify the problem and apply the appropriate design strategy to develop algorithm
- Design algorithm in context of space and time complexity and apply asymptotic notation

Course Contents:

Unit No.	Title	Number of Lectures
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Unit 1	Basics of Algorithms	8
	1.1 Algorithm definition and characteristics 1.2 Space complexity 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
	2.1 General method, control abstraction 2.2 Binary search 2.3 Merge sort, Quick sort 2.4 Comparison between Traditional method of Matrix Multiplication vs. Strassen's Matrix Multiplication	
Unit 3	Greedy Method	10
	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 3.8 Shortest Path: Dijkstra's algorithm	
Unit 4	Dynamic Programming	7
	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
	5.1 Definition of Graph 5.2 Representation of Graph By - DFS and BFS 5.3 Topological sorting 5.4 Connected components and spanning trees 5.5 By Variable Size decrease Euclid's algorithm 5.6 Flow in graph 5.7 Articulation Point and Bridge edge	
Unit 6	Backtracking	5
	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
	7.1 Introduction 7.2 Definitions of LCBB Search 7.3 Bounding Function, Ranking Function 7.4 FIFO BB Search 7.5 Traveling Salesperson problem Using Variable tuple 7.6 Formulation using LCBB 7.7 0/1 knapsack problem using LCBB	

Unit 8	Problem Classification	3
	8.1 Nondeterministic algorithm 8.2 The class of P, NP, NP-hard and NP-Complete problems 8.3 Cook's theorem	
Unit 9	Experiential Learning	1
	9.1 Search n number of cities on Google map and find shortest route 9.2 Consider any stable algorithms which are currently in use and find out space Complexity, Time Complexity and control abstraction	

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran. 2007. Computer Algorithms (2nd. ed.). Silicon Press, USA, ISBN-13: 978-8173716126
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press, Cambridge, Massachusetts London, England, McGraw-Hill Book Company Boston Burr Ridge, WI New York San Francisco St. Louis Montréal Toronto, ISBN-13: 978-0262033848
3. A. Aho, J. Hopcroft & J. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley, 1974, ISBN-13: 978-0201000290
4. Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81, Addison Wesley, ISBN-13: 978-0134397603
5. Steven Skiena, The Algorithm Manual, Springer, ISBN:13-978-8184898651
6. Dieter Jungnickel, Graphs, Networks and Algorithms, Springer, ISBN:13: 978-3540219056

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP112

Course Name : .NET

Teaching Scheme: TH: 4 Hours/Week
Examination Scheme: CIA : 50 Marks

Credit : 04
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 Outcome:

- Students able to learn C# fundamentals
- Students develop web-sites using .NET framework

Course Contents

Unit No.	Title	Number of Lectures
Unit 1	DOTNET Framework	2
	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
	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 Generics 2.4 Generics 2.4.1 Using generics 2.4.2 Defining Generics, generic Interfaces, Generic methods, Generic Delegate	
Unit 3	Window Programming	5
	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
	4.1 File System Data 4.2 XML 4.3 Databases and ADO.NET 4.4 Data Binding	
Unit 5	Web Programming	2

	5.1 Basic Web programming 5.2 Advanced Web programming 5.3 Web Services 5.4 Deployment Web applications	
Unit 6	.NET Assemblies	4
	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
	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
	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
	9.1 About ASP.NET 9.2 Environment 9.3 Life cycle	
Unit 10	Server Controls and Variables, control Structures & Functions	2
	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, Data collections 10.5 Overview of Control structures 10.6 Functions : web controls as parameters	
Unit 11	Even Driven Programming and Post Back	2
	11.1 HTML events 11.2 ASP.NET page events 11.3 ASP.NET Web control events 11.4 Event driven programming and post back	
Unit 12	Reading from Databases	5
	12.1 Data pages 12.2 ADO.NET	

Unit 13	ASP.NET Server Controls	7
	13.1 ASP.NET Web Controls 13.2 HTML Server Controls 13.3 Web Controls	
Unit 14	DOTNET assemblies and Custom Controls	2
	14.1 Introduction to Cookies, Sessions 14.2 Session events 14.3 State management Recommendations	
Unit 15	Web Services	2
	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
	16.1 Review performance statistics of websites developed in .net	

References :

1. Beginning Visual C#, Wrox Publication, ISBN13: **978-0764543821**
2. Professional Visual C#, Wrox Publication, ISBN13: **978-8126548538**
3. Inside C#, by Tom Archer, Microsoft Press © 2001, ISBN: 0735612889
4. Beginning ASP.NET 3.5, Wrox Publication, ISBN13: **978-0470187593**
5. Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly, ISBN: 9780596529567

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code :23CsCmaP113
Course Name : Web Programming-I

Teaching Scheme: 4 Lectures/Week

Credits: 4

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Desirable Prerequisites:

- Basic knowledge in HTML
- Tags & skill of creating web pages should be known

Course Objectives:

- Visualize the basic concept of HTML,XML
- Introduce concept of CSS

Course Outcomes:

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

- Implement interactive webpage(s) using HTML,CSS,XML
- Design a responsive website using HTML5 and above,CSS3 and above and XML

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Introduction to Web Technologies	6
	1.1 Introduction to Web Technologies 1.2 How the Website Works? 1.3 Software to create your website 1.4 What makes a good website?	
	1.5 Client-Server and its Communication 1.6 Client and Server Scripting Languages 1.7 Internet-Basic, Internet 1.8 Protocols(HTTP,FTP,IP) 1.9 World Wide Web(WWW). 1.10 HTTP request message, HTTP response message 1.11 Types of Websites (Static and Dynamic Websites)	
Unit 2	Introduction to HTML	10
	2.1 Introduction to HTML 2.2 HTML tags and attributes 2.3 Working with Elements 2.4 Inserting Image 2.5 Client Server image mapping 2.6 List 2.7 Tables 2.8 Text and Image links 2.9 Frames 2.10 Forms and controls 2.11 Introduction with textbox, textarea, buttons, Listbox, radio, checkbox etc	
Unit 3	CSS	6

	3.1 Introduction to Style Sheet 3.2 Introduction to Responsive Website 3.3 Types of CSS 3.4 CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display, properties 3.5 Use of Id & classes in CSS 3.6 Use of <div> & 3.7 Introduction of CSS3: Gradients, Transitions , Animations, multiple columns 3.8 Introduction of Bootstrap	
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Unit 4	JAVASCRIPT	9
	4. 1 Concept of script, Types of Scripts, Introduction to JavaScript 4.2 Variables, identifier & operator, control structure 4.3 Examples on JavaScript operators 4.4 Functions 4.5 Event Handling in JavaScript 4.6 Concept of array, how to use it in JavaScript, Types of an array, examples 4.7 Event handling in JavaScript with examples 4.8 Math and date object and examples 4.9 String object and examples on it, and some predefined functions 4.10 DOM concept in Java Script, DOM objects 4.11 Validations in JavaScript with examples	
Unit 5	jQuery	5
	5.1 jQuery basics 5.2 jQuery selectors 5.3 jQuery effects 5.4 jQuery - DOM Manipulation 5.5 jQuery - CSS Manipulation 5.6 jQuery Events	
Unit 6	XML	10
	6.1 Introduction to XML 6.2 Uses of XML 6.3 Simple XML, 6.4 XML key components 6.5 DTD and Schemas, 6.6 Using XML with web applications. 6.7 Introduction to XSL, XSL elements, transforming with XSLT	
Unit 7	EXPERIENTIAL LEARNING	1

Reference Books:

1. Steven Holzner, "HTML Black Book", Dreamtech Press, ISBN-13: 978-8177220865
2. Web Technologies, Black Book, Dreamtech Press, ISBN-13: 978-8177229974
3. Complete HTML -
Thomas Powell, fifth edition, McGraw Hill publication, ISBN: 9780070701946
4. HTML and JavaScript -
Ivan Bayross, fourth edition, BPB publication, ISBN: 978818330084
5. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India, ISBN-13: 978-8126508037
6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
7. Thinking in HTML eBook by Aravind Shenoy

Reference Links:

1. <https://www.tutorialspoint.com/>
2. <https://www.w3schools.com/>
3. <https://www.javatpoint.com/jquery-tutorial/>

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP114

Course Name : Lab on .NET and Web Programming-I

Teaching Scheme: Practical: 2+2 = 4 Hours/Week

Credit : 02

Examination Scheme: CIA : 25 Marks

End-Sem : 25 Marks

Assignments on Web Programming-I

Sub: Web Programming:I (HTML, CSS, JavaScript, XML)	
Sr. No.	Title of the Assignment
1.	HTML tags
2.	Frames, Elements of Forms
3.	CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display properties
4.	CSS3 Gradients, Transitions, Animations, multiple columns
5.	Simple function in JavaScript
6.	Array in JavaScript
7.	Validations in JavaScript
8.	Simple XML
9.	Using DTD and Schemas in XML
10.	Using XML with web applications.

Sub: Assignments on .NET	
Sr. No	Title of the Assignment
1.	Array(one dimension, Two dimension, Jagged Array)
2.	Function
3.	OOP's concepts
4.	Properties
5.	Indexers
6.	Parameter Modifiers
7.	Exception Handling
8.	Collection classes
9.	Generic
10.	Window Application(ADO.NET)
11.	Web Application(ADO.NET)
12.	Web Services

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First Year of M.Sc. (Computer Application) (2019 Course)
Course Code : 23CsCmaP121
Course Name : Software Development Engineering in Testing

Teaching Scheme: TH:4Hours/Week

Credits : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Pre-requisites : Knowledge of Software Engineering

Objectives :

- Understanding software development life cycle
- Understanding Security testing

Course outcome :

On completion of the course, students will be able to

- Learn the different types of testing tools
- Apply the tools to write test cases and use different testing tools

Course Contents:

Unit	Title	Number of Lectures
Unit 1	SDLC	4
	1.1 What is Software development life cycle(SDLC)? 1.2 Phases of SDLC 1.3 Models of SDLC-Waterfall, Agile and Agile	

	Scrum 1.4 What is the difference between Waterfall and Agile? 1.5 Advantages of using Agile Over Waterfall 1.6 Agile Scrum and Lean Model 1.7 User story, Story Points, Product backlog, Sprint backlog, Roles and responsibility of a scrum master and Product owner 1.8 Meetings conducted in Agile Scrum	
Unit 2	Types of Testing	10
	2.1 Static Testing/ Dynamic Testing 2.2 Regression/ Retesting 2.3 Usability/ accessibility 2.4 Smoke / Sanity testing 2.5 Unit Testing/ Integration Testing/ System Testing 2.6 UAT – Alpha Testing /Beta Testing 2.7 White Box/Black box testing 2.8 Functional/Non-functional Testing 2.9 Performance Testing 2.10 Load Testing 2.11 Stress Testing 2.12 Penetration Testing 2.13 Cross platform / Cross device testing	
Unit 3	STLC (Software Testing Life Cycle)	5
	3.1 Test Planning 3.2 Test Plan 3.3 What is a test Plan 3.4 Who creates a Test Plan 3.5 When is the Test Plan created 3.6 Purpose of creating a Test Plan 3.7 Components of a Test plan. 3.8 Test design 3.9 Test implementation and Execution	

	3.10 Defect Reporting and tracking 3.11 Defect life cycle 3.12 Test closures 3.13 Test metrics	
Unit 4	Automation Testing – Basics	6
	4.1 Introduction to Automation Testing 4.2 What is Automation testing 4.3 Benefits of Automation Testing 4.4 Tool selection criteria	
Unit 5	Security Testing	6
	5.1 The Basis of Security Testing 5.2 Security Risks 5.3 Information Security Policies and Procedures 5.4 Security Auditing and Its Role in Security Testing	
Unit 6	Automation Testing with Testing Tools - Advanced	10
	6.1 Fundamentals of Selenium, overview, presentation, export features, installation, Selenium IDE and web driver 6.2 Test application with Selenium IDE, RC VS web driver, how to create test drive with web drive 6.3 Install Selenium IDE and Firebug 6.4 Selenium IDE Script, Locators in Selenium IDE 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
	7.1 Service Oriented Architecture (SOA), who uses SOA 7.2 Web Services, Why Web Services are Being Used? What is WSDL? , Web Service Standards, tools to test 7.3 Web services, how to test web services, why to test web services 7.4 Understanding WSDL, how is it used, specifications,	

	document, and file, Retrieving and Viewing/ Inspecting WSDL file 7.5 SOAP, SoapUI tool, download and installation RESTFul Service	
Unit 8	Experiential learning	1
	8.1 Compare performance characteristics of different testing tools	

Reference Books:

- 1) Lessons Learned in Software Testing: By Cem Kaner , James Bach, Bret Pettichord,
ISBN 9781283294928
- 2) Software Testing by Ron Patton, Lisa Crispin, Janet Gregory: Agile Testing : A
Practical Guide for Testers and Agile Teams, **ISBN:** 9788131730683

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP122

Course Name : Advanced Database Concepts

Teaching Scheme: 4 Lectures/Week

Credits: 4

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:

On completion of the course, student will be able to

- Design and implement full-fledged real life applications integrated with database systems.
- Apply security controls to avoid any type of security incidents on vital database systems.
- Design advanced data systems using Object based systems or Distributing databases for better resource management.

Course Contents

Unit No.	Title	Number of Lectures
Unit 1	Introduction to Advanced Databases	3
	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
	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
	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

	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 Databases	9
	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
	6.1 Introduction 6.2 Four V's of Big data 6.3 NoSQL Databases 6.4 Examples of NoSQL DB 6.5 Advantages 6.6 NoSQL Vs SQL	
Unit 7	NoSQL (Any one from MongoDB / CASSANDRA)	12
	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 7.10 CRUD 7.11 Indexes	
Unit 8	Experiential Learning	1
	8.1 Create same database using RDBMS and NoSQL 8.2 Do operations on these databases 8.3 Do comparative study of it.	

Reference books:

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

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code: 23CsCmaP122
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
- To inculcate logical 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:

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

1. Describe importance of research
2. Differentiate between unethical and ethical practices of publication ethics
3. Select research problem appropriately
4. Prepare good hypothesis
5. Design research problem systematically
6. Analyze and organize data correctly
7. Prepare good scientific research report

Course Contents

Unit No.	Title	Number of Lectures
Unit 1	Research problem and design	15
	1.1 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 1.2 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 1.3 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	
Unit 2	Data analysis, report writing and publication ethics	15
	2.1 Data Analysis: 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 2.2 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 2.3 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 :

1. C. R. Kothari (2004) Research Methodology : Methods and Techniques 2nd Edition, New age International (p) Ltd Publications, New Delhi, India
2. J.W. Creswell and J.D. Creswell (2017) Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications, USA.
3. C. G. Thomas (2021) *Research Methodology and Scientific Writing*, 2nd Edition, Springer Nature, New York.
4. M. Kheider lectures from University of Biskra (2017) <https://univ-biskra.dz/sites/fll/images/houadjli%20Ahmed%20Chaouki.pdf>

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP122
Course Name : Artificial Intelligence (Departmental Specific Elective)

Section 2

Teaching Scheme: TH: 4 Hours/Week
Examination Scheme: CIA : 25 Marks

Credit : 02
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:

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

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalize a given problem in the language/framework of different AI methods.

Course Contents

Unit No.	Title	Number of Lectures
Unit 1	Introduction to AI	2
	1.1 Introduction to AI 1.2 History of AI 1.3 Course logistics	
Unit 2	Problem Solving	6
	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
	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
	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
	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
	6.1 Minimax, alpha-beta pruning 6.2 Overview of different forms of learning	
Unit 7	Experiential Learning	3
	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., 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

(First Year)

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP211

Course Name : Advanced Operating Systems

Teaching Scheme: 4 Lectures/Week

Credits: 4

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Prerequisites:

- Knowledge of Basic Operating System Concepts
- Knowledge of Computer Architecture

Course Objectives:

- To understand design issues related to process management
- To understand design issues related to memory management
- To understand design issues related to File management
- To study, learn and understand the main concepts of advanced operating systems
- To study Thread management
- Study of Synchronization, communication and scheduling in Parallel systems

Course Outcomes:

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

- Understand the concept of process and memory management
- Get the knowledge of process synchronization
- Identify and evaluate the storage management policies with respect to different storage management technologies
- Writing Shell scripts

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Introduction	6
	1.1 Definition 1.2 Types of Operating systems 1.3 System Boot 1.4 Services provided by OS 1.5 Introduction to UNIX OS 1.6 Architecture of UNIX 1.7 Basics of navigating UNIX environment 1.8 Introduction to UNIX file system 1.9 File system layout 1.10 Files and directory management 1.11 Processes and process management	
Unit 2	Process Management	4
	2.1 Process Concept – The process, Process states, Process control block 2.2 Process Scheduling – Scheduling queues, Schedulers, context switch System Calls: definition, implementation 2.3 Operations on Process – Process creation with program using fork(), Process termination	
Unit 3	CPU scheduling	6
	3.1 Basic Concept – CPU-I/O burst cycle, CPU scheduler, Pre-emptive scheduling, Dispatcher 3.2 Scheduling Criteria 3.3 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel	

	feedback queue scheduling	
Unit 4	Memory Management	8
	4.1 Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries 4.2 Swapping 4.3 Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation 4.4 Paging – Basic Method, Hardware support, Protection, Shared Pages 4.5 Segmentation – Basic concept, 4.6 Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, OPT, LRU, Second chance page replacement	
Unit 5	Deadlock	6
	5.1 System model 5.2 Deadlock Characterization – Necessary conditions, Resource allocation graph 5.3 Deadlock Prevention 5.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm 5.5 Deadlock Detection 5.6 Recovery from Deadlock – Process termination, Resource pre-emption	
Unit 6	File System	4
	6.1 File concept 6.2 Access Methods – Sequential, Direct, Other access methods 6.3 Directory and Disk Structure – Storage structure, Directory overview, Single level	

	directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory 6.4 Allocation Methods – Contiguous allocation, Linked allocation, Indexed allocation 6.5 Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps	
Unit 7	Introduction to Shell	10
	7.1 Types of shell 7.2 Working of Shell 7.3 Shell Commands 7.4 Permissions, users and groups 7.5 Using variables 7.6 Basic operators 7.7 Conditional statements 7.8 Loops 7.9 Command line arguments& IO redirection 7.10 Functions and file manipulations 7.11 Regular expressions and filters	
Unit 8	Inter process Communication	3
	8.1 Inter process Communication – Shared memory system, Message passing systems 8.2 Critical Section Problem 8.3 Semaphores: Usage, 8.4 Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem	
	EXPERIENTIAL LEARNING	1

Reference Books:

1. Operating System Concepts – Silberschatz, Galvin, Gagne, 9th edition, ISBN-13: 978-0470128725
2. The Design of the UNIX Operating System, PHI, by Maurice J. Bach, ISBN-13:978-8120305168
3. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens, ISBN-13:978-0321637734
4. Modern Operating Systems, Tanenbaum, IIIrd Edition, PHI, ISBN-13:978-0130313584
5. Linux Command Line & Shell Scripting, Richard Blum and Christine Brenham, 2nd edition, Wiley

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP212

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 cryptography

Course Outcomes:

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

- Develop knowledge and skills for career in Information Security

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
	4.1 Principles 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. Atul Kahate," Cryptography And Network Security" TMH, ISBN-10: 9781259029882
2. Nina Godbole, "Information Systems Security", Wiley, ISBN-13: 978-8126516926

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code :23CsCmaP213
Course Name : Web Programming -II

Teaching Scheme: 4 Lectures/Week

Credits: 4

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Desirable Prerequisites:

- Basic knowledge of HTML tags and skill of creating webpages

Course Objectives:

- Learn Core-PHP, Server Side Scripting Language
- Learn PHP-Database handling

Course Outcomes:

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

- To Design dynamic and interactive Webpages

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Introduction to Web Technologies	6
	1.1 HTTP basics, Introduction to Web server and Web browser 1.2 Introduction to PHP 1.3 What does PHP do? 1.4 Lexical structure 1.5 Language basics	
Unit 2	Function and String	4
	2.1 Defining and calling a function 2.2 Default parameters 2.3 Variable parameters, Missing parameters 2.4 Variable function, Anonymous function 2.5 Types of strings in PHP 2.6 Printing functions 2.7 Encoding and escaping 2.8 Comparing strings 2.9 Manipulating and searching strings 2.10 Regular expressions buttons, Listbox, radio, checkbox etc	
Unit 3	Arrays	8
	3.1 Indexed Vs Associative arrays 3.2 Identifying elements of an array 3.3 Storing data in arrays 3.4 Multidimensional arrays, Extracting multiple values 3.5 Conversion between arrays and variables 3.6 Traversing arrays 3.7 Sorting 3.8 Action on entire arrays 3.9 Using arrays	
Unit 4	Databases(PHP-PostgreSQL)	8

	4.1 Using PHP to access a database 4.2 Relational databases and SQL 4.3 PEARDB basics 4.4 Advanced data base techniques	
Unit 5	Handling email with PHP	8
	5.1 Email background 5.2 Internet mail protocol 5.3 Structure of an email message 5.4 Sending email with php 5.5 Email attachments.	

	5.6 Email id validation and verification 5.7 PHP error handling	
Unit 6	PHP framework	5
	6.1 Introduction to PHP framework. 6.2 Features, Applications. 6.3 Introduction to Laravel	
Unit 7	AJAX	8
	7.1 Introduction of AJAX 7.2 AJAX web application model 7.3 AJAX–PHP framework 7.4 Performing AJAX validation 7.5 Handling XML data using php and AJAX 7.6 Connecting database using php and AJAX	
Unit 8	EXPERIENTIAL LEARNING	1

References Books:

1. Programming PHP By Rasmus Lerdorf and Kevin Tatroe O'Reilly publication, ISBN-13:978-1449392772
2. Beginning PHP5, Wrox publication, ISBN-13:978-1565926103
3. PHP web services, Wrox publication, ISBN-10:9780470413968
4. AJAX Black Book, Kogent solutions Inc, ISBN-13:978-8177228380
5. Mastering PHP, BPB Publication,
6. PHP cook book, O'Reilly publication, ISBN-13:978-0596101015
7. Learning PHP and MYSQL, O'Reilly publication
8. PHP for Beginners, SPD publication
9. Programming the World Wide Web, Robert W Sebesta(3rd Edition)
10. Check out Joomla press Pearson(Addison-Wesley Professional)

Reference Links:

1. www.W3schools.com
2. www.wrox.com
3. <https://laravel.com>
4. <https://www.javatpoint.com/laravel>

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code :23CsCmaP214
Course Name : Lab on Advanced Operating
System and Web Programming(PHP)-II

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

Practical Assignment on PHP	
Sub: Web Programming: II	
Sr.No.	Topic of Assignment
1.	String manipulation
2.	Arrays
3.	Function
4.	Using object oriented concept
5.	File Handling
6.	Form designing
7.	Error handling in PHP
8.	Database Connectivity in PHP
9.	Sessions and cookies
10.	Simple AJAX
11.	AJAX validation
12.	Handling XML data using PHP and AJAX

Practical Assignments on Advanced Operating system	
Sub: Advanced Operating system	
Sr. No.	Topic of Assignment
1.	Introduction to Linux (Using basic commands like cat with options, ls with options, cal, pwd, wc, grep with options, i/o redirection using >, >>, <, etc)
2.	Creating a directory structure in Linux (Using commands mkdir, cd, rmdir, cp, mv etc.)
3.	An interactive program that accepts month name and checks with current date if the person is late
4.	A command line program that accepts only two arguments and outputs sum and product of the two
5.	Write a shell script to accept a file name, check if it is regular & show it's contents. (use cat command)
6.	Write a shell script to display “ Good Morning”, “ Good afternoon” , and “Good evening” depending on the hour (use date command)
7.	Write a shell script to accept argument string , and display present working directory if argument string is “current” ,display parent directory if argument string is “parent” and display the contents of root directory if argument string is “root” (use pwd, cd and ls command)
8.	Write a shell script which checks if any of the strings in the output of date command are present in the dirfile
9.	Write a shell script to print the information as to how many files and how many directories are present in current directory.
10.	Write a shell script that accepts name from the user and creates a directory by that name, then creates a text file in that directory and stores in it, the data accepted from user(till ^z), and displays the number of characters stored in the file. The program stops if directory name given is null
11.	Write a program to implement CPU scheduling algorithm
12.	Write a program to implement memory management algorithm
13.	Write a program to implement Banker's algorithm

Progressive Education Society's
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Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 19CsCmaP221

Course Name : Soft Computing

Teaching Scheme: TH:4 Hours/Week

Credits: 4

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Prerequisites:

- Proficiency with algorithms
- Critical thinking and problem solving skills
- Knowledge of Probability and Classical logic

Objectives:

- To understand the concepts of how an Intelligent System works and its development process
- To introduce the ideas of Soft Computational techniques based on human thinking
- To generate an ability to design, analyze and perform experiments on real life problems using various Algorithms
- To apply the process of Approximate Reasoning in Modeling

Course outcome:

This course exposes Learners to Neural Network, Fuzzy Logic and Genetic Algorithms which are the major building blocks of Intelligent Systems. Students will be able to develop Soft Computing based Systems.

Unit No.	Title	Number of Lectures
Unit 1	Origins and issues	3
	1.1 Modern neuroscience 1.2 Artificial Intelligence 1.3 Classical AI and Neural Network 1.4 Hybrid Intelligent Systems 1.5 The human brain 1.6 Biological neurons	
Unit 2	Artificial neurons, neural network and architecture	5
	2.1 Neuron abstraction 2.2 Neuron signal functions 2.3 Architectures: feed forward and feedback 2.4 Salient properties and application domains of neural networks	
Unit 3	Geometry of binary threshold neurons and their networks	5
	3.1 Pattern recognition and data classification 3.2 Convex sets, convex hulls and linear separability 3.3 Space of Boolean functions 3.4 Pattern Dichotomizers 3.5 Capacity of a simple threshold logic neuron 3.6 XOR problem 3.7 Multiplayer networks	
Unit 4	Perceptrons and LMS	5

	4.1 Learning and memory 4.2 From synapses to behaviour : The case of Aplysia 4.3 Learning algorithms 4.4 Error correction and gradient descent rules 4.5 The learning objectives for TLNs 4.6 Pattern space and weight space 4.7 Perceptron learning algorithm 4.8 MSE Error Surface and its Geometry	
Unit 5	Backpropagation	5
	5.1 Multilayered Network Architecture 5.2 Backpropagation Learning Algorithm 5.3 Practical Considerations in implementing BP algorithm 5.4 Applications of Feedforward Neural Networks	
Unit 6	Foundations of Fuzzy Systems	5
	6.1 From Crisp to Fuzzy Sets 6.2 Representing Fuzzy Elements 6.3 Basic Terms and Operations 6.4 Properties of Fuzzy sets 6.5 Fuzzy Measures 6.6 Fuzzification 6.7 The Extension Principle 6.8 Alpha-cuts and the Resolution Principle	
Unit 7	Fuzzy Relations	4
	7.1 Composition of Fuzzy Relations 7.2 Arithmetic Operations of Fuzzy Numbers 7.3 The alpha-cut method	
Unit 8	Linguistic Descriptions	4

	8.1 Fuzzy linguistic descriptions 8.2 Fuzzy Relation Inferences 8.3 Fuzzy Implication and Fuzzy Algorithms	
Unit 9	Defuzzification Methods	3
	9.1 Centre of Area Defuzzification 9.2 Centre of Sums Defuzzification 9.3 Mean of Maxima (MOM) Defuzzification	
Unit 10	Introduction to Genetic Algorithms	4
	10.1 Robustness of traditional Optimization and search methods 10.2 How are genetic algorithms different from Traditional methods 10.3 Genetic Algorithm(GA) – A Simulation by hand 10.4 Similarity Templates	
Unit 11	Computer Implementation of a Genetic Algorithm	5
	11.1 Data Structures 11.2 Reproduction, Crossover and Mutation 11.3 A Time to Cross 11.4 Mapping Objective Functions to Fitness Form 11.5 Fitness Scaling 11.6 Coding 11.7 Constraints	

Reference Books:

1. Neural Networks, A Classroom Approach by Satish Kumar
Tata McGraw-Hill Publishing Company Limited
ISBN : 0-07-048292-6
2. Fuzzy Logic with Engineering Applications
Timothy J Ross, Wiley Publication, ISBN-10: 047074376X
3. Genetic Algorithms, in Search, Optimization & Machine Learning by David E. Goldberg,
Pearson Education, ISBN : 81-7758-829-X

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 19CsCmaP222
Course Name : Cloud and Grid Computing

Teaching Scheme: TH: 4Hours/Week

Credit : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Prerequisites:

- Knowledge of Programming and Networking

Course Objectives:

- Understand how Grid Computing helps in solving large scale scientific problems
- Gain knowledge on the concept of virtualization that is fundamental to Cloud Computing
- Learn how to program the grid and the cloud
- Understand the security issues in the Grid and the Cloud environment

Course Outcomes:

At the end of the course, the student should be able to:

- Apply Grid Computing techniques to solve large scale scientific problems
- Apply the concept of virtualization
- Use the Grid and Cloud tool kits
- Apply the security models in the Grid and Cloud Environment

Unit No.	Title	Number of Lectures
Unit 1	Introduction	10
	1.1 Scalable computing over the Internet 1.2 Technologies for network based systems 1.3 Clusters of cooperative computers 1.4 Grid computing Infrastructures 1.5 Cloud computing 1.6 Evolution of Distributed computing 1.7 Scalable computing over the Internet 1.8 Technologies for network based systems 1.9 Clusters of cooperative computers 1.10 Grid computing Infrastructures 1.11 Introduction to Grid Architecture and standards 1.12 Elements of Grid 1.13 Overview of Grid Architecture	
Unit 2	Grid services	8
	2.1 Introduction to Open Grid Services Architecture (OGSA) 2.2 Functionality Requirements Practical and Detailed view of OGSA/OGSI 2.3 Data intensive grid service models 2.4 OGSA services	
Unit 3	Virtualization	10

	3.1 Cloud deployment models: public, private, hybrid, community 3.2 Categories of cloud computing: Everything as a service: Infrastructure, platform, software – Pros and Cons of cloud computing 3.3 Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters 3.4 Resource Management – Virtualization for data center Automation	
Unit 4	Programming Model	10
	4.1 Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model 4.2 Introduction to Hadoop Framework – Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system 4.3 HDFS concepts, command line and java interface, dataflow of File read & File write	
Unit 5	Security	10
	5.1 Trust models for Grid security environment – Authentication and Authorization methods 5.2 Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture 5.3 IAM practices in the cloud 5.4 SaaS, PaaS, IaaS availability in the cloud 5.5 Key privacy issues in the cloud	

Reference Books:

1. Cloud Computing Bible, Barrie Sosinsky, Willey India Edition, ISBN: 9788126529803
2. Cloud Computing Principles and Paradigms, Rajkumar Buya, James Broberg, Andrzej, Wiley, 2011, ISBN: 0470887990
3. Grid Computing, Joshy Joseph, Craig Fellenstein, Person Education, Person Eductaion, ISBN: 978-81-317-0885-9

Course Name : On Job Training-Project

Course code: 23CsCmaP204

Teaching Scheme: Practical :120Hours

Credit : 04

Examination Scheme: CIA :50 Marks

End-Sem : 50 Marks

To be given by College Authorities

Objectives

- To provide students with practical, hands-on-experience in applying theoretical
- knowledge to real-world tasks
- To help students develop and enhance their skills, problem solving abilities and work
- culture of the industry
- To foster effective teamwork and collaboration skills
- To encourage students to build and expand their professional network by interactive
- with experienced experts and mentors in industry

Course Outcomes

On Completion of this course, student will be able to -

CO1: Enhance the knowledge related to various tools and technologies used in industry

CO2: Improve the ability to solve complex problems independently and creatively

CO3: Effectively utilize critical thinking and analytical skills in tackling real world challenges

CO4: Effectively communicate and collaborate skills through interaction with team members and mentors.

CO5: Get an experience in working on projects or related working within industry

CO6: Develop the ability to document process, design, implementation and testing

CO7: Familiar with specific industry domain relevant to internship

CO8: Complete projects and tasks as per the predetermined objectives

Sr.No.	Guidelines for On Job Training (OJT)
1	Student must start the OJT/Internship immediately after semester-II examination during the summer vacation
2	Student are expected to complete the IT related work/project within 120 hours assigned by organization (company/ industry/ consultancy/ institution)
3	The internship work may involve the IT related assignment(s) OR the maintenance of existing project OR the design/development of new project OR equivalent work
4	College should assign the mentors/guides for students to monitor the progress throughout the OJT
5	Students have to submit the weekly progress report duly signed by the concern authorities of organization to the assigned mentor
6	At the end of OJT, students should prepare the documentation and submit a report to the college in prescribed format
7	After completion, the final presentation and documentation will be evaluated by the examination panel as per the University norms

Semester –III

(Second Year)

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of M.Sc. (Computer Application)

Course Code : 23CsCmaP311
Course Name : Mobile Technologies

Teaching Scheme: TH: 6 Hours/Week

Credit : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 25 Marks(T+P)

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:

- To study Mobile Computing and Mobile Technology.
- To learn the changes/modifications required in Standard Protocols like Mobile IP and Mobile TCP for Mobile Wireless Network.
- To learn new protocols that will be implemented in MANET.
- To learn Software Architecture and changes in Application Environment for the Mobile Computing.
- To get introduced to various platforms and Android Programming Environment.

Course Contents

Unit No	Topic	Number of lectures
Unit 1	Introduction to Mobile Computing	2 lectures
	1.1 Mobility and Portability 1.2 Location 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, ISBN: **978-8131724262**
2. Mobile Computing Principles, Reza B'Far, CAMBRIDGE, ISBN: **978-0521817332**
3. Beginning Android Application Development by Wei-Meng Lee Wiley India, **ISBN-13: 978-8126531066**
4. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder
5. The Android Developers Guide [<http://developer.android.com/guide/index.htm>]

Lab Assignments on Mobile Technologies (Android)

Sr. No.	Title
1	Setup Java Development Kit
2	Configure Android SDK
3	Setup Eclipse IDE
4	Setup Android Development Tools Plugin
5	Create Android Virtual Device
6	Problem Definition and Scope
7	Database Design or File Structure Design
8	UML Diagrams
9	GUI Development
10	Testing Android Application
11	Deploying Android Application on Device
12	Testing and Bug Fixing

Progressive Education Society's
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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP312

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 outcome:

On completion of the course students will get knowledge of:

- Data preprocessing and data quality.
- Modeling and design of data warehouses.
- Algorithms for data mining.

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:

1. Data Mining: Concepts and Techniques, Han, Elsevier, ISBN:9789380931913/ 9788131205358
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education, ISBN-13, **978-0130888921**
3. Tom Mitchell, —Machine Learning, McGraw-Hill, 1997
4. R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification. Second edition. John Wiley and 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 Kaufman), ISBN:9789380501864
8. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data mining field

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP313
Course Name : Block Chain Technology

Teaching Scheme: TH: 4 Hours/Week

Credit : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Prerequisites:

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

Course Objectives:

- To understand the concepts of block chain technology
- To understand the consensus and hyper ledger fabric in block chain technology
- Explore major components of blockchain.
- Learn about Bitcoin, Cryptocurrency and Ethereum

Course Outcomes:

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

1. Learn the fundamentals of Blockchain Technology
2. Learn Blockchain programming
3. Basic knowledge of Smart Contracts and how they function

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	
Unit 4	Cryptocurrency Intuition	10 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	
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	Experiential Learning	2 Lectures
	Demo on Blockchain , Smart Contracts	

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:

1. Wattenhofer, The Science of the Blockchain, Createspace Independent pub, ISBN-10: 1522751831
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Oreilly publication, ISBN-13: 978-1449374044
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, ISBN: 978-1509491353
4. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
5. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Progressive Education Society's
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First Year of M.Sc. (Computer Application)

Course Code : 23CsCmaP314

Course Name : Lab on Programming Language (Python)

Teaching Scheme: TH: 4 Hours/Week

Credit : 02

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:

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

- Students can solve problems by using Python language.
- Students can implement projects by using Python Framework.

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 Algorithms learned in DAA are implemented by using Python
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

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First Year of M.Sc. (Computer Application)

Course Code : 23CsCmaP321

Course Name : Data Science

Teaching Scheme: TH: 4 Hours/Week

Credit : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Course Contents

Unit	Topic	No. of Lectures
Unit 1	Introduction to Data Science	8 lectures
	1.1 What is Data Science, importance of data science, 1.2 Big data and data Science, the current Scenario, 1.3 Industry Perspective Types of Data: Structured vs. Unstructured Data, 1.4 Quantitative vs. Categorical Data, 1.5 Big Data vs. Little Data, Data science process 1.6 Role of Data Scientist	
Unit 2	Statistical Interference and Exploratory Data Analysis	8 lectures
	2.1 Introduction-Population and samples, Data Preparation, 2.2 Exploratory Data Analysis-Summarizing Data 2.3 Data Distribution, Outlier Treatment, Measuring Symmetry, Continuous Distribution, Kernel Density, Estimation: Sample and Estimated Mean, Variance and Standard Scores, Covariance, and Pearson's and Spearman's Rank Correlation	
Unit 3	Machine Learning Algorithms	8 lectures
	3.1 Machine Learning Algorithms: Linear Regression, K-nearest Neighbors(k-NN), K-mean, Spam Filters, Naive Bayes, and Wrangling: Naive Bayes, Comparing Naive Bayes to k-NN, 3.2 Scraping the Web: APIs and Other Tools	
Unit 4	Data Visualization	8 lectures

	4.1 Data visualization: Introduction, Types of data visualization, Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings	
Unit 5	Recommendation Systems	8 lectures
	5.1 A Model for Recommendation Systems: The Utility Matrix, The Long Tail, Applications of Recommendation Systems, Populating the Utility Matrix, 5.2 Content-Based Recommendations: Item Profiles, Discovering Features of Documents, Obtaining Item Features From Tags, Representing Item Profiles, User Profiles, Recommending Items to Users Based on Content, Collaborative Filtering: Measuring Similarity, The Duality of Similarity, Clustering Users and Items, Evaluation of Recommendation System	
Unit 6	Social Network Analysis	7 lectures
	6.1 Social Networks as Graphs, Varieties of Social Networks, Graphs With Several Node Types, Clustering of Social-Network 6.2 Graphs: Distance Measures for Social-Network Graphs, Applying Standard Clustering Methods, Betweenness, The Girvan-Newman Algorithm, Using Betweenness to Find Communities	
Unit 7	Experiential Learning	1 lecture
	Case studies	

Text Books:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly, ISBN-13: **978-1449358655**
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press, ISBN-13, **978-1316638491**

Reference Books:

1. Laura Igual and Santi Segui, Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, Springer; 1st ed. 2017 edition, ISBN-13: **978-3319500164**

1.

E-book

1. Introduction to Data Analytics <https://nptel.ac.in/courses/110/106/110106064/> E-books:
<http://infolab.stanford.edu/~ullman/mmds/book0n.pdf>

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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP322
Course Name : User Experience and Design

Teaching Scheme: TH: 4 Hours/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 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 5.5.1 Export 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 (5 Lectures)	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, ISBN-13: **978-1491950296**
2. Learning AngularJS - By Brad Dayley, ISBN-13: **978-0134034546**
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/>

Progressive Education Society's
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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP304
Course Name : Research Project I

Teaching Scheme: TH: 8 Hours/Week

Credit : 04

Examination Scheme: CIA : 50 Marks

End-Sem : 50 Marks

Index of Documentation

- 1) Title pages
- 2) Abstract
- 3) Introduction
- 4) Literature Review
- 5) Methodology
- 6) Platform
- 7) Analysis specification (Object Oriented Approach)
- 8) Design specification (Object Oriented Approach)
- 9) Input/Output screens
- 10) Testing strategies used/Testing tools used
- 11) Results and Analysis
- 12) Limitations of Research work
- 13) Conclusion
- 14) Future directions
- 15) Bibliography
- 16) Appendices

Semester –IV

(Second Year)

Progressive Education Society's
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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP411

Course Name : Industrial Training / Institutional Project

Teaching Scheme: Full Time Training in Industry/Institution

Teaching Scheme: TH: 2 Hours/Week

Credits : 16

Examination Scheme: CIA :200 Marks

End-Sem : 200 Marks

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 Savitribai Phule 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(ES) of Industrial Training Project(ITP) / Institutional Project(IP) of 150 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 300 :150 marks CIA + 150 marks ES

Grades will be assigned as below:

Sr. No.	% of Max. Marks	Grade Point	Grade Letter
1	91<= Marks <= 100	10	O (Outstanding)
2	75 <= Marks <= 90	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

Receiver's Signature

Date: _____

Date: _____

Place: _____

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

Progressive Education Society's
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First Year of M.Sc. (Computer Application) (2019 Course)

Course Code : 23CsCmaP404
Course Name : Research Project II

Teaching Scheme: TH: 12 Hours/Week

Credit : 06

Examination Scheme: CIA : 75 Marks

End-Sem : 75 Marks

Index of Documentation

- 1) Title pages
- 2) Abstract
- 3) Introduction
- 4) Literature Review
- 5) Methodology
- 6) Platform
- 7) Analysis specification (Object Oriented Approach)
- 8) Design specification (Object Oriented Approach)
- 9) Input/Output screens
- 10) Testing strategies used/Testing tools used
- 11) Results and Analysis
- 12) Limitations of Research work
- 13) Conclusion
- 14) Future directions
- 15) Bibliography
- 16) Appendices

IMP NOTE: Publishing Research Paper in National/ International Journal or Conference is mandatory